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Mathematics Achievement in Missouri and Oregon in an International Context: 1997 TIMSS Benchmarking

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Contents

Introduction

MATHEMATICS

The Third International Mathematics and Science Study (TIMSS) is the largest, most comprehensive, and most rigorous international study of student achievement ever undertaken. Conducted by the International Association for the Evaluation of Education Achievement (IEA),[1] TIMSS tested the mathematics and science knowledge of nearly a half million students in more than 40 countries around the world during the 1995 school year.

TIMSS tested students in mathematics and science at five grade levels. All countries that participated in TIMSS were to test students in the two grades with the largest proportion of 13-year olds (seventh and eighth grades in most countries). Many TIMSS countries also tested students in the grades with largest proportion of 9-year-olds (third and fourth grades in most countries) and students in their final year of secondary school. Together with the achievement tests, TIMSS administered a broad array of background questionnaires. The data collected from students, teachers, and school principals, as well as the system-level information collected from the participating countries make it possible to examine differences in current levels of performance in relation to a wide variety of variables associated with the contexts within which education takes place.

Recent calls for improvement in education are based on the premise that international competition in the global marketplace requires a future work force that is educationally well-equipped. With the ever increasing impact of technology on the daily lives of individual throughout the world, skills in mathematics and science are becoming more and more critical. The TIMSS data provide a reference point from which we can begin to clarify what is meant by "world class" education.

The data provide a basis for benchmarking the performance of students in the United States and the way in which we deliver instruction. In his 1997 State of the Union Address, President Clinton challenged every community and state to adopt standards of excellence in education. As part of the President's initiative, the United States Department of Education provided states an opportunity to administer the TIMSS mathematics and science tests and background questionnaires at the eighth grade to obtain comparisons of achievement with the TIMSS countries. Missouri and Oregon took advantage of this unique opportunity to view their mathematics and science education from an international perspective.

[1] Since its inception in 1959, IEA has conducted a series of international comparative studies designed to provide policy makers, educators, researchers, and practitioners with information about educational achievement and learning contexts. The previous mathematics studies were conducted in 1964 and 1980-82, and the science studies in 1970-71 and 1983-84. For information about TIMSS procedures see Appendix A.

This report presents findings from the TIMSS eighth-grade mathematics assessments in Oregon and Missouri in relation to the results obtained from the TIMSS countries. A companion report, *Science Achievement in Missouri and Oregon in an International Context: 1997 TIMSS Benchmarking*, presents corresponding results about students' science achievement as compared to the TIMSS countries.

To provide a fair and accurate comparison of mathematics and science achievement, the 1997 TIMSS Benchmarking Study was directed by the TIMSS International Study Center at Boston College using the same procedures and applying the same technical standards that were followed in the international project. Rigorous procedures were designed specifically to translate the tests, and numerous regional training sessions were held in data collection and scoring procedures. Quality control monitors observed testing sessions and sent back reports.The samples of students selected for testing were scrutinized according to rigorous standards designed to prevent bias and ensure comparability. In this publication, the countries are grouped for reporting of achievement according to their compliance with the sampling guidelines and the level of their participation rates. Prior to analysis, the data from each country were subjected to exhaustive checks for adherence to the international formats as well as for consistency and comparability. To enhance the utility of the state results, the procedures used paralleled those for the United States as closely as possible. Just as was done for the United States' participation in TIMSS, Westat, Inc., was responsible for drawing the school sample, administering the tests and questionnaires, and preparing the data files. Following the end-of-school-year schedule used in TIMSS, the tests were administered in Missouri and Oregon in April and May of 1997.

OVERVIEW OF RESULTS

Brief Summary of Results for Missouri

The average mathematics score for Missouri of 505 was comparable to the international average of the participating countries (513) and to performance by the United States (500). Compared to all participating countries, the average performance for Missouri's grade 8 students was above that of 10 countries, equivalent to 13 countries, and below that of 18 countries. Singapore had the highest level of achievement in mathematics with Korea, Japan, and Hong Kong also among the top-performing countries.

About 7% of Missouri's eighth graders achieved at or above the level considered to represent the top 10 percent of grade 8 students participating in TIMSS, which compared to 5% for the United States. There was no significant difference between the average mathematics performance of males and females in Missouri. In the content areas, Missouri performed similar to the international average in fractions, algebra, and proportionality. Missouri eighth graders were significantly above the international average in data representation. However, they had lower relative performance in geometry and measurement, performing significantly below the average of the participating countries.

Brief Summary of Results for Oregon

The average mathematics score for Oregon of 525 was not significantly different from the international average (513). However, eighth-graders in Oregon outperformed their counterparts in 17 countries, including the United States. They had performance equivalent with that of the students in 16 countries, and performed below students in 8 countries.

About 9% of Oregon's eighth graders achieved at or above the Top 10% level of students internationally. There was no significant difference in average mathematics achievement by gender. The results in the content areas revealed that eighth-grade students in Oregon performed significantly above the international average in data representation. Oregon's performance was approximately at the international average in fractions, geometry, algebra, measurement, and proportionality.

MAJOR ASPECTS OF TIMSS

Which Countries and States Participated?

As shown in Table 1, this report compares the results for Missouri and Oregon with those of 40 countries including the United States. Because the Flemish and French educational systems in Belgium participated separately, the tables contain the results for 41 international participants as well as Oregon and Missouri. Table 2 presents information about the grades tested in the TIMSS countries and presented in this report, including the name for the grade, the years of formal schooling students had completed when they were tested for TIMSS, and the average age of students tested.

What Was the Nature of the Mathematics Test?

All countries that participated in TIMSS wished to ensure that the achievement items were appropriate for their students and reflected their current curriculum. Developing the TIMSS tests was a cooperative venture involving all of the NRCs during the entire process. Through a series of efforts, countries submitted items that were reviewed by mathematics subject-matter specialists, and additional items were written to ensure that the desired mathematics topics were covered adequately. Items were piloted, the results reviewed, and new items were written and piloted. The resulting TIMSS mathematics test contained 151 items representing a range of mathematics topics and skills.

The TIMSS curriculum frameworks described the content dimensions for the TIMSS tests as well as performance expectations (behaviors that might be expected of students in school mathematics).[2] Six content areas are covered in the TIMSS mathematics test for the eighth grade. These areas and the percentage of the test items devoted to each include: fractions and number sense (34%); measurement (12%); proportionality (7%); data representation, analysis, and probability (14%); geometry (15%); and algebra (18%). The performance expectations include: knowing (22%); performing routine procedures (25%); using complex procedures (21%); and solving problems (32%).

About one-fourth of the questions were in the free-response format, requiring students to generate and write their answers. These questions, some of which required extended responses, were allotted approximately one-third of the testing time. Responses to the free-response questions were evaluated to capture diagnostic information, and some were scored using procedures that permitted partial credit.[3]

[2] Robitaille, D.F., McKnight, C.C., Schmidt, W.H., Britton, E.D., Raizen, S.A., and Nicol, C. (1993). *TIMSS Monograph No. 1: Curriculum Frameworks for Mathematics and Science*. Vancouver, B.C.: Pacific Educational Press.

[3] TIMSS scoring reliability studies within and across countries indicate that the percent of exact agreement for correctness scores averaged well above 90%. For more details see Appendix A.

Table 1

Countries and States Participating in TIMSS

- **MISSOURI**
- **OREGON**
- **UNITED STATES**
- Australia
- Austria
- Belgium*
- Bulgaria
- Canada
- Colombia
- Cyprus
- Czech Republic
- Denmark
- England
- France
- Germany
- Greece
- Hong Kong
- Hungary
- Iceland
- Iran, Islamic Republic
- Ireland
- Israel
- Japan
- Korea, Republic of
- Kuwait
- Latvia
- Lithuania
- Netherlands
- New Zealand
- Norway
- Portugal
- Romania
- Russian Federation
- Scotland
- Singapore
- Slovak Republic
- Slovenia
- South Africa
- Spain
- Sweden
- Switzerland
- Thailand

*The Flemish and French educational systems in Belgium participated separately.

Table 2

Information About the Grades Tested

Country	State or Country's Name for the Grade Tested	Years of Formal Schooling Including the Grade Tested[1]	Average Age of Students
UNITED STATES	8	8	14.2
MISSOURI	8	8	14.6
OREGON	8	8	14.4
[2] Australia	8 or 9	8 or 9	14.2
Austria	4. Klasse	8	14.3
Belgium (Fl)	2A & 2P	8	14.1
Belgium (Fr)	2A & 2P	8	14.3
Bulgaria	8	8	14.0
Canada	8	8	14.1
Colombia	8	8	15.7
Cyprus	8	8	13.7
Czech Republic	8	8	14.4
Denmark	7	7	13.9
England	Year 9	9	14.0
France	4ème (90%) or 4ème Technologique (10%)	8	14.3
Germany	8	8	14.8
Greece	Secondary 2	8	13.6
Hong Kong	Secondary 2	8	14.2
Hungary	8	8	14.3
Iceland	8	8	13.6
Iran, Islamic Rep.	8	8	14.6
Ireland	2nd Year	8	14.4
Israel	8	8	14.1
Japan	2nd Grade Lower Secondary	8	14.4
Korea, Republic of	2nd Grade Middle School	8	14.2
Kuwait	9	9	15.3
Latvia	8	8	14.3
Lithuania	8	8	14.3
Netherlands	Secondary 2	8	14.3
[3] New Zealand	Form 3	8.5 - 9.5	14.0
Norway	7	7	13.9
Philippines	1st Year High School	7	-
Portugal	Grade 8	8	14.5
Romania	8	8	14.6
[4] Russian Federation	8	7 or 8	14.0
Scotland	Secondary 2	9	13.7
Singapore	Secondary 2	8	14.5
Slovak Republic	8	8	14.3
Slovenia	8	8	14.8
Spain	8 EGB	8	14.3
South Africa	Standard 6	8	15.4
Sweden	7	7	13.9
Switzerland			14.2
(German)	7	7	-
(French and Italian)	8	8	-
Thailand	Secondary 2	8	14.3

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

[1]Years of schooling based on the number of years children in the grade level have been in formal schooling, beginning with primary education (International Standard Classification of Education Level 1). Does not include preprimary education.

[2]Australia: Each state/territory has its own policy regarding age of entry to primary school. In 4 of the 8 states/territories students were sampled from grades 7 and 8; in the other four states/territories students were sampled from grades 8 and 9.

[3]New Zealand: The majority of students begin primary school on or near their 5th birthday so the "years of formal schooling" vary.

[4]Russian Federation: 70% of students in the seventh grade have had 6 years of formal schooling; 70% in the eighth grade have had 7 years of formal schooling.

The tests were given so that no one student took all of the items, which would have required more than three hours. Instead, the test was assembled in eight booklets, each requiring 90 minutes to complete. Each student took only one booklet, and the items were rotated through the booklets so that each item was answered by a representative sample of students.

How Does TIMSS Document Compliance with Sampling Guidelines?

TIMSS developed procedures and guidelines to ensure that the national samples were of the highest quality possible. Standards for coverage of the target population, participation rates, and the age of students were established as were clearly documented procedures on how to obtain the samples. The TIMSS target population was defined as students in the two adjacent grades with the most 13-year-olds at the time of testing, the seventh and eighth grades in most countries – including the United States. Because it was the upper grade tested in the United States and most countries, grade 8 was selected for the TIMSS Benchmarking Study and both Missouri and Oregon defined the target population as students attending eighth-grade public schools. The United States and the other TIMSS participating countries included both public and private schools. In Oregon, 7% of the eighth-grade students attended private schools and in Missouri 14% attended private schools.

For the most part, the national samples were drawn in accordance with the TIMSS standards, and achievement results can be compared with confidence. However, despite efforts to meet the TIMSS specifications, some countries did not do so. Figure 1 shows how the states and countries have been grouped in tables reporting achievement results. An acceptable participation rate was either 85% for both the schools and students, or a combined rate (the product of school and student participation) of 75% – with or without replacement schools. Countries that achieved acceptable participation rates, and that complied with the TIMSS guidelines for grade selection and classroom sampling are shown in the first panel of Figure 1. Missouri and Oregon both achieved acceptable participation rates, however, Missouri met sample participation guidelines only after the replacement schools were included. Both states satisfied the TIMSS guidelines for grade selection and classroom sampling.

Countries not reaching at least 50% school participation without the use of replacement schools, or that failed to reach the sampling participation standard even with the inclusion of replacement schools, are shown in the second panel of Figure 1. These countries are presented in a separate section of the achievement tables in Chapters 1, 2, and 3 in alphabetical order, and are shown in tables in Chapters 4 and 5 in italics.

Figure 1

Countries Grouped for Reporting of Achievement According to Their Compliance with Guidelines for Sample Implementation and Participation Rates

Eighth Grade*

Countries satisfying guidelines for sample participation rates, grade selection, and sampling procedures	
† Belgium (Fl)	[1] Lithuania
Canada	† Missouri
Cyprus	New Zealand
Czech Republic	Norway
†[2] England	Oregon
France	Portugal
Hong Kong	Russian Federation
Hungary	Singapore
Iceland	Slovak Republic
Iran, Islamic Rep.	Spain
Ireland	Sweden
Japan	[1] Switzerland
Korea	† United States
[1] Latvia (LSS)	
Countries not satisfying guidelines for sample participation	
Australia	Bulgaria
Austria	Netherlands
Belgium (Fr)	Scotland
Countries not meeting age/grade specifications (high percentage of older students)	
Colombia	Romania
†[1] Germany	Slovenia
Countries with unapproved sampling procedures at the classroom level	
Denmark	Thailand
Greece	
Countries with unapproved sampling procedures at classroom level and not meeting other guidelines	
[1] Israel	South Africa
Kuwait	

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

***** Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.
† Met guidelines for sample participation rates only after replacement schools were included.
[1] National Desired Population does not cover all of Iternational Desired Population (see Table 1). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
[2] National Defined Population covers less than 90 percent of National Desired Population (see Table 1).

To provide a better curricular match, four countries (i.e., Colombia, Germany, Romania, and Slovenia), elected to test their seventh- and eighth-grade students even though that meant not testing the two grades with the most 13-year olds. This led to their students being somewhat older than in the other countries and states. These countries are also presented in a separate section of the achievement tables in Chapters 1, 2, and 3 in alphabetical order, and are shown in tables in Chapters 4 and 5 in italics.

For a variety of reasons, three countries (Denmark, Greece, and Thailand) did not comply with the guidelines for sampling classrooms. Their results are also presented in a separate section of the achievement tables in Chapters 1, 2, and 3 in alphabetical order, and are italicized in tables in Chapters 4 and 5. At the eighth grade, Israel, Kuwait, and South Africa also had difficulty complying with the classroom selection guidelines, but in addition had other difficulties (Kuwait tested a single grade with relatively few 13-year-olds; Israel and South Africa had low sampling participation rates), and so these countries are also presented in separate sections in tables in Chapters 1, 2, and 3, and are italicized in tables in Chapters 4 and 5.

Chapter 1

Mathematics Achievement in an International Context

Chapter 1 summarizes the mathematics achievement of the TIMSS countries and the states of Missouri and Oregon. Results are provided overall and by gender for the eighth grade public-school students in Oregon and Missouri and students in the upper grade of the TIMSS target population in 41 countries.[1] This was the eighth grade in the United States and in many other countries, but by virtue of the organization of their educational systems several countries tested in either the seventh or ninth grades (see Table 2).

How Did Missouri and Oregon Perform Compared with the TIMSS Countries?

Table 1.1 presents the mean (or average) mathematics achievement for the United States, Missouri, Oregon, and for the 40 other countries participating in TIMSS at the eighth grade.[2] Missouri and Oregon and the 25 countries shown by decreasing order of mean achievement in the upper part of the table were judged to have met the TIMSS requirements for testing a representative sample of students.[3]

The means for Missouri (505) and Oregon (525) and for each country can be compared with the international average of 513, which represents the average across the means for each of the 41 international participants shown in the table. A triangle pointing up next to the mean indicates that performance was significantly higher than the international average, while a triangle pointing down indicates that performance was significantly lower. A bullet next to the mean indicates the mean was not significantly different from the international average. As can be seen from the results, Missouri and Oregon performed similar to the international average as did the United States.

[1] The TIMSS target population was defined as students in the two grades with the most 13-year-olds at the time of testing.

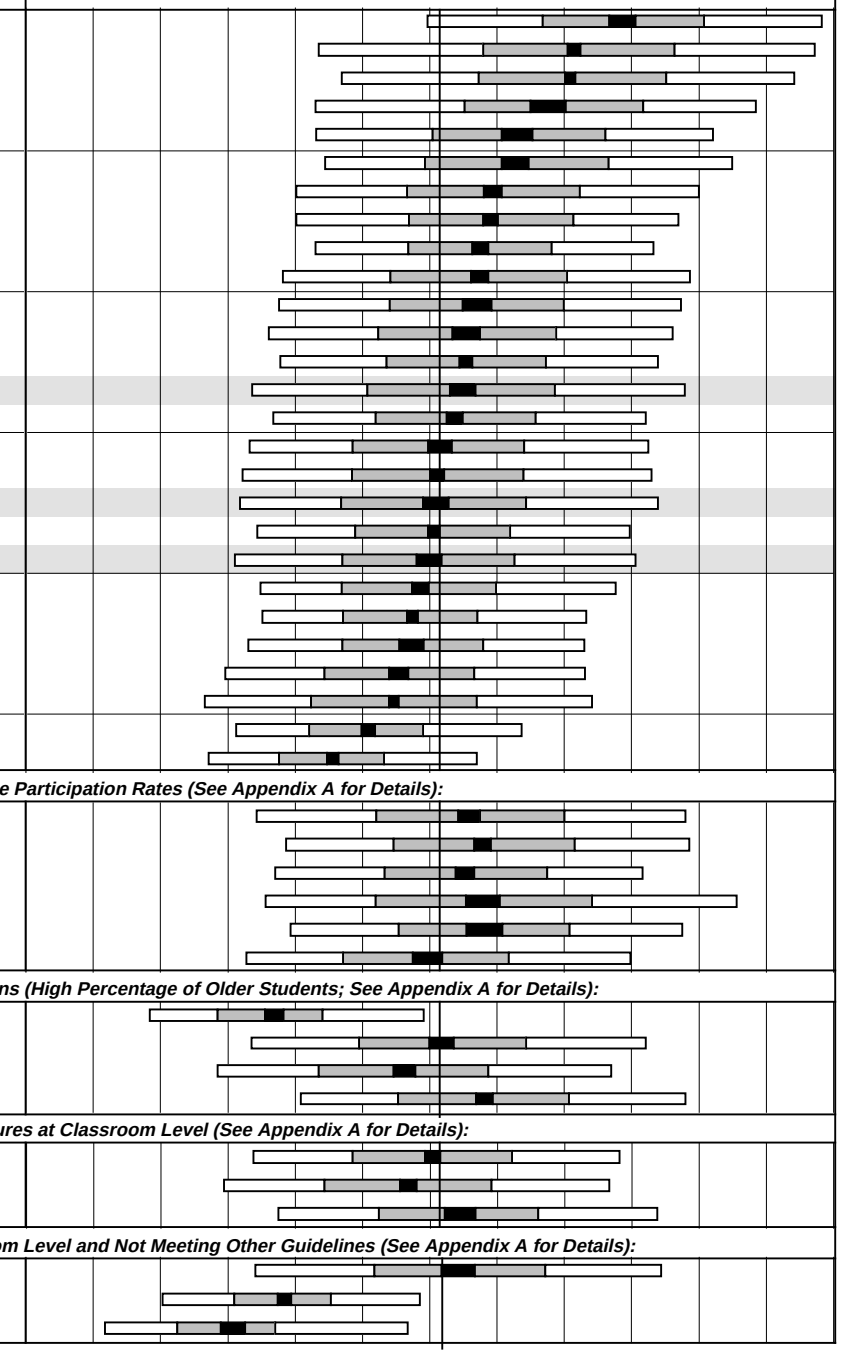
[2] TIMSS used item response theory (IRT) methods to summarize the achievement results for both grades of the TIMSS target population (seventh and eighth grades in most TIMSS countries) on a scale with a mean of 500 and a standard deviation of 100. Scaling averages students' responses to the subsets of items they took in a way that accounts for differences in the difficulty of those items. It allows students' performance to be summarized on a common metric even though individual students responded to different items in the mathematics test. For more detailed information, see the "IRT Scaling and Data Analysis" section of Appendix A.

[3] Although all countries tried very hard to meet the TIMSS sampling requirements, several encountered resistance from schools and teachers. Several participants, including the United States and the state of Missouri, met the sample participation rates only after replacement schools were included, and are annotated for this reason. The countries shown "below the line" did not have participation of 85% or higher as specified in the TIMSS guidelines, even with the use of replacement schools (i.e., Australia, Austria, Belgium (French), Bulgaria, the Netherlands, and Scotland). To provide a better curricular match, four countries (i.e., Colombia, Germany, Romania, and Slovenia) elected to test their eighth-grade students even though that led to their students being somewhat older than those in the other countries. The countries in the remaining two categories encountered various degrees of difficulty in implementing the prescribed methods for sampling classrooms within schools. A full discussion of the sampling procedures and outcomes for each country can be found in Appendix A.

Table 1.1

Distributions of Mathematics Achievement: Eighth Grade*

Country	Mean	Mathematics Achievement Scale Score
Singapore	▲ 643 (4.9)	
Korea	▲ 607 (2.4)	
Japan	▲ 605 (1.9)	
Hong Kong	▲ 588 (6.5)	
‡ Belgium (Fl)	▲ 565 (5.7)	
Czech Republic	▲ 564 (4.9)	
Slovak Republic	▲ 547 (3.3)	
‡ Switzerland	▲ 545 (2.8)	
‡ France	▲ 538 (2.9)	
Hungary	▲ 537 (3.2)	
Russian Federation	▲ 535 (5.3)	
Ireland	● 527 (5.1)	
Canada	▲ 527 (2.4)	
OREGON	● 525 (4.8)	
Sweden	● 519 (3.0)	
New Zealand	● 508 (4.5)	
‡ England	● 506 (2.6)	
‡ **MISSOURI**	● 505 (4.8)	
Norway	▼ 503 (2.2)	
‡ **UNITED STATES**	● 500 (4.6)	
‡ Latvia (LSS)	▼ 493 (3.1)	
Spain	▼ 487 (2.0)	
Iceland	▼ 487 (4.5)	
‡ Lithuania	▼ 477 (3.5)	
Cyprus	▼ 474 (1.9)	
Portugal	▼ 454 (2.5)	
Iran, Islamic Rep.	▼ 428 (2.2)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	▲ 530 (4.0)	
Austria	▲ 539 (3.0)	
Belgium (Fr)	▲ 526 (3.4)	
Bulgaria	▲ 540 (6.3)	
Netherlands	▲ 541 (6.7)	
Scotland	● 499 (5.5)	
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	▼ 385 (3.4)	
‡ Germany	● 509 (4.5)	
Romania	▼ 482 (4.0)	
Slovenia	▲ 541 (3.1)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	▼ 502 (2.8)	
Greece	▼ 484 (3.1)	
Thailand	● 522 (5.7)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	● 522 (6.2)	
Kuwait	▼ 392 (2.5)	
South Africa	▼ 354 (4.4)	



▲ = Country/ state mean significantly higher than international average

▼ = Country/ state mean significantly lower than international average

● = No statistically significant difference between country/state mean and international average

Statistically significant at .05 level, adjusted for multiple comparisons.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Figure 1.1

Countries' Average Mathematics Performance at Eighth Grade* Compared with Missouri and Oregon

Comparison with MISSOURI			Comparison with OREGON	
Country	Mean Scale Score		Country	Mean Scale Score
Singapore	643 (4.9)		**Singapore**	643 (4.9)
Korea	607 (2.4)		**Korea**	607 (2.4)
Japan	605 (1.9)		**Japan**	605 (1.9)
Hong Kong	588 (6.5)		**Hong Kong**	588 (6.5)
Belgium (Fl)	565 (5.7)		**Belgium (Fl)**	565 (5.7)
Czech Republic	564 (4.9)		**Czech Republic**	564 (4.9)
Slovak Republic	547 (3.3)		**Slovak Republic**	547 (3.3)
Switzerland	545 (2.8)		**Switzerland**	545 (2.8)
Slovenia	541 (3.1)		*Slovenia*	541 (3.1)
Netherlands	541 (6.7)		*Netherlands*	541 (6.7)
Bulgaria	540 (6.3)		*Bulgaria*	540 (6.3)
Austria	539 (3.0)		*Austria*	539 (3.0)
France	538 (2.9)		**France**	538 (2.9)
Hungary	537 (3.2)		**Hungary**	537 (3.2)
Russian Federation	535 (5.3)		**Russian Federation**	535 (5.3)
Australia	530 (4.0)		*Australia*	530 (4.0)
Canada	527 (2.4)		**Canada**	527 (2.4)
Belgium (Fr)	526 (3.4)		**Ireland**	527 (5.1)
Ireland	527 (5.1)		*Belgium (Fr)*	526 (3.4)
Thailand	522 (5.7)	**OREGON 525**	**OREGON**	525 (4.8)
Israel	522 (6.2)		*Thailand*	522 (5.7)
Sweden	519 (3.0)		*Israel*	522 (6.2)
Germany	509 (4.5)		**Sweden**	519 (3.0)
New Zealand	508 (4.5)		*Germany*	509 (4.5)
England	506 (2.6)		**New Zealand**	508 (4.5)
MISSOURI	505 (4.8)	**MISSOURI 505**	**England**	506 (2.6)
Norway	503 (2.2)		**Norway**	503 (2.2)
Denmark	502 (2.8)		*Denmark*	502 (2.8)
UNITED STATES	500 (4.6)		**UNITED STATES**	500 (4.6)
Scotland	499 (5.5)		*Scotland*	499 (5.5)
Latvia (LSS)	493 (3.1)		**Latvia (LSS)**	493 (3.1)
Iceland	487 (4.5)		**Iceland**	487 (4.5)
Spain	487 (2.0)		**Spain**	487 (2.0)
Greece	484 (3.1)		*Greece*	484 (3.1)
Romania	482 (4.0)		*Romania*	482 (4.0)
Lithuania	477 (3.5)		**Lithuania**	477 (3.5)
Cyprus	474 (1.9)		**Cyprus**	474 (1.9)
Portugal	454 (2.5)		**Portugal**	454 (2.5)
Iran, Islamic Rep.	428 (2.2)		**Iran, Islamic Rep.**	428 (2.2)
Kuwait	392 (2.5)		*Kuwait*	392 (2.5)
Colombia	385 (3.4)		*Colombia*	385 (3.4)
South Africa	354 (4.4)		*South Africa*	354 (4.4)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

Significantly Higher than State Average

Not Significantly Different from State Average

Significantly Lower than State Average

*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Among the countries meeting the TIMSS sampling guidelines, Singapore had the highest performance, with Korea, Japan, Hong Kong, Belgium (Flemish), and the Czech Republic also performing very well.

To illustrate the broad range of achievement both across and within countries, Table 1.1 also provides a visual representation of the distribution of student performance within each country. Achievement for each country is shown for the 25th and 75th percentiles as well as for the 5th and 95th percentiles. The range between the 25th and 75th percentiles represents performance by the middle half of the students. In contrast, performance at the 5th and 95th percentiles represents the extremes in both lower and higher achievement. The dark boxes at the midpoints of the distributions show the 95% confidence intervals around the average achievement in each country.

In general, the results reveal substantial differences in average mathematics achievement between the top- and bottom-performing countries, although most countries had achievement somewhere in the middle ranges. Also, the differences between the extremes in performance were very large within most countries as well as in Missouri and Oregon. Comparisons across countries reveal that performance of the average students in Oregon and Missouri was comparable to that of below average students (5th to 25th percentiles) in Singapore, Korea, and Japan. The best performing students (75th to 95th percentiles) were comparable to average performing students in those Asian countries.

Because the precise mean score of each TIMSS participant cannot be determined with perfect accuracy, to fairly compare Missouri and Oregon to the TIMSS countries the nations have been grouped into broad bands according to whether their performance was higher than, not significantly different from, or lower than Missouri and Oregon, respectively. These results are presented in Figure 1.1 for Missouri (first panel) and Oregon (second panel).

Students in 18 countries outperformed the public-school eighth graders in Missouri. Students in 13 countries – including the United States – did not perform significantly different than those in Missouri, and Missouri students outperformed the students in 10 countries. The public-school eighth graders in Oregon were outperformed by students in 8 countries, performance was not statistically different in 16 countries, and performance was statistically higher than 17 countries, including the United States.

What Are the Differences in Performance Compared to Three Marker Levels of International Mathematics Achievement?

Table 1.2 portrays performance in terms of international levels of achievement for the eighth grade. This table presents the percentage of students in each country reaching each of three international marker levels, or benchmarks. Since the TIMSS achievement tests do not have any pre-specified performance standards, three marker levels were chosen on the basis of the combined performance of all students at a grade level in the study — the Top 10%, the Top Quarter (25%), and the Top Half (50%). For example, Table 1.2 shows that 10% of all eighth graders in countries participating in the TIMSS study achieved at the level of 656 or better. This score point, then, was designated as the marker level for the Top 10%. Similarly, the Top Quarter marker level was determined as 587 and the Top Half marker level as 509.

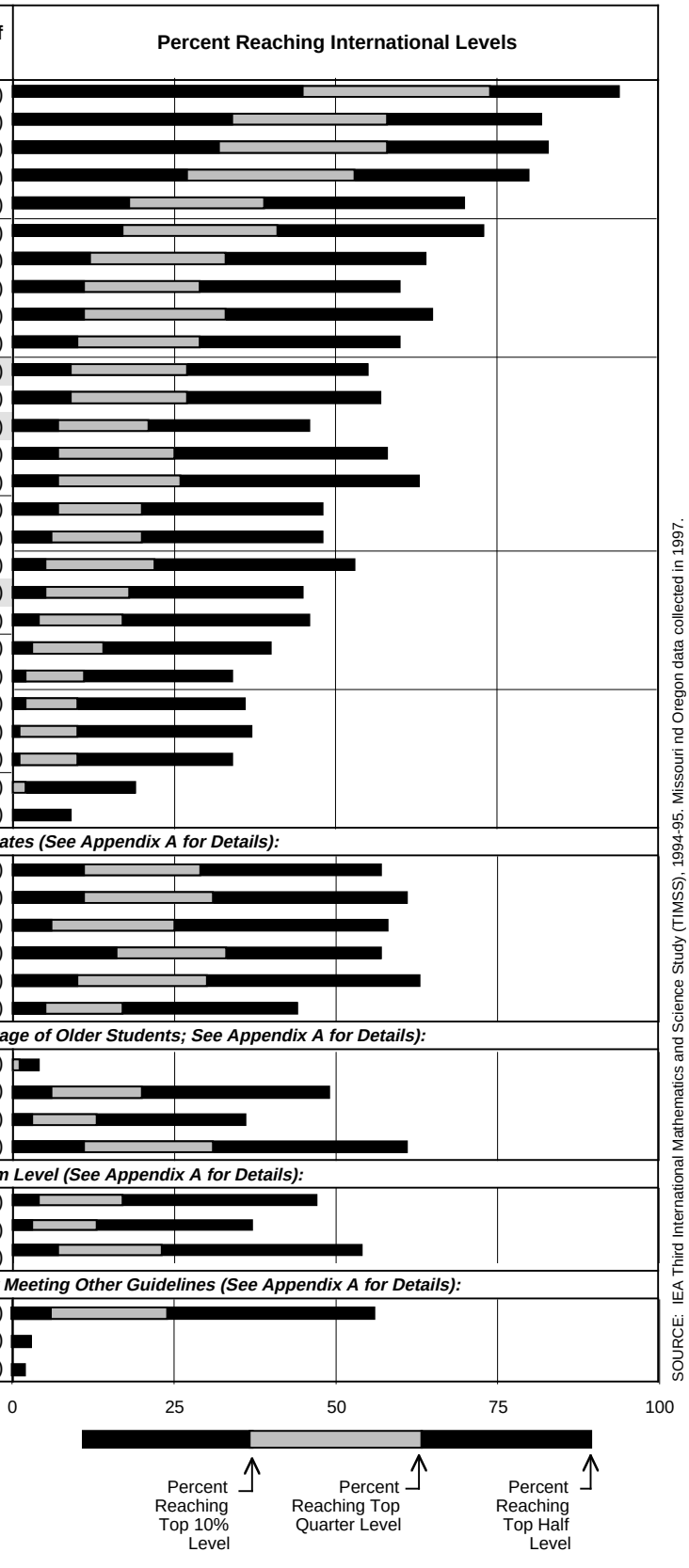
If every country had the same distribution of high-, medium-, and low-performing students, then each country would be expected to have approximately 10% of its students reaching the Top 10% level, 25% reaching the Top Quarter level, and 50% reaching the Top Half level. Although no country achieved exactly this pattern, the data in Table 1.2 indicate that Oregon came close to the international norm, with 9%, 27%, and 55% reaching the marker levels. In Missouri, students fell just short of the international levels, with 7%, 21%, and 46% of the students reaching the levels, respectively. The corresponding figures for the United States were 5% performing at the Top 10% level, 18% at or above the Top Quarter level, and 45% at or above the Top Half level. In contrast, 45% of the students in Singapore reached the Top 10% level, 74% reached the Top Quarter level, and 94% performed at or above the Top Half level.

Table 1.2

Percentages of Students Achieving International Marker Levels in Mathematics

Eighth Grade*

Country	Top 10% Level	Top Quarter Level	Top Half Level
Singapore	45 (2.5)	74 (2.1)	94 (0.8)
Korea	34 (1.1)	58 (1.0)	82 (0.8)
Japan	32 (0.8)	58 (0.9)	83 (0.6)
Hong Kong	27 (2.1)	53 (2.6)	80 (2.4)
Czech Republic	18 (1.9)	39 (2.3)	70 (1.9)
‡ Belgium (Fl)	17 (1.2)	41 (2.3)	73 (2.9)
Slovak Republic	12 (1.0)	33 (1.5)	64 (1.6)
Hungary	11 (0.8)	29 (1.3)	60 (1.6)
‡ Switzerland	11 (0.7)	33 (1.2)	65 (1.4)
Russian Federation	10 (0.7)	29 (2.4)	60 (2.6)
OREGON	9 (1.1)	27 (1.7)	55 (2.1)
Ireland	9 (1.0)	27 (1.9)	57 (2.4)
‡ **MISSOURI**	7 (0.7)	21 (1.6)	46 (2.1)
Canada	7 (0.7)	25 (1.1)	58 (1.2)
‡ France	7 (0.8)	26 (1.5)	63 (1.5)
‡ England	7 (0.6)	20 (1.1)	48 (1.4)
New Zealand	6 (0.8)	20 (1.6)	48 (2.2)
Sweden	5 (0.5)	22 (1.2)	53 (1.5)
‡ **UNITED STATES**	5 (0.6)	18 (1.5)	45 (2.3)
Norway	4 (0.4)	17 (0.9)	46 (1.2)
‡ Latvia (LSS)	3 (0.5)	14 (1.2)	40 (1.5)
Cyprus	2 (0.3)	11 (0.6)	34 (1.1)
Spain	2 (0.2)	10 (0.7)	36 (1.2)
Iceland	1 (0.3)	10 (1.3)	37 (2.9)
‡ Lithuania	1 (0.3)	10 (1.0)	34 (1.8)
Portugal	0 (0.1)	2 (0.4)	19 (1.3)
Iran, Islamic Rep.	0 (0.0)	0 (0.2)	9 (0.8)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):			
Australia	11 (0.9)	29 (1.5)	57 (1.7)
Austria	11 (0.7)	31 (1.3)	61 (1.4)
Belgium (Fr)	6 (0.6)	25 (1.5)	58 (1.7)
Bulgaria	16 (1.9)	33 (2.7)	57 (2.7)
Netherlands	10 (1.6)	30 (2.7)	63 (3.2)
Scotland	5 (0.9)	17 (2.1)	44 (2.7)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):			
Colombia	0 (0.0)	1 (0.3)	4 (0.8)
‡ Germany	6 (0.7)	20 (1.7)	49 (2.3)
Romania	3 (0.4)	13 (1.1)	36 (2.0)
Slovenia	11 (0.7)	31 (1.4)	61 (1.5)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):			
Denmark	4 (0.5)	17 (1.0)	47 (1.6)
Greece	3 (0.4)	13 (0.8)	37 (1.5)
Thailand	7 (1.2)	23 (2.6)	54 (2.7)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):			
‡ Israel	6 (0.9)	24 (2.5)	56 (2.6)
Kuwait	0 (0.0)	0 (0.1)	3 (0.5)
South Africa	0 (0.0)	0 (0.0)	2 (0.9)



SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri nd Oregon data collected in 1997.

The international levels correspond to the percentiles computed from the combined data from all of the participating countries.

Top 10% Level (90th Percentile) = 656
Top Quarter Level (75th Percentile) = 587
Top Half Level (50th Percentile) = 509

*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some differences may appear inconsistent.

What Are the Gender Differences in Mathematics Achievement?

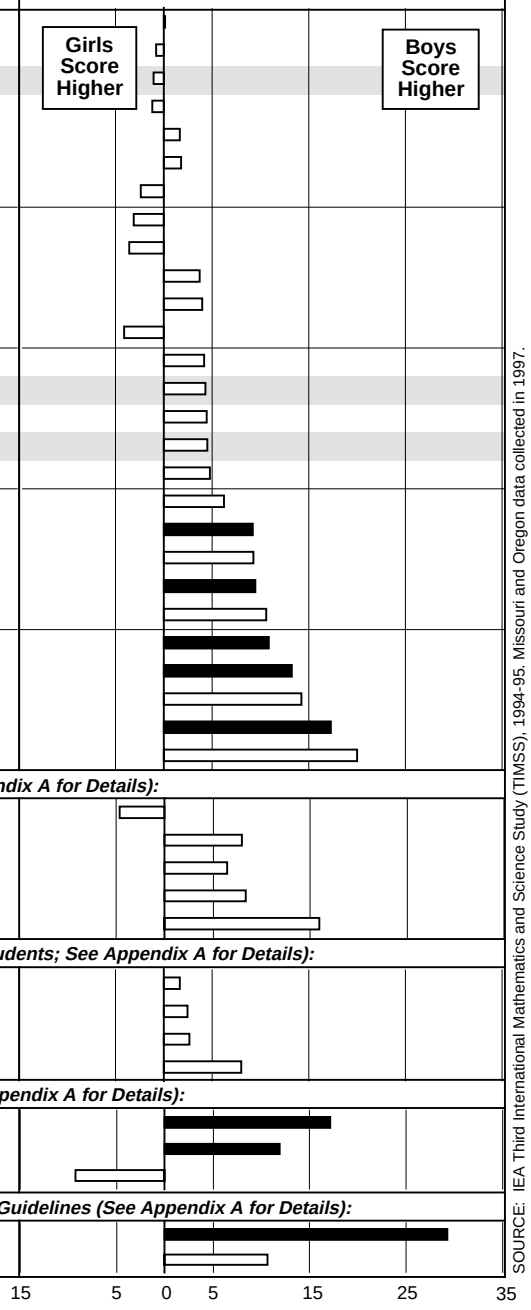
Table 1.3, showing the differences in achievement by gender, reveals that girls and boys had approximately the same average mathematics achievement in both Missouri and Oregon. This is similar to the pattern shown by most countries, including the United States. However, the differences in achievement that did exist in some countries tended to favor boys rather than girls.

The table presents mean mathematics achievement separately for boys and girls for each country, as well as the difference between the means. The visual representation of the gender difference for each country, shown by a bar, indicates the amount of the difference, whether the direction of the difference favors girls or boys, and whether or not the difference is statistically significant (indicated by a darkened bar). Regardless of their directions, about three-fourths of the differences were not statistically significant, indicating that, for most countries, gender differences in mathematics achievement generally are small or negligible in the middle years of schooling. That is, nearly three-quarters of the differences favoring boys at the eighth grade were not statistically significant. Also, girls had higher mean achievement than boys in eight countries and in Missouri, even though those results were not statistically significant either. From another perspective, however, all the statistically significant differences favored boys rather than girls. Boys had significantly higher mathematics achievement than girls in Japan, Spain, Portugal, Iran, Korea, Denmark, Greece, and Israel.

Table 1.3

Gender Differences in Mathematics Achievement: Eighth Grade*

Country	Boys Mean	Girls Mean	Difference Absolute Value	Gender Difference
Hungary	537 (3.6)	537 (3.6)	0 (5.1)	
‡ Lithuania	477 (4.0)	478 (4.1)	1 (5.7)	
‡ **MISSOURI**	504 (5.5)	505 (4.3)	1 (7.0)	
Russian Federation	535 (6.3)	536 (5.0)	1 (8.0)	
Iceland	488 (5.5)	486 (5.6)	2 (7.8)	
Sweden	520 (3.6)	518 (3.1)	2 (4.7)	
Singapore	642 (6.3)	645 (5.4)	2 (8.3)	
Cyprus	472 (2.8)	475 (2.5)	3 (3.7)	
Canada	526 (3.2)	530 (2.7)	4 (4.2)	
Slovak Republic	549 (3.7)	545 (3.6)	4 (5.2)	
Norway	505 (2.8)	501 (2.7)	4 (3.9)	
‡ Belgium (Fl)	563 (8.8)	567 (7.4)	4 (11.5)	
‡ England	508 (5.1)	504 (3.5)	4 (6.2)	
OREGON	527 (5.1)	523 (5.0)	4 (7.1)	
‡ Latvia (LSS)	496 (3.8)	491 (3.5)	4 (5.2)	
‡ **UNITED STATES**	502 (5.2)	497 (4.5)	5 (6.9)	
‡ Switzerland	548 (3.5)	543 (3.1)	5 (4.7)	
‡ France	542 (3.1)	536 (3.8)	6 (4.9)	
Japan	609 (2.6)	600 (2.1)	9 (3.3)	
New Zealand	512 (5.9)	503 (5.3)	9 (7.9)	
Spain	492 (2.5)	483 (2.6)	10 (3.6)	
Czech Republic	569 (4.5)	558 (6.3)	11 (7.7)	
Portugal	460 (2.8)	449 (2.7)	11 (3.9)	
Iran, Islamic Rep.	434 (2.9)	421 (3.3)	13 (4.4)	
Ireland	535 (7.2)	520 (6.0)	14 (9.3)	
Korea	615 (3.2)	598 (3.4)	17 (4.7)	
Hong Kong	597 (7.7)	577 (7.7)	20 (10.9)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):				
Australia	527 (5.1)	532 (4.6)	5 (6.9)	
Austria	544 (3.2)	536 (4.5)	8 (5.6)	
Belgium (Fr)	530 (4.7)	524 (3.7)	6 (6.0)	
Netherlands	545 (7.8)	536 (6.4)	8 (10.1)	
Scotland	506 (6.6)	490 (5.3)	16 (8.5)	
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):				
Colombia	386 (6.9)	384 (3.6)	2 (7.7)	
‡ Germany	512 (5.1)	509 (5.0)	3 (7.1)	
Romania	483 (4.8)	480 (4.0)	3 (6.2)	
Slovenia	545 (3.8)	537 (3.3)	8 (5.0)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):				
Denmark	511 (3.2)	494 (3.4)	17 (4.7)	
Greece	490 (3.7)	478 (3.1)	12 (4.8)	
Thailand	517 (5.6)	526 (7.0)	9 (9.0)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):				
‡ Israel	539 (6.6)	509 (6.9)	29 (9.6)	
South Africa	360 (6.3)	349 (4.1)	11 (7.5)	



SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

International Averages

Boys	Girls	Difference
519	512	8

(Averages of all country means. Does not include Missouri and Oregon)

Gender difference statistically significant at .05 level.

Gender difference not statistically significant.

*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Chapter 2

Average achievement in Mathematics Content Areas

Recognizing that important curricular differences exist between and within countries is an important aspect of IEA studies, TIMSS attempted to measure achievement in different areas within mathematics that would be useful in relating achievement to curriculum. After much deliberation, the mathematics test for the eighth grade was designed to enable reporting by six content areas. These six content areas include:

- fractions and number sense
- geometry
- algebra
- data representation, analysis, and probability
- measurement
- proportionality

This chapter describes differences in average achievement in mathematics content areas for Missouri and Oregon as compared to the TIMSS countries. Chapter 3 contains further information about the types of items within each content area, including a range of five or six example items within each content area and the percent of correct responses on those items for each of the TIMSS participants.

How Does Achievement Differ Across Mathematics Content Areas?

As we have seen in Chapter 1, there are substantial differences in achievement among the participating countries on the TIMSS mathematics test. Given that the mathematics test was designed to include items from different curricular areas, it is important to examine whether or not Missouri and Oregon have particular strengths and weaknesses in their achievement in these content areas. Table 2.1 provides an analysis based on the average percent of correct responses to items within each content area to address the question of how well Missouri and Oregon performed in each mathematics content area in relation to the TIMSS countries.

The results for the average percent across all mathematics items are provided for each country and Missouri and Oregon primarily to provide a basis of comparison for performance in each of the content areas. For the purpose of comparing overall achievement between participants, it is preferable to use the results presented in Chapter 1. It is interesting to note, however, that even though the relative standings of countries differ somewhat from Table 1.1, the slight differences are well within the limits expected by sampling error and can be attributed to the differences in the methodologies used.

Table 2.1

Average Percent Correct by Mathematics Content Areas: Eighth Grade*

Country	Mathematics Overall (151 items)	Fractions & Number Sense (51 items)	Geometry (23 items)	Algebra (27 items)	Data Representation, Analysis & Probability (21 items)	Measurement (18 items)	Proportionality (11 items)
Singapore	▲ 79 (0.9)	▲ 84 (0.8)	▲ 76 (1.0)	▲ 76 (1.1)	▲ 79 (0.8)	▲ 77 (1.0)	▲ 75 (1.0)
Japan	▲ 73 (0.4)	▲ 75 (0.4)	▲ 80 (0.4)	▲ 72 (0.6)	▲ 78 (0.4)	▲ 67 (0.5)	▲ 61 (0.5)
Korea	▲ 72 (0.5)	▲ 74 (0.5)	▲ 75 (0.6)	▲ 69 (0.6)	▲ 78 (0.6)	▲ 66 (0.7)	▲ 62 (0.6)
Hong Kong	▲ 70 (1.4)	▲ 72 (1.4)	▲ 73 (1.5)	▲ 70 (1.5)	▲ 72 (1.3)	▲ 65 (1.7)	▲ 62 (1.4)
‡ Belgium (Fl)	▲ 66 (1.4)	▲ 71 (1.2)	▲ 64 (1.5)	▲ 63 (1.7)	▲ 73 (1.3)	▲ 60 (1.3)	▲ 53 (1.8)
Czech Republic	▲ 66 (1.1)	▲ 69 (1.1)	▲ 66 (1.1)	▲ 65 (1.3)	▲ 68 (0.9)	▲ 62 (1.2)	▲ 52 (1.3)
Slovak Republic	▲ 62 (0.8)	▲ 66 (0.8)	▲ 63 (0.8)	▲ 62 (0.9)	● 62 (0.7)	▲ 60 (0.9)	▲ 49 (1.0)
‡ Switzerland	▲ 62 (0.6)	▲ 67 (0.7)	▲ 60 (0.8)	● 53 (0.7)	▲ 72 (0.7)	▲ 61 (0.8)	▲ 52 (0.7)
Hungary	▲ 62 (0.7)	▲ 65 (0.8)	▲ 60 (0.8)	▲ 63 (0.9)	▲ 66 (0.7)	▲ 56 (0.8)	● 47 (0.9)
‡ France	▲ 61 (0.8)	▲ 64 (0.8)	▲ 66 (0.8)	● 54 (1.0)	▲ 71 (0.8)	▲ 57 (0.9)	▲ 49 (0.9)
Russian Federation	▲ 60 (1.3)	▲ 62 (1.2)	▲ 63 (1.4)	▲ 63 (1.5)	● 60 (1.2)	▲ 56 (1.5)	● 48 (1.5)
Canada	▲ 59 (0.5)	▲ 64 (0.6)	● 58 (0.6)	● 54 (0.7)	▲ 69 (0.5)	● 51 (0.7)	▲ 48 (0.7)
Ireland	● 59 (1.2)	▲ 65 (1.2)	▼ 51 (1.3)	● 53 (1.3)	▲ 69 (1.1)	● 53 (1.3)	▲ 51 (1.2)
OREGON	● 57 (1.0)	● 61 (1.1)	● 55 (1.0)	● 56 (1.3)	▲ 70 (1.0)	● 47 (1.2)	● 46 (0.9)
Sweden	● 56 (0.7)	▲ 62 (0.8)	▼ 48 (0.7)	▼ 44 (0.9)	▲ 70 (0.7)	▲ 56 (0.9)	● 44 (0.9)
New Zealand	● 54 (1.0)	● 56 (1.1)	● 54 (1.1)	● 49 (1.1)	▲ 66 (1.0)	● 48 (1.2)	● 42 (1.0)
Norway	● 54 (0.5)	● 58 (0.6)	▼ 51 (0.6)	▼ 45 (0.7)	▲ 66 (0.6)	● 51 (0.6)	▼ 40 (0.6)
‡ England	● 53 (0.7)	▼ 54 (0.8)	● 54 (1.0)	▼ 49 (0.9)	▲ 66 (0.7)	● 50 (0.9)	● 41 (1.1)
‡ **UNITED STATES**	● 53 (1.1)	● 59 (1.1)	▼ 48 (1.2)	● 51 (1.2)	● 65 (1.1)	▼ 40 (1.1)	● 42 (1.1)
‡ **MISSOURI**	● 53 (1.1)	● 59 (1.2)	▼ 49 (1.3)	● 51 (1.4)	▲ 66 (1.0)	▼ 42 (1.2)	● 42 (1.0)
‡ Latvia (LSS)	▼ 51 (0.8)	▼ 53 (0.9)	● 57 (0.8)	● 51 (0.9)	▼ 56 (0.8)	▼ 47 (0.9)	▼ 39 (0.9)
Spain	▼ 51 (0.5)	▼ 52 (0.5)	▼ 49 (0.6)	● 54 (0.8)	▼ 60 (0.7)	▼ 44 (0.7)	▼ 40 (0.8)
Iceland	▼ 50 (1.1)	● 54 (1.2)	▼ 51 (1.4)	▼ 40 (1.3)	● 63 (1.1)	▼ 45 (1.4)	▼ 38 (1.4)
‡ Lithuania	▼ 48 (0.9)	▼ 51 (1.0)	● 53 (1.1)	▼ 47 (1.2)	▼ 52 (1.0)	▼ 43 (0.9)	▼ 35 (0.9)
Cyprus	▼ 48 (0.5)	▼ 50 (0.6)	▼ 47 (0.6)	▼ 48 (0.7)	▼ 53 (0.6)	▼ 44 (0.9)	▼ 40 (0.7)
Portugal	▼ 43 (0.7)	▼ 44 (0.7)	▼ 44 (0.8)	▼ 40 (0.8)	▼ 54 (0.7)	▼ 39 (0.7)	▼ 32 (0.8)
Iran, Islamic Rep.	▼ 38 (0.6)	▼ 39 (0.6)	▼ 43 (0.8)	▼ 37 (0.8)	▼ 41 (0.6)	▼ 29 (1.2)	▼ 36 (0.8)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):							
Australia	▲ 58 (0.9)	● 61 (0.9)	● 57 (1.0)	● 55 (1.0)	▲ 67 (0.8)	▲ 54 (1.0)	● 47 (0.9)
Austria	▲ 62 (0.8)	▲ 66 (0.8)	● 57 (1.0)	▲ 59 (0.8)	▲ 68 (0.8)	▲ 62 (1.0)	▲ 49 (0.9)
Belgium (Fr)	▲ 59 (0.9)	▲ 62 (1.0)	● 58 (1.0)	● 53 (1.1)	▲ 68 (1.0)	▲ 56 (1.0)	● 48 (0.9)
Bulgaria	▲ 60 (1.2)	● 60 (1.4)	▲ 65 (1.3)	▲ 62 (1.5)	● 62 (1.1)	● 54 (1.6)	● 47 (1.5)
Netherlands	● 60 (1.6)	● 62 (1.6)	● 59 (1.8)	● 53 (1.6)	▲ 72 (1.7)	▲ 57 (1.6)	▲ 51 (1.9)
Scotland	● 52 (1.3)	▼ 53 (1.3)	● 52 (1.4)	▼ 46 (1.5)	● 65 (1.3)	● 48 (1.6)	▼ 40 (1.4)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):							
Colombia	▼ 29 (0.8)	▼ 31 (0.9)	▼ 29 (0.9)	▼ 28 (0.9)	▼ 37 (1.0)	▼ 25 (1.5)	▼ 23 (0.9)
‡ Germany	● 54 (1.1)	● 58 (1.1)	▼ 51 (1.3)	▼ 48 (1.3)	● 64 (1.2)	● 51 (1.1)	● 42 (1.3)
Romania	▼ 49 (1.0)	▼ 48 (1.0)	▼ 52 (0.9)	● 52 (1.3)	▼ 49 (1.0)	● 48 (1.1)	● 42 (1.2)
Slovenia	▲ 61 (0.7)	▲ 63 (0.7)	▲ 60 (0.9)	▲ 61 (0.8)	▲ 66 (0.7)	▲ 59 (0.9)	▲ 49 (0.8)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):							
Denmark	▼ 52 (0.7)	▼ 53 (0.9)	● 54 (0.9)	▼ 45 (0.7)	▲ 67 (0.9)	● 49 (1.0)	▼ 41 (0.8)
Greece	▼ 49 (0.7)	▼ 53 (0.8)	▼ 51 (0.7)	▼ 46 (0.8)	▼ 56 (0.8)	▼ 43 (0.9)	▼ 39 (1.1)
Thailand	● 57 (1.4)	● 60 (1.5)	▲ 62 (1.3)	● 53 (1.7)	● 63 (1.1)	● 50 (1.4)	▲ 51 (1.5)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):							
‡ Israel	● 57 (1.3)	● 60 (1.4)	● 57 (1.4)	▲ 61 (1.6)	● 63 (1.3)	● 48 (1.6)	● 43 (1.6)
Kuwait	▼ 30 (0.7)	▼ 27 (0.8)	▼ 38 (1.0)	▼ 30 (1.0)	▼ 38 (1.0)	▼ 23 (1.0)	▼ 21 (0.7)
South Africa	▼ 24 (1.1)	▼ 26 (1.4)	▼ 24 (1.0)	▼ 23 (1.1)	▼ 26 (1.2)	▼ 18 (1.1)	▼ 21 (0.9)
International Average Percent Correct (Does not include Missouri and Oregon)	55 (0.1)	58 (0.1)	56 (0.1)	52 (0.2)	62 (0.1)	51 (0.1)	45 (0.2)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

▲ = Country/state mean significantly higher than international mean

● = No statistically significant difference between country/state mean and international mean

▼ = Country/state mean significantly lower than international mean

*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

It is important to note that content areas differed in terms of their level of difficulty. As shown by the international averages across the bottom of Table 2.1 based on the performance of the 41 TIMSS countries, items in the data representation content area were easiest, while proportionality items were the most difficult. Thus, in comparing across columns most participants will appear to have higher performance in data representation than in proportionality. The results in this chapter are most appropriate for comparing performance *within* specific content areas.

For each content area shown in Table 2.1, a triangle pointing up indicates performance above the international average, a dot indicates performance about the same as the international average, and a triangle pointing down indicates performance below the international average for that content area. Compared to students in other countries, the performance of United States eighth graders was similar to the international average in most content areas, except in geometry and measurement where its performance was significantly below the international average. In relation to the TIMSS countries, performance in Missouri was quite similar to that of the United States. Eighth-grade students in Missouri performed at the international average in fractions and number sense, algebra, and proportionality, and below the international average in geometry and measurement. However, Missourian eighth graders performed above the international average in data representation. In contrast, eighth graders in Oregon did not perform below the international average in geometry and measurement. Oregonian eighth graders performed similar to the international average in all content areas except data representation, where like the students in Missouri, they performed above the international average.

Figure 2.1 provides a comparison of the performance of Missouri students with those in the TIMSS countries in each of six mathematics content areas. In relative terms, students from Missouri performed best in the area of data representation, analysis, and probability. They were outperformed by students in only seven countries, including those in Asia and several European countries (i.e., Belgium (Flemish), Switzerland, and France). Students in Missouri performed similarly in the areas of fractions and number sense and algebra, where they were outperformed by 13 countries. Nineteen countries had significantly higher achievement than Missouri in proportionality. Relatively, students in Missouri performed least well in geometry and measurement. In geometry, students in Missouri were outperformed by 22 countries and had higher achievement than students in 5 countries. In measurement, they were outperformed by 30 countries and did better than students in only 4 countries. In each content area, the results for Missouri were nearly identical to those for the United States.

Figure 2.2 presents the corresponding comparisons for Oregon. The pattern of achievement across the content areas is quite similar to that of Missouri. Relative to the TIMSS countries, Oregon performed best in data representation, analysis, and probability. Only Singapore, Japan, and Korea had higher achievement than Oregon in this content area. Students in Oregon performed similarly in the areas of fractions and number sense, algebra, and proportionality, where they were outperformed by 9 countries in the first two of these areas and by 7 countries in the third. In geometry, students had significantly lower achievement than did students in 14 of the TIMSS countries. Eighth graders in Oregon did least well internationally in the area of measurement. Here they were outperformed by students in 19 countries, and had higher achievement than students in only 6 countries. Oregon had significantly higher achievement than the United States in three of the content areas – geometry, data representation, and measurement.

Figure 2.1

Countries' Average Achievement in Mathematics Content Areas Compared with Missouri: Eighth Grade*

Fractions and Number Sense		Geometry		Algebra		Data Representation, Analysis, and Probability		Measurement		Proportionality	
Country	Average Percent Correct	Country	Average Percent Correct	Country	Average Percent Correct	Country	Average Percent Correct	Country	Average Percent Correct	Country	Average Percent Correct
Singapore	84 (0.8)	**Japan**	80 (0.4)	**Singapore**	76 (1.1)	**Singapore**	79 (0.8)	**Singapore**	77 (1.0)	**Singapore**	75 (1.0)
Japan	75 (0.4)	**Singapore**	76 (1.0)	**Japan**	72 (0.6)	**Japan**	78 (0.4)	**Japan**	67 (0.5)	**Korea**	62 (0.6)
Korea	74 (0.5)	**Korea**	75 (0.6)	**Hong Kong**	70 (1.5)	**Korea**	78 (0.6)	**Korea**	66 (0.7)	**Hong Kong**	62 (1.4)
Hong Kong	72 (1.4)	**Hong Kong**	73 (1.5)	**Korea**	69 (0.6)	**Belgium (Fl)**	73 (1.3)	**Hong Kong**	65 (1.7)	**Japan**	61 (0.5)
Belgium (Fl)	71 (1.2)	**Czech Republic**	66 (1.1)	**Czech Republic**	65 (1.3)	**Switzerland**	72 (0.7)	**Czech Republic**	62 (1.2)	**Belgium (Fl)**	53 (1.8)
Czech Republic	69 (1.1)	**France**	66 (0.8)	**Belgium (Fl)**	63 (1.7)	**Hong Kong**	72 (1.3)	*Austria*	62 (1.0)	**Czech Republic**	52 (1.3)
Switzerland	67 (0.7)	*Bulgaria*	65 (1.3)	**Russian Fed.**	63 (1.5)	**France**	71 (0.8)	**Switzerland**	61 (0.8)	**Switzerland**	52 (0.7)
Slovak Republic	66 (0.8)	**Belgium (Fl)**	64 (1.5)	**Hungary**	63 (0.9)	*Netherlands*	72 (1.7)	**Belgium (Fl)**	60 (1.3)	*Netherlands*	51 (1.9)
Austria	66 (0.8)	**Slovak Republic**	63 (0.8)	*Bulgaria*	62 (1.5)	**Sweden**	70 (0.7)	**Slovak Republic**	60 (0.9)	**Ireland**	51 (1.2)
Hungary	65 (0.8)	**Russian Fed.**	63 (1.4)	**Slovak Republic**	62 (0.9)	**Ireland**	69 (1.1)	*Slovenia*	59 (0.9)	*Thailand*	51 (1.5)
Ireland	65 (1.2)	*Thailand*	62 (1.3)	*Slovenia*	61 (0.8)	**Canada**	69 (0.5)	*Netherlands*	57 (1.6)	*Austria*	49 (0.9)
France	64 (0.8)	**Switzerland**	60 (0.8)	*Israel*	61 (1.6)	**Czech Republic**	68 (0.9)	**France**	57 (0.9)	*Slovenia*	49 (0.8)
Canada	64 (0.6)	**Hungary**	60 (0.8)	*Austria*	59 (0.8)	*Belgium (Fr)*	68 (1.0)	**Sweden**	56 (0.9)	**Slovak Republic**	49 (1.0)
Slovenia	63 (0.7)	*Slovenia*	60 (0.9)	*Australia*	55 (1.0)	*Austria*	68 (0.8)	*Belgium (Fr)*	56 (1.0)	**France**	49 (0.9)
Netherlands	62 (1.6)	*Netherlands*	59 (1.8)	**France**	54 (1.0)	*Australia*	67 (0.8)	**Hungary**	56 (0.8)	**Russian Fed.**	48 (1.5)
Russian Fed.	62 (1.2)	**Canada**	58 (0.6)	**Canada**	54 (0.7)	*Denmark*	67 (0.9)	**Russian Fed.**	56 (1.5)	***Belgium (Fr)***	48 (0.9)
Belgium (Fr)	62 (1.0)	**Belgium (Fr)**	58 (1.0)	**Spain**	54 (0.8)	**New Zealand**	66 (1.0)	*Australia*	54 (1.0)	**Canada**	48 (0.7)
Sweden	62 (0.8)	*Austria*	57 (1.0)	*Thailand*	53 (1.7)	**Hungary**	66 (0.7)	*Bulgaria*	54 (1.6)	**Hungary**	47 (0.9)
Australia	61 (0.9)	*Australia*	57 (1.0)	**Switzerland**	53 (0.7)	**Norway**	66 (0.6)	**Ireland**	53 (1.3)	*Australia*	47 (0.9)
Bulgaria	60 (1.4)	*Israel*	57 (1.4)	*Netherlands*	53 (1.6)	**MISSOURI**	66 (1.0)	**Canada**	51 (0.7)	*Bulgaria*	47 (1.5)
Thailand	60 (1.5)	**Latvia (LSS)**	57 (0.8)	*Belgium (Fr)*	53 (1.1)	**England**	66 (0.7)	**Norway**	51 (0.6)	**Sweden**	44 (0.9)
Israel	60 (1.4)	*Denmark*	54 (0.9)	**Ireland**	53 (1.3)	*Slovenia*	66 (0.7)	*Germany*	51 (1.1)	*Israel*	43 (1.6)
MISSOURI	59 (1.2)	**New Zealand**	54 (1.1)	*Romania*	52 (1.3)	*Scotland*	65 (1.3)	**England**	50 (0.9)	*Germany*	42 (1.3)
UNITED STATES	59 (1.1)	**England**	54 (1.0)	**Latvia (LSS)**	51 (0.9)	**UNITED STATES**	65 (1.1)	*Thailand*	50 (1.4)	**New Zealand**	42 (1.0)
Germany	58 (1.1)	**Lithuania**	53 (1.1)	**MISSOURI**	51 (1.4)	*Germany*	64 (1.2)	*Denmark*	49 (1.0)	*Romania*	42 (1.2)
Norway	58 (0.6)	*Scotland*	52 (1.4)	**UNITED STATES**	51 (1.2)	**Iceland**	63 (1.1)	**New Zealand**	48 (1.2)	**MISSOURI**	42 (1.0)
New Zealand	56 (1.1)	*Romania*	52 (0.9)	**New Zealand**	49 (1.1)	*Israel*	63 (1.3)	*Scotland*	48 (1.6)	**UNITED STATES**	42 (1.1)
Iceland	54 (1.2)	**Ireland**	51 (1.3)	**England**	49 (0.9)	*Thailand*	63 (1.1)	*Israel*	48 (1.6)	**England**	41 (1.1)
England	54 (0.8)	*Germany*	51 (1.3)	*Germany*	48 (1.3)	*Bulgaria*	62 (1.1)	*Romania*	48 (1.1)	*Denmark*	41 (0.8)
Denmark	53 (0.9)	**Norway**	51 (0.6)	**Cyprus**	48 (0.7)	**Slovak Republic**	62 (0.7)	**Latvia (LSS)**	47 (0.9)	**Norway**	40 (0.6)
Scotland	53 (1.3)	**Iceland**	51 (1.4)	**Lithuania**	47 (1.2)	**Russian Fed.**	60 (1.2)	**Iceland**	45 (1.4)	*Scotland*	40 (1.4)
Latvia (LSS)	53 (0.9)	*Greece*	51 (0.7)	*Scotland*	46 (1.5)	**Spain**	60 (0.7)	**Spain**	44 (0.7)	**Spain**	40 (0.8)
Greece	53 (0.8)	**MISSOURI**	49 (1.3)	*Greece*	46 (0.8)	*Greece*	56 (0.8)	**Cyprus**	44 (0.9)	**Cyprus**	40 (0.7)
Spain	52 (0.5)	**Spain**	49 (0.6)	*Denmark*	45 (0.7)	**Latvia (LSS)**	56 (0.8)	*Greece*	43 (0.9)	*Greece*	39 (1.1)
Lithuania	51 (1.0)	**Sweden**	48 (0.7)	**Norway**	45 (0.7)	**Portugal**	54 (0.7)	**Lithuania**	43 (0.9)	**Latvia (LSS)**	39 (0.9)
Cyprus	50 (0.6)	**UNITED STATES**	48 (1.2)	**Sweden**	44 (0.9)	**Cyprus**	53 (0.6)	**MISSOURI**	42 (1.2)	**Iceland**	38 (1.4)
Romania	48 (1.0)	**Cyprus**	47 (0.6)	**Iceland**	40 (1.3)	**Lithuania**	52 (1.0)	**UNITED STATES**	40 (1.1)	**Iran, Islamic Rep.**	36 (0.8)
Portugal	44 (0.7)	**Portugal**	44 (0.8)	**Portugal**	40 (0.8)	*Romania*	49 (1.0)	**Portugal**	39 (0.7)	**Lithuania**	35 (0.9)
Iran, Islamic Rep.	39 (0.6)	**Iran, Islamic Rep.**	43 (0.8)	**Iran, Islamic Rep.**	37 (0.8)	**Iran, Islamic Rep.**	41 (0.6)	**Iran, Islamic Rep.**	29 (1.2)	**Portugal**	32 (0.8)
Colombia	31 (0.9)	*Kuwait*	38 (1.0)	*Kuwait*	30 (1.0)	*Kuwait*	38 (1.0)	*Colombia*	25 (1.5)	*Colombia*	23 (0.9)
Kuwait	27 (0.8)	*Colombia*	29 (0.9)	*Colombia*	28 (0.9)	*Colombia*	37 (1.0)	*Kuwait*	23 (1.0)	*Kuwait*	21 (0.7)
South Africa	26 (1.4)	*South Africa*	24 (1.0)	*South Africa*	23 (1.1)	*South Africa*	26 (1.2)	*South Africa*	18 (1.1)	*South Africa*	21 (0.9)

Country average significantly higher than Missouri average

No statistically significant difference between country average and Missouri average

Country average significantly lower than Missouri average

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected 1997.

*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Figure 2.2

Countries' Average Achievement in Mathematics Content Areas Compared with Oregon: Eighth Grade*

Fractions and Number Sense		Geometry		Algebra		Data Representation, Analysis, and Probability		Measurement		Proportionality	
Country	Average Percent Correct	Country	Average Percent Correct	Country	Average Percent Correct	Country	Average Percent Correct	Country	Average Percent Correct	Country	Average Percent Correct
Singapore	84 (0.8)	**Japan**	80 (0.4)	**Singapore**	76 (1.1)	**Singapore**	79 (0.8)	**Singapore**	77 (1.0)	**Singapore**	75 (1.0)
Japan	75 (0.4)	**Singapore**	76 (1.0)	**Japan**	72 (0.6)	**Japan**	78 (0.4)	**Japan**	67 (0.5)	**Korea**	62 (0.6)
Korea	74 (0.5)	**Korea**	75 (0.6)	**Hong Kong**	70 (1.5)	**Korea**	78 (0.6)	**Korea**	66 (0.7)	**Hong Kong**	62 (1.4)
Hong Kong	72 (1.4)	**Hong Kong**	73 (1.5)	**Korea**	69 (0.6)	**Belgium (Fl)**	73 (1.3)	**Hong Kong**	65 (1.7)	**Japan**	61 (0.5)
Belgium (Fl)	71 (1.2)	**Czech Republic**	66 (1.1)	**Czech Republic**	65 (1.3)	**Hong Kong**	72 (1.3)	**Czech Republic**	62 (1.2)	**Belgium (Fl)**	53 (1.8)
Czech Republic	69 (1.1)	**France**	66 (0.8)	**Russian Fed.**	63 (1.5)	**Switzerland**	72 (0.7)	*Austria*	62 (1.0)	**Czech Republic**	52 (1.3)
Switzerland	67 (0.7)	*Bulgaria*	65 (1.3)	**Hungary**	63 (0.9)	*Netherlands*	72 (1.7)	**Switzerland**	61 (0.8)	**Switzerland**	52 (0.7)
Slovak Republic	66 (0.8)	**Belgium (Fl)**	64 (1.5)	**Slovak Republic**	62 (0.9)	**France**	71 (0.8)	**Belgium (Fl)**	60 (1.3)	*Netherlands*	51 (1.9)
Austria	66 (0.8)	**Slovak Republic**	63 (0.8)	*Slovenia*	61 (0.8)	**OREGON**	70 (1.0)	**Slovak Republic**	60 (0.9)	**Ireland**	51 (1.2)
Hungary	65 (0.8)	**Russian Fed.**	63 (1.4)	**Belgium (Fl)**	63 (1.7)	**Sweden**	70 (0.7)	*Slovenia*	59 (0.9)	*Thailand*	51 (1.5)
Ireland	65 (1.2)	*Thailand*	62 (1.3)	*Bulgaria*	62 (1.5)	**Canada**	69 (0.5)	*Netherlands*	57 (1.6)	*Austria*	49 (0.9)
France	64 (0.8)	**Switzerland**	60 (0.8)	*Israel*	61 (1.6)	**Ireland**	69 (1.1)	**France**	57 (0.9)	**Slovak Republic**	49 (1.0)
Canada	64 (0.6)	**Hungary**	60 (0.8)	*Austria*	59 (0.8)	**Czech Republic**	68 (0.9)	**Sweden**	56 (0.9)	*Slovenia*	49 (0.8)
Slovenia	63 (0.7)	*Slovenia*	60 (0.9)	**OREGON**	56 (1.3)	*Austria*	68 (0.8)	*Belgium (Fr)*	56 (1.0)	**France**	49 (0.9)
Netherlands	62 (1.6)	*Netherlands*	59 (1.8)	*Australia*	55 (1.0)	*Belgium (Fr)*	68 (1.0)	**Hungary**	56 (0.8)	**Russian Fed.**	48 (1.5)
Russian Fed.	62 (1.2)	**Canada**	58 (0.6)	**France**	54 (1.0)	*Australia*	67 (0.8)	**Russian Fed.**	56 (1.5)	***Belgium (Fr)***	48 (0.9)
Belgium (Fr)	62 (1.0)	**Belgium (Fr)**	58 (1.0)	**Canada**	54 (0.7)	*Denmark*	67 (0.9)	*Australia*	54 (1.0)	**Canada**	48 (0.7)
Sweden	62 (0.8)	*Austria*	57 (1.0)	**Spain**	54 (0.8)	**New Zealand**	66 (1.0)	*Bulgaria*	54 (1.6)	**Hungary**	47 (0.9)
Australia	61 (0.9)	*Australia*	57 (1.0)	*Thailand*	53 (1.7)	*Scotland*	65 (1.3)	**Ireland**	53 (1.3)	*Bulgaria*	47 (1.5)
OREGON	61 (1.1)	*Israel*	57 (1.4)	**Switzerland**	53 (0.7)	**Hungary**	66 (0.7)	**Canada**	51 (0.7)	*Australia*	47 (0.9)
Bulgaria	60 (1.4)	**Latvia (LSS)**	57 (0.8)	*Netherlands*	53 (1.6)	*Slovenia*	66 (0.7)	**Norway**	51 (0.6)	**OREGON**	46 (0.9)
Thailand	60 (1.5)	**OREGON**	55 (1.0)	*Belgium (Fr)*	53 (1.1)	**England**	66 (0.7)	*Germany*	51 (1.1)	**Sweden**	44 (0.9)
Israel	60 (1.4)	**New Zealand**	54 (1.1)	**Ireland**	53 (1.3)	**Norway**	66 (0.6)	**England**	50 (0.9)	*Israel*	43 (1.6)
UNITED STATES	59 (1.1)	**England**	54 (1.0)	*Romania*	52 (1.3)	**UNITED STATES**	65 (1.1)	*Thailand*	50 (1.4)	*Germany*	42 (1.3)
Germany	58 (1.1)	*Denmark*	54 (0.9)	**UNITED STATES**	51 (1.2)	*Germany*	64 (1.2)	*Denmark*	49 (1.0)	**New Zealand**	42 (1.0)
Norway	58 (0.6)	**Lithuania**	53 (1.1)	**Latvia (LSS)**	51 (0.9)	*Israel*	63 (1.3)	**New Zealand**	48 (1.2)	*Romania*	42 (1.2)
New Zealand	56 (1.1)	*Scotland*	52 (1.4)	**New Zealand**	49 (1.1)	*Thailand*	63 (1.1)	*Scotland*	48 (1.6)	**UNITED STATES**	42 (1.1)
England	54 (0.8)	*Romania*	52 (0.9)	**England**	49 (0.9)	**Iceland**	63 (1.1)	*Israel*	48 (1.6)	**England**	41 (1.1)
Iceland	54 (1.2)	**Ireland**	51 (1.3)	*Germany*	48 (1.3)	**Slovak Republic**	62 (0.7)	*Romania*	48 (1.1)	*Denmark*	41 (0.8)
Denmark	53 (0.9)	*Germany*	51 (1.3)	**Cyprus**	48 (0.7)	*Bulgaria*	62 (1.1)	**OREGON**	47 (1.2)	**Norway**	40 (0.6)
Scotland	53 (1.3)	**Iceland**	51 (1.4)	**Lithuania**	47 (1.2)	**Russian Fed.**	60 (1.2)	**Latvia (LSS)**	47 (0.9)	*Scotland*	40 (1.4)
Latvia (LSS)	53 (0.9)	**Norway**	51 (0.6)	*Scotland*	46 (1.5)	**Spain**	60 (0.7)	**Iceland**	45 (1.4)	**Spain**	40 (0.8)
Greece	53 (0.8)	*Greece*	51 (0.7)	*Greece*	46 (0.8)	**Latvia (LSS)**	56 (0.8)	**Spain**	44 (0.7)	**Cyprus**	40 (0.7)
Spain	52 (0.5)	**Spain**	49 (0.6)	*Denmark*	45 (0.7)	*Greece*	56 (0.8)	**Cyprus**	44 (0.9)	**Latvia (LSS)**	39 (0.9)
Lithuania	51 (1.0)	**Sweden**	48 (0.7)	**Norway**	45 (0.7)	**Portugal**	54 (0.7)	*Greece*	43 (0.9)	*Greece*	39 (1.1)
Cyprus	50 (0.6)	**UNITED STATES**	48 (1.2)	**Sweden**	44 (0.9)	**Cyprus**	53 (0.6)	**Lithuania**	43 (0.9)	**Iceland**	38 (1.4)
Romania	48 (1.0)	**Cyprus**	47 (0.6)	**Iceland**	40 (1.3)	**Lithuania**	52 (1.0)	**UNITED STATES**	40 (1.1)	**Iran, Islamic Rep.**	36 (0.8)
Portugal	44 (0.7)	**Portugal**	44 (0.8)	**Portugal**	40 (0.8)	*Romania*	49 (1.0)	**Portugal**	39 (0.7)	**Lithuania**	35 (0.9)
Iran, Islamic Rep.	39 (0.6)	**Iran, Islamic Rep.**	43 (0.8)	**Iran, Islamic Rep.**	37 (0.8)	**Iran, Islamic Rep.**	41 (0.6)	**Iran, Islamic Rep.**	29 (1.2)	**Portugal**	32 (0.8)
Colombia	31 (0.9)	*Kuwait*	38 (1.0)	*Kuwait*	30 (1.0)	*Kuwait*	38 (1.0)	*Colombia*	25 (1.5)	*Colombia*	23 (0.9)
Kuwait	27 (0.8)	*Colombia*	29 (0.9)	*Colombia*	28 (0.9)	*Colombia*	37 (1.0)	*Kuwait*	23 (1.0)	*Kuwait*	21 (0.7)
South Africa	26 (1.4)	*South Africa*	24 (1.0)	*South Africa*	23 (1.1)	*South Africa*	26 (1.2)	*South Africa*	18 (1.1)	*South Africa*	21 (0.9)

Country average significantly higher than Oregon average

No statistically significant difference between country average and Oregon average

Country average significantly lower than Oregon average

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected 1997.

*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

What Are the Gender Differences in Achievement for the Content Areas?

In the United States, as in other countries, policy makers have made great efforts to make mathematics more accessible to girls, and to encourage gender equity in this subject. Table 2.2 shows that similar to the findings for the United States, Missouri and Oregon showed no significant gender gap in any of the six content areas. In fact, Table 2.2 indicates few statistically significant gender differences in achievement by content areas. However, the reduced number of gender differences in performance overall compared to the differences in scale scores discussed in Chapter 1 reinforces the idea of less precision in the percent-correct metric. Still, the findings are consistent — few gender differences, but the differences that do exist tended to favor boys. The exception to the pattern internationally occurred in algebra, where, if anything, girls tended to have the advantage.

In fractions and number sense, geometry, and data representation, the gender differences were minimal, except Korean boys outperformed girls in both fractions and number sense and data representation and boys in Greece had significantly higher achievement than girls in geometry. In proportionality, there were no significant gender differences, with boys and girls performing similarly in most countries.

In algebra, no gender differences were statistically significant, but the results appeared to be more diverse, with girls having slightly higher averages (three percentage points or more) than boys in a dozen or so countries. This pattern also is evidenced in the results for Missouri.

Even though the differences were statistically significant only in Korea, Portugal, Spain and Denmark, the most differences in performance by gender were found in measurement. The data indicate higher achievement for boys than girls in a number of countries, including the United States—a pattern also found in Missouri and Oregon.

In some respects, the TIMSS findings about gender differences parallel those found in the Second International Mathematics Study (SIMS) conducted in 1980-82.[1] Based on testing the grade with the most 13-year-old students, SIMS results indicated that girls were more likely to achieve better than boys in computation-level arithmetic, whole numbers, estimation and approximation, and algebra. Boys tended to be better in measurement, geometry, and proportional thinking. Even though the SIMS gender differences in arithmetic, geometry, and proportional thinking did not appear in the TIMSS results, the patterns of higher achievement for girls in algebra and of higher achievement for boys in measurement are consistent from the second to the third IEA mathematics studies. In the SIMS report, the authors suggested that "boys' familiarity with the application of, and relationships between, units of measure may well be related to their link with traditionally male occupations, hobbies, and pastimes, and the gender differences for this subtest may underline the effect that experience can have on learning." This potential explanation for boys' advantage in the content area of measurement may also be worth considering in the context of the TIMSS data.

[1] Robitaille, D.F. (1989). "Students' Achievements: Population A" in D.F. Robitaille and R.A. Garden (eds.), *The IEA Study of Mathematics II: Contexts and Outcomes of School Mathematics*. New York: Pergamon Press.

Table 2.2

Average Percent Correct for Boys and Girls by Mathematics Content Areas: Eighth Grade*

Country	Mathematics Overall		Fractions & Number Sense		Geometry		Algebra	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
‡ **UNITED STATES**	53 (1.2)	53 (1.1)	60 (1.3)	59 (1.2)	49 (1.4)	47 (1.1)	50 (1.4)	51 (1.2)
‡ **MISSOURI**	53 (1.6)	54 (1.5)	58 (1.8)	60 (1.6)	49 (1.5)	50 (1.8)	49 (2.1)	53 (1.9)
OREGON	58 (1.8)	57 (1.8)	61 (2.1)	60 (1.9)	56 (1.5)	54 (1.8)	56 (2.2)	56 (2.3)
‡ Belgium (Fl)	65 (2.0)	66 (1.9)	71 (1.8)	72 (1.7)	63 (2.1)	64 (2.1)	60 (2.5)	65 (2.4)
Canada	59 (0.7)	59 (0.6)	63 (0.8)	64 (0.7)	58 (0.9)	58 (0.7)	52 (0.9)	55 (1.0)
Cyprus	47 (0.6)	48 (0.6)	50 (0.7)	50 (0.8)	47 (0.9)	48 (0.8)	46 (0.9)	49 (0.9)
Czech Republic	67 (1.0)	64 (1.3)	70 (1.1)	68 (1.3)	68 (1.1)	65 (1.4)	64 (1.4)	66 (1.4)
‡ England	53 (1.3)	53 (0.9)	54 (1.3)	53 (1.0)	54 (1.5)	54 (1.3)	47 (1.6)	51 (1.1)
‡ France	62 (0.8)	61 (0.9)	65 (0.9)	64 (1.0)	67 (1.0)	65 (1.1)	54 (1.1)	54 (1.3)
Hong Kong	72 (1.7)	68 (1.7)	74 (1.7)	70 (1.7)	74 (1.8)	71 (1.9)	71 (1.8)	69 (2.0)
Hungary	61 (0.8)	62 (0.8)	64 (1.0)	65 (0.9)	61 (1.0)	60 (1.0)	61 (1.0)	66 (1.1)
Iceland	49 (1.3)	50 (1.3)	54 (1.8)	55 (1.4)	50 (1.3)	52 (1.6)	39 (1.1)	41 (1.9)
Iran, Islamic Rep.	39 (0.8)	36 (0.8)	40 (0.9)	37 (0.8)	45 (1.1)	40 (1.2)	36 (0.9)	38 (1.2)
Ireland	60 (1.6)	58 (1.4)	65 (1.7)	64 (1.5)	54 (1.7)	49 (1.6)	54 (1.7)	53 (1.7)
Japan	74 (0.5)	73 (0.4)	76 (0.6)	75 (0.5)	79 (0.6)	80 (0.5)	72 (0.7)	72 (0.7)
Korea	▲ 73 (0.6)	70 (0.7)	▲ 76 (0.7)	72 (0.8)	77 (0.8)	73 (0.8)	70 (0.8)	69 (0.9)
‡ Latvia (LSS)	52 (1.0)	51 (0.8)	53 (1.2)	53 (1.0)	58 (1.0)	56 (1.1)	50 (1.3)	51 (0.9)
‡ Lithuania	48 (1.1)	49 (1.0)	51 (1.2)	52 (1.2)	54 (1.2)	53 (1.2)	45 (1.5)	49 (1.4)
New Zealand	55 (1.4)	53 (1.3)	58 (1.4)	55 (1.3)	54 (1.5)	55 (1.4)	48 (1.5)	49 (1.3)
Norway	54 (0.6)	53 (0.6)	58 (0.7)	58 (0.7)	50 (0.8)	51 (0.9)	44 (0.9)	46 (0.9)
Portugal	44 (0.8)	42 (0.7)	45 (0.9)	42 (0.8)	46 (1.2)	42 (0.9)	39 (1.0)	40 (1.0)
Russian Federation	59 (1.4)	61 (1.3)	61 (1.5)	62 (1.1)	62 (1.7)	64 (1.4)	61 (1.8)	64 (1.3)
Singapore	79 (1.1)	79 (1.0)	83 (1.0)	84 (0.8)	76 (1.3)	77 (1.2)	75 (1.3)	77 (1.3)
Slovak Republic	63 (0.9)	62 (0.8)	66 (1.0)	66 (0.8)	65 (0.9)	62 (1.0)	60 (1.1)	64 (1.0)
Spain	52 (0.7)	50 (0.7)	53 (0.7)	51 (0.7)	51 (0.8)	48 (0.8)	54 (1.0)	54 (0.9)
Sweden	56 (0.8)	56 (0.8)	62 (0.9)	62 (0.9)	48 (0.8)	49 (0.8)	43 (1.0)	45 (1.1)
‡ Switzerland	63 (0.8)	61 (0.7)	67 (0.8)	66 (0.9)	60 (1.1)	59 (0.9)	53 (1.1)	53 (0.9)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):								
Australia	57 (1.2)	59 (1.1)	60 (1.2)	61 (1.1)	57 (1.3)	58 (1.2)	53 (1.3)	57 (1.2)
Austria	63 (0.8)	61 (1.2)	67 (0.9)	65 (1.1)	57 (1.3)	57 (1.4)	59 (0.9)	60 (1.2)
Belgium (Fr)	59 (1.1)	58 (1.0)	62 (1.4)	62 (0.9)	60 (1.3)	57 (1.1)	52 (1.6)	55 (1.3)
Netherlands	61 (1.8)	59 (1.6)	63 (1.8)	60 (1.7)	61 (2.1)	58 (1.8)	52 (1.8)	53 (1.8)
Scotland	53 (1.7)	50 (1.3)	55 (1.5)	51 (1.3)	54 (1.8)	50 (1.4)	46 (2.0)	46 (1.4)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):								
Colombia	30 (1.6)	29 (0.9)	31 (1.8)	30 (0.7)	29 (1.6)	29 (1.1)	28 (1.7)	28 (1.0)
‡ Germany	54 (1.3)	54 (1.2)	60 (1.3)	57 (1.3)	51 (1.5)	53 (1.5)	47 (1.5)	49 (1.4)
Romania	49 (1.1)	49 (1.0)	48 (1.2)	48 (1.0)	53 (1.1)	51 (1.1)	50 (1.5)	54 (1.2)
Slovenia	62 (0.8)	60 (0.7)	64 (0.9)	62 (0.8)	61 (1.1)	59 (1.1)	61 (1.0)	61 (0.9)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):								
Denmark	▲ 54 (0.8)	50 (0.9)	55 (1.0)	51 (1.1)	56 (1.1)	53 (1.3)	47 (0.8)	44 (1.0)
Greece	51 (0.9)	48 (0.7)	54 (1.0)	51 (0.8)	▲ 53 (0.9)	48 (0.9)	46 (1.0)	46 (0.9)
Thailand	56 (1.4)	58 (1.7)	59 (1.5)	61 (1.8)	60 (1.3)	63 (1.5)	51 (1.8)	55 (2.0)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):								
‡ Israel	61 (1.5)	55 (1.5)	64 (1.6)	58 (1.6)	61 (1.3)	55 (1.8)	63 (1.7)	59 (1.9)
South Africa	25 (1.7)	22 (1.0)	28 (2.0)	24 (1.2)	25 (1.6)	24 (0.9)	24 (1.5)	23 (1.2)
International Average Percent Correct	56 (0.2)	55 (0.2)	58 (0.2)	57 (0.2)	56 (0.2)	55 (0.2)	52 (0.2)	53 (0.2)

▲ = Difference from other gender statistically significant at .05 level, adjusted for multiple comparisons

*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 2.2 (Continued)

Average Percent Correct for Boys and Girls by Mathematics Content Areas: Eighth Grade*

Country	Data Representation, Analysis & Probability		Measurement		Proportionality	
	Boys	Girls	Boys	Girls	Boys	Girls
‡ **UNITED STATES**	65 (1.1)	66 (1.2)	42 (1.2)	38 (1.2)	43 (1.1)	42 (1.2)
‡ **MISSOURI**	65 (1.5)	67 (1.4)	44 (1.9)	40 (1.5)	43 (1.6)	41 (1.5)
OREGON	70 (1.8)	70 (1.5)	49 (2.2)	45 (2.0)	47 (1.7)	45 (1.9)
‡ Belgium (Fl)	72 (2.2)	73 (1.4)	60 (1.9)	59 (2.0)	52 (2.2)	53 (2.7)
Canada	69 (0.9)	69 (0.6)	52 (0.9)	50 (0.8)	48 (0.9)	48 (1.0)
Cyprus	52 (0.9)	54 (0.9)	44 (1.1)	43 (1.1)	40 (1.0)	39 (0.9)
Czech Republic	70 (0.9)	67 (1.4)	64 (1.2)	60 (1.5)	54 (1.4)	49 (1.7)
‡ England	67 (1.2)	65 (1.1)	51 (1.5)	48 (1.1)	42 (1.5)	40 (1.3)
‡ France	72 (0.8)	70 (1.1)	58 (1.0)	56 (1.1)	50 (1.2)	48 (1.2)
Hong Kong	73 (1.6)	69 (1.4)	68 (1.9)	62 (2.1)	63 (1.5)	60 (1.9)
Hungary	66 (0.9)	65 (0.9)	57 (1.0)	56 (1.0)	47 (1.2)	46 (1.1)
Iceland	63 (1.6)	62 (1.4)	45 (1.8)	45 (2.0)	40 (1.6)	37 (1.4)
Iran, Islamic Rep.	42 (0.8)	40 (0.9)	32 (1.7)	26 (1.4)	38 (1.3)	34 (1.1)
Ireland	70 (1.6)	68 (1.3)	55 (1.9)	51 (1.6)	52 (1.8)	49 (1.2)
Japan	79 (0.5)	77 (0.5)	68 (0.6)	67 (0.6)	62 (0.8)	60 (0.8)
Korea	▲ 80 (0.7)	75 (0.8)	▲ 69 (0.9)	62 (1.0)	62 (0.9)	61 (0.9)
‡ Latvia (LSS)	57 (1.0)	55 (1.0)	49 (1.2)	46 (1.1)	41 (1.1)	37 (1.0)
‡ Lithuania	52 (1.2)	52 (1.1)	44 (1.1)	41 (1.2)	34 (1.1)	35 (1.2)
New Zealand	67 (1.3)	65 (1.3)	50 (1.5)	46 (1.4)	44 (1.5)	40 (1.4)
Norway	67 (0.8)	66 (0.8)	53 (0.8)	50 (0.7)	41 (0.8)	40 (0.8)
Portugal	55 (0.9)	53 (0.8)	▲ 41 (0.9)	36 (0.8)	33 (1.0)	30 (0.9)
Russian Federation	60 (1.2)	60 (1.4)	56 (1.3)	56 (1.8)	48 (1.6)	49 (1.6)
Singapore	79 (1.1)	79 (1.0)	77 (1.3)	77 (1.0)	75 (1.2)	76 (1.1)
Slovak Republic	62 (0.9)	61 (0.8)	62 (1.1)	59 (1.0)	50 (1.1)	48 (1.3)
Spain	61 (0.8)	59 (0.8)	▲ 47 (1.0)	42 (0.9)	42 (1.1)	38 (0.9)
Sweden	70 (0.9)	69 (0.9)	56 (1.1)	55 (1.0)	46 (1.1)	43 (1.1)
‡ Switzerland	73 (1.0)	71 (0.7)	62 (1.0)	59 (1.0)	53 (1.0)	52 (0.9)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):						
Australia	66 (1.1)	69 (1.0)	54 (1.2)	53 (1.1)	47 (1.3)	46 (1.1)
Austria	69 (0.9)	68 (1.2)	64 (1.0)	60 (1.6)	50 (1.0)	48 (1.3)
Belgium (Fr)	69 (1.4)	67 (1.1)	56 (1.2)	55 (1.2)	49 (1.1)	46 (1.2)
Netherlands	74 (2.0)	70 (1.5)	58 (1.8)	56 (1.7)	54 (2.4)	49 (1.9)
Scotland	67 (1.6)	63 (1.3)	50 (2.0)	45 (1.4)	43 (1.7)	37 (1.4)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):						
Colombia	38 (1.9)	36 (1.1)	25 (1.9)	25 (2.5)	24 (1.5)	22 (0.9)
‡ Germany	65 (1.3)	64 (1.3)	52 (1.3)	50 (1.3)	44 (1.6)	41 (1.3)
Romania	49 (1.2)	48 (1.1)	49 (1.4)	47 (1.3)	41 (1.3)	42 (1.3)
Slovenia	67 (0.9)	65 (0.8)	60 (1.1)	57 (1.0)	50 (1.1)	48 (1.2)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):						
Denmark	69 (1.0)	64 (1.3)	▲ 52 (1.0)	47 (1.2)	43 (1.2)	39 (0.9)
Greece	58 (1.2)	55 (0.8)	45 (1.0)	41 (1.0)	41 (1.3)	38 (1.1)
Thailand	62 (1.3)	63 (1.4)	50 (1.5)	51 (1.8)	50 (1.7)	52 (1.9)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):						
‡ Israel	67 (1.6)	60 (1.6)	52 (1.9)	46 (1.8)	48 (2.0)	40 (1.6)
South Africa	28 (1.9)	25 (1.1)	20 (1.8)	16 (1.0)	23 (1.4)	20 (0.9)
International Average Percent Correct	63 (0.2)	62 (0.2)	52 (0.2)	49 (0.2)	46 (0.2)	44 (0.2)

▲ = Difference from other gender statistically significant at .05 level, adjusted for multiple comparisons

*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Chapter 3

Performance on Items Within Each Mathematics Content Area

This chapter presents five or six example items within each of the mathematics content areas, including the performance on each of the items for Missouri and Oregon and for each of the TIMSS countries. The example items were selected to illustrate the different topics covered within each content area as well as the different performance expectations. The items also were chosen to show the range of item formats used within each area. To provide some sense of what types of items were answered correctly by higher-performing as compared to lower-performing students, the items show a range of difficulty within each content area. Finally, it should be noted that all these items and others are released for use by the public.[1]

The presentation for each of the content areas begins with a brief description of the major topics included in the content area and a discussion of student performance in that content area. The discussion is followed by a series of tables showing achievement results on example items from that content area. Each table shows the percentages of correct responses on the example item for the United States, Missouri, and Oregon and for each of the countries participating in TIMSS at the eighth grade. Each table also presents the example item in its entirety. The correct answer is circled for multiple-choice items and shown in the answer space for short-answer items. For extended-response questions, the answer shown exemplifies the type of student responses that were given full credit. All of the responses shown have been reproduced from students' actual test booklets.

After the tables showing the results on each of the items, there is a figure relating achievement on each of the example items to performance on the TIMSS international mathematics scale. This "difficulty map" provides a pictorial representation of achievement on the scale in relation to achievement on the example items for the content area.

[1] The IEA retained about one-third of the TIMSS items as secure for possible future use in measuring international trends in mathematics and science achievement. All remaining items are available for general use.

What Have Students Learned About Fractions and Number Sense?

The category of fractions and number sense included operations and problem solving with whole numbers, fractions, decimals, and percentages, as well as estimating and rounding. Example Item 1 is a subtraction problem with whole numbers that requires regrouping (borrowing). The international average percent correct (86%) shown in Table 3.1 indicates that most students were successful on this item. Both Missouri and Oregon performed at about the international average with 87% and 85%, respectively. In general, the lack of variation in performance across countries and states suggests that most eighth graders have developed a grasp of how to solve this type of problem prior to the eighth grade.

Example Item 2 involved understanding the relative size of fractions and required students to provide their response, rather than select an answer in the multiple-choice format. As seen in Table 3.2, on average, three-fourths of eighth graders (75%) provided a correct response (any fraction larger than two-sevenths). Students in Missouri and Oregon performed above the international average, with 82% of the students responding correctly in both states. With the exception of Iran, Kuwait, and South Africa, at least 60% of the students in each of the participating countries responded correctly.

As indicated in Table 3.3, on average, about two-thirds of the students (67%) correctly solved Example Item 3. This item required students to interpret the information about the scale provided on the map shown in Table 3.3. Students in Missouri and Oregon performed near the international average, with 62% and 64% correct responses, respectively.

Example Item 4 required students to demonstrate their understanding of rounded values. Any value within the range of 165 through 174 was coded as a correct response. Oregon (70%) and Missouri (64%) both performed above the international average of 54% on this problem. There was considerable variation in performance on this problem across countries. For example, as indicated in Table 3.4, 80% or more of the students in the Czech Republic, Korea, Singapore, Sweden, and Australia provided a correct answer to this question. In contrast, fewer than 20% of the students did so in Cyprus, Iran, Spain, Colombia, Kuwait, and South Africa.

Multi-step problems such as the one shown in Example Item 5 were difficult for most students. As indicated in Table 3.5, on average, 39% of students internationally, responded correctly to this problem. The most prevalent mistake was to select the amount of fuel used on the trip (option C) rather than the amount of fuel remaining in the tank. Thirty-four percent of students across the United States and in Oregon responded correctly to this item, while in Missouri 33% responded correctly.

The international averages for Example Item 6 presented in Table 3.6 indicate that working with percentages is a challenge for many students. Only about one-fourth of the students (29%) responded correctly to this multiple-choice item, on average. Singapore posted by far the best performance on this item (78%), with Hong Kong having the next highest achievement (54%). Students in Missouri (19%) performed below the international average as did those in the United States (20%). Eighth graders in Oregon (27%) performed closer to the international average.

Figure 3.1 presents a pictorial representation of the relationship between performance on the TIMSS international mathematics scale and achievement on the six example items for fractions and number sense.[2] The achievement on each example item is indicated both by the average percent correct at the eighth grade and by the international mathematics scale value, or item difficulty level, for each item.

For the figure, the item results have been placed on the scale at the point where students at that level were more likely than not (65% probability) to answer the question correctly. For example, students scoring at or above 546 on the scale were likely to provide a correct response to the rounding item about the dolphin's actual weight (Example Item 4), and those scoring at or above 610 were likely to have responded correctly to the problem about rate of fuel consumption (Example Item 5). Considering that the international average on the scale was 513, students achieving at about the level of the international average such as those in Missouri and Oregon were unlikely to have answered Example Item 5 or Example Item 6 correctly. These results, however, varied dramatically by country. Students in Singapore, whose mean achievement was 643, had relatively high probabilities of answering all but the most difficult fractions and number sense items correctly. Indeed, this is borne out by Singapore's average percent correct of 79% in this content area.

[2] The three-digit item label shown in the lower right corner of the box locating each example item on the item difficulty map refers to the original item identification number used in the student test booklets.

Table 3.1: Fractions and Number Sense

Percent Correct for Example Item 1 - Eighth Grade*

Country	Percent Correct	Example 1 Subtraction problem with whole numbers
‡ **UNITED STATES**	90 (1.1)	
‡ **MISSOURI**	87 (1.5)	
OREGON	85 (1.7)	
‡ Belgium (Fl)	93 (2.9)	
Canada	91 (1.7)	
Cyprus	85 (2.2)	
Czech Republic	97 (0.9)	
‡ England	65 (3.2)	
‡ France	97 (1.2)	
Hong Kong	89 (1.9)	
Hungary	96 (1.2)	
Iceland	89 (3.2)	
Iran, Islamic Rep.	83 (2.6)	
Ireland	94 (1.5)	
Japan	93 (1.2)	
Korea	89 (1.8)	
‡ Latvia (LSS)	89 (2.1)	
‡ Lithuania	92 (1.6)	
New Zealand	71 (2.3)	
Norway	87 (2.0)	
Portugal	87 (1.7)	
Russian Federation	92 (1.6)	
Singapore	98 (0.7)	
Slovak Republic	93 (1.3)	
Spain	98 (0.7)	
Sweden	88 (1.6)	
‡ Switzerland	96 (1.1)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	82 (1.7)	
Austria	96 (1.2)	
Belgium (Fr)	91 (1.6)	
Bulgaria	78 (2.8)	
Netherlands	82 (3.6)	
Scotland	72 (2.5)	
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	64 (4.0)	
‡ Germany	89 (2.0)	
Romania	79 (2.4)	
Slovenia	98 (0.8)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	88 (2.0)	
Greece	91 (1.4)	
Thailand	86 (1.6)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	95 (1.4)	
Kuwait	52 (3.5)	
South Africa	56 (3.3)	
International Average Percent Correct	86 (0.3)	

Subtract: 6000 − 2369

A. 4369

B. 3742

C. 3631

D. 3531

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.2: Fractions and Number Sense

Percent Correct for Example Item 2 - Eighth Grade*

Country	Percent Correct	Example 2 Write a larger fraction
‡ **UNITED STATES**	81 (1.9)	Write a fraction that is larger than $\frac{2}{7}$.
‡ **MISSOURI**	82 (1.5)	
OREGON	82 (1.9)	
‡ Belgium (Fl)	81 (3.1)	
Canada	80 (1.6)	
Cyprus	77 (2.4)	
Czech Republic	83 (2.1)	
‡ England	79 (2.6)	
‡ France	75 (2.4)	
Hong Kong	85 (2.2)	Answer: $\frac{3}{7}$
Hungary	87 (1.9)	
Iceland	89 (2.8)	
Iran, Islamic Rep.	31 (3.2)	
Ireland	82 (2.0)	
Japan	87 (1.2)	
Korea	84 (2.2)	
‡ Latvia (LSS)	69 (3.1)	
‡ Lithuania	67 (3.0)	
New Zealand	80 (2.0)	
Norway	84 (1.6)	
Portugal	63 (2.7)	
Russian Federation	83 (1.9)	
Singapore	88 (1.6)	
Slovak Republic	85 (1.8)	
Spain	71 (2.0)	
Sweden	78 (2.5)	
‡ Switzerland	83 (2.0)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	78 (1.6)	
Austria	87 (1.7)	
Belgium (Fr)	72 (2.6)	
Bulgaria	64 (4.7)	
Netherlands	76 (3.3)	
Scotland	81 (2.4)	
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	77 (2.8)	
‡ Germany	81 (2.3)	
Romania	64 (2.7)	
Slovenia	77 (2.7)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	65 (3.8)	
Greece	77 (2.0)	
Thailand	73 (2.1)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	80 (3.1)	
Kuwait	37 (5.7)	
South Africa	50 (2.4)	
International Average Percent Correct	75 (0.4)	

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.3: Fractions and Number Sense

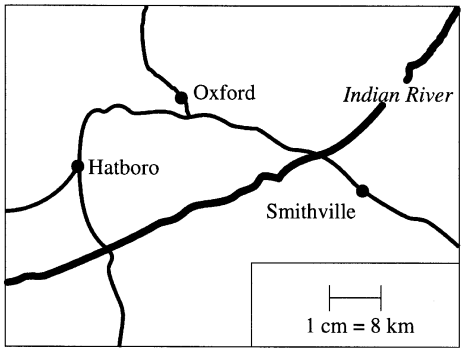
Percent Correct for Example Item 3 - Eighth Grade*

Country	Percent Correct
‡ **UNITED STATES**	61 (2.5)
‡ **MISSOURI**	62 (2.3)
OREGON	64 (2.4)
‡ Belgium (Fl)	84 (2.6)
Canada	63 (2.0)
Cyprus	61 (2.7)
Czech Republic	83 (2.5)
‡ England	69 (3.1)
‡ France	84 (2.0)
Hong Kong	64 (2.5)
Hungary	82 (2.0)
Iceland	68 (4.4)
Iran, Islamic Rep.	32 (3.2)
Ireland	67 (2.4)
Japan	79 (1.7)
Korea	74 (2.3)
‡ Latvia (LSS)	70 (2.8)
‡ Lithuania	67 (3.0)
New Zealand	67 (2.2)
Norway	65 (2.7)
Portugal	56 (2.6)
Russian Federation	77 (2.3)
Singapore	84 (1.6)
Slovak Republic	76 (2.3)
Spain	62 (2.3)
Sweden	77 (1.9)
‡ Switzerland	81 (2.5)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):	
Australia	69 (1.8)
Austria	78 (3.6)
Belgium (Fr)	82 (3.1)
Bulgaria	75 (4.4)
Netherlands	74 (3.7)
Scotland	65 (3.1)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):	
Colombia	31 (3.1)
‡ Germany	72 (2.9)
Romania	50 (2.7)
Slovenia	76 (2.2)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):	
Denmark	85 (2.3)
Greece	50 (2.4)
Thailand	67 (2.2)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):	
‡ Israel	59 (3.3)
Kuwait	30 (4.1)
South Africa	24 (2.2)
International Average Percent Correct	67 (0.4)

Example 3

Distance on map

One centimeter on the map represents 8 kilometers on the land.



About how far apart are Oxford and Smithville on the land?

A. 4 km

B. 16 km

C. 35 km

D. 50 km

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.4: Fractions and Number Sense

Percent Correct for Example Item 4 - Eighth Grade*

Country	Percent Correct	Example 4 Actual weight from rounded value
‡ **UNITED STATES**	66 (2.1)	Rounded to the nearest 10 kg the weight of a dolphin was reported as 170 kg. Write down a weight that might have been the actual weight of the dolphin. Answer: 168
‡ **MISSOURI**	64 (2.5)	
OREGON	70 (1.8)	
‡ Belgium (Fl)	65 (2.4)	
Canada	67 (1.7)	
Cyprus	17 (1.9)	
Czech Republic	80 (1.7)	
‡ England	72 (2.5)	
‡ France	– –	
Hong Kong	56 (2.8)	
Hungary	67 (2.0)	
Iceland	59 (4.1)	
Iran, Islamic Rep.	6 (1.1)	
Ireland	68 (2.0)	
Japan	76 (1.3)	
Korea	85 (1.3)	
‡ Latvia (LSS)	49 (2.5)	
‡ Lithuania	47 (2.5)	
New Zealand	74 (1.8)	
Norway	77 (1.6)	
Portugal	33 (1.9)	
Russian Federation	59 (2.8)	
Singapore	89 (1.3)	
Slovak Republic	52 (2.1)	
Spain	28 (2.1)	
Sweden	88 (1.3)	
‡ Switzerland	59 (1.8)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	81 (1.4)	
Austria	63 (2.1)	
Belgium (Fr)	30 (2.6)	
Bulgaria	44 (3.8)	
Netherlands	61 (2.9)	
Scotland	74 (2.0)	
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	6 (1.1)	
‡ Germany	55 (2.4)	
Romania	26 (2.0)	
Slovenia	38 (2.4)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	71 (2.0)	
Greece	56 (2.0)	
Thailand	40 (2.4)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	63 (3.6)	
Kuwait	10 (1.9)	
South Africa	16 (2.2)	
International Average Percent Correct	54 (0.4)	

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. Internationally comparable data are unavailable for France on Example Item 4.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon datta collected in 1997.

Table 3.5: Fractions and Number Sense

Percent Correct for Example Item 5 - Eighth Grade*

Country	Percent Correct
‡ **UNITED STATES**	34 (1.8)
‡ **MISSOURI**	33 (1.6)
OREGON	34 (1.9)
‡ Belgium (Fl)	49 (3.0)
Canada	36 (2.0)
Cyprus	30 (2.5)
Czech Republic	43 (4.1)
‡ England	40 (2.9)
‡ France	34 (2.5)
Hong Kong	48 (3.1)
Hungary	46 (3.0)
Iceland	25 (4.1)
Iran, Islamic Rep.	30 (2.3)
Ireland	42 (2.5)
Japan	– –
Korea	50 (2.7)
‡ Latvia (LSS)	38 (3.3)
‡ Lithuania	38 (3.3)
New Zealand	40 (2.7)
Norway	37 (2.7)
Portugal	37 (2.6)
Russian Federation	41 (2.9)
Singapore	70 (2.6)
Slovak Republic	38 (2.4)
Spain	25 (2.2)
Sweden	43 (2.8)
‡ Switzerland	44 (2.1)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):	
Australia	42 (2.2)
Austria	33 (2.7)
Belgium (Fr)	36 (2.6)
Bulgaria	63 (5.2)
Netherlands	50 (3.5)
Scotland	38 (2.9)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):	
Colombia	29 (3.4)
‡ Germany	37 (2.7)
Romania	39 (2.9)
Slovenia	31 (2.9)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):	
Denmark	31 (3.5)
Greece	29 (2.6)
Thailand	44 (2.7)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):	
‡ Israel	41 (5.1)
Kuwait	22 (3.1)
South Africa	23 (2.1)
International Average Percent Correct	39 (0.5)

Example 5

Rate of fuel consumption

A car has a fuel tank that holds 35 L of fuel. The car consumes 7.5 L of fuel for each 100 km driven. A trip of 250 km was started with a full tank of fuel. How much fuel remained in the tank at the end of the trip?

A. 16.25 L

B. 17.65 L

C. 18.75 L

D. 23.75 L

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indictes data are not available. Internationally comparable data are unavailable for Japan on Example Item 5.

Table 3.6: Fractions and Number Sense

Percent Correct for Example Item 6 - Eighth Grade*

Country	Percent Correct
‡ **UNITED STATES**	20 (1.8)
‡ **MISSOURI**	19 (1.7)
OREGON	27 (2.2)
‡ Belgium (Fl)	33 (2.4)
Canada	20 (1.7)
Cyprus	19 (2.8)
Czech Republic	38 (3.4)
‡ England	21 (2.5)
‡ France	29 (2.7)
Hong Kong	54 (2.7)
Hungary	46 (2.8)
Iceland	24 (3.2)
Iran, Islamic Rep.	11 (2.2)
Ireland	39 (3.2)
Japan	41 (2.0)
Korea	37 (2.8)
‡ Latvia (LSS)	17 (2.4)
‡ Lithuania	14 (2.5)
New Zealand	30 (2.4)
Norway	29 (2.5)
Portugal	11 (1.6)
Russian Federation	26 (2.4)
Singapore	78 (2.4)
Slovak Republic	34 (2.6)
Spain	11 (1.6)
Sweden	32 (2.1)
‡ Switzerland	25 (1.8)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):	
Australia	28 (1.9)
Austria	40 (2.7)
Belgium (Fr)	36 (4.4)
Bulgaria	29 (4.6)
Netherlands	44 (3.1)
Scotland	25 (3.2)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):	
Colombia	11 (2.0)
‡ Germany	32 (3.5)
Romania	20 (2.2)
Slovenia	31 (2.6)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):	
Denmark	22 (2.3)
Greece	19 (2.0)
Thailand	33 (3.3)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):	
‡ Israel	31 (4.5)
Kuwait	13 (2.5)
South Africa	18 (1.7)
International Average Percent Correct	29 (0.4)

Example 6

Percent increase in price

If the price of a can of beans is raised from 60 cents to 75 cents, what is the percent increase in the price?

A. 15%

B. 20%

C. 25%

D. 30%

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

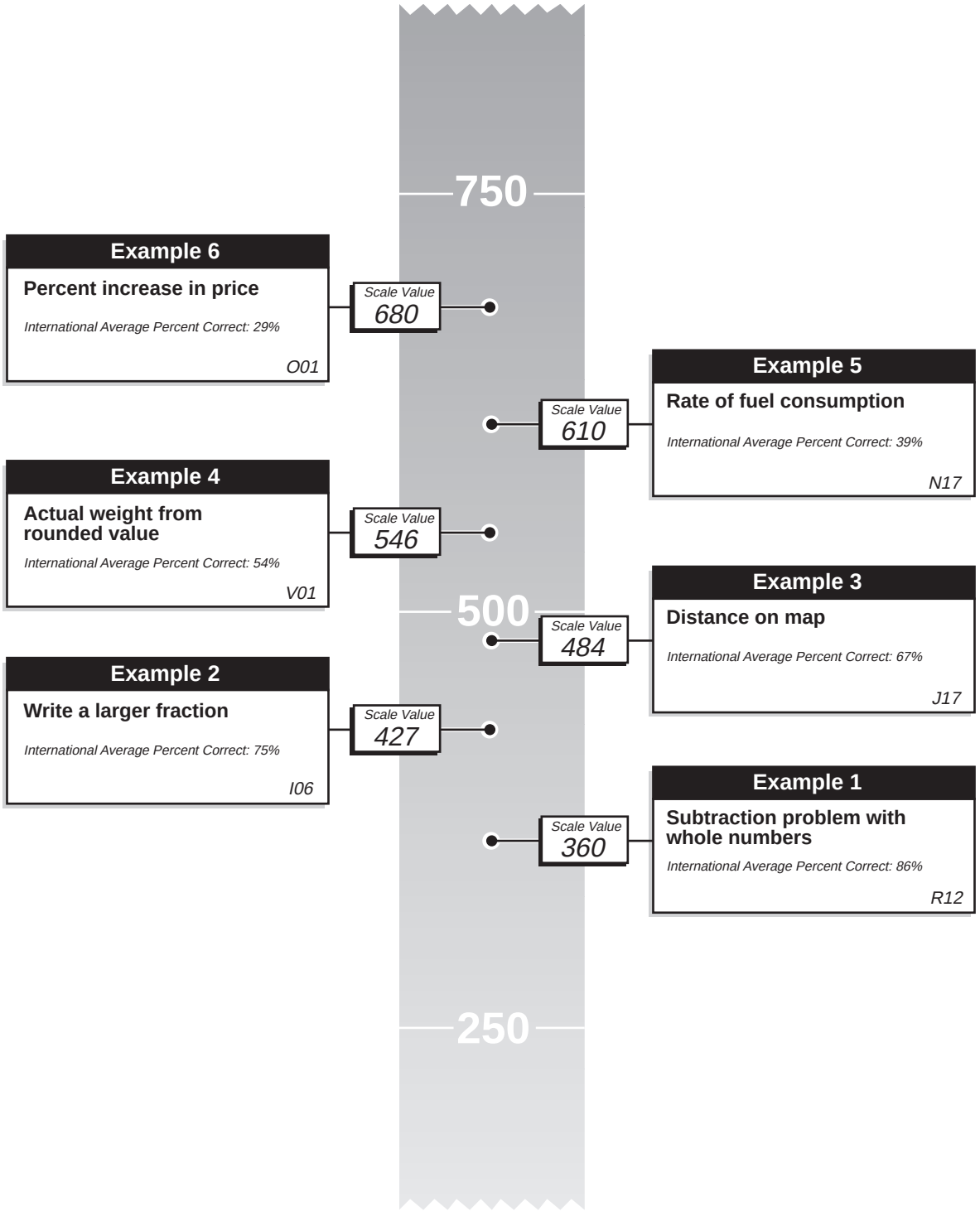
*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Figure 3.1

International Difficulty Map for Fractions and Number Sense Example Items: Eighth Grade*



*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.
NOTE: Each item was placed onto the TIMSS international mathematics scale based on students' performance in both grades of TIMSS Population 2 (seventh and eighth grades in most countries). Items are shown at the point on the scale where students with that level of proficiency had a 65 percent probability of providing a correct response.

What Have Students Learned About Geometry?

There was perhaps more variation in the geometry curriculum across countries than in any of the other mathematics content areas. The TIMSS geometry items required students to visualize geometric figures and to demonstrate their understanding of the properties of geometric figures. The range of student understanding in geometry is demonstrated by their performance on Example Items 7 through 12.

Example Item 7 (Table 3.7) assessed spatial visualization skills, and Example Item 8 (Table 3.8) lines of symmetry. Although the content differed, about two-thirds of the students internationally, on average, answered these questions correctly (Example Item 7 - 68%, Example Item 8 - 66%). On Example Item 7, Oregon (69%) performed near the international average while Missouri (61%) performed somewhat below it, as did the United States (62%). However, on Example Item 8, both Missouri and Oregon performed at least 10 percentage points above the international average.

On average, internationally, Example Item 9 (Table 3.9) requiring understanding of ratio and perimeter, was answered correctly by 56% of the students. Missouri performed at the international average while Oregon, at 63%, performed above the international average.

The majority of students had difficulties with Example Item 10 on the properties of parallelograms. As indicated by Table 3.10, the international average for the percent correct was 49%. Students in Missouri and Oregon also had difficulty with this problem with percents correct of 38% and 37%, respectively. Only in Belgium (Flemish) (79%), Korea (79%), and Bulgaria (78%) did more than three-fourths of the students answer this question correctly.

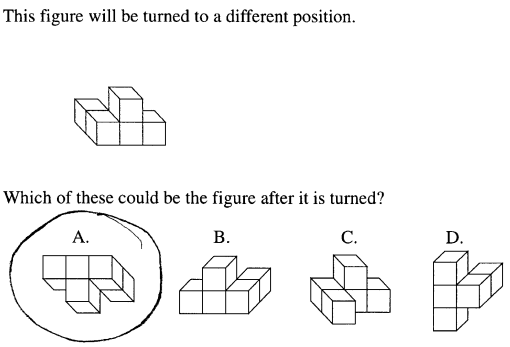
When given its coordinates and asked about another point on a line (Example Item 11), students showed great variation in performance. As presented in Table 3.11, on average, the results were low (41%). The United States performed at the international average, as did Missouri (43%), while Oregon (50%) performed above it. In the Netherlands, the top-performing country on this item, 66% of the students answered correctly. Students in England (55%) and Scotland (52%) also performed relatively well compared to their counterparts in other countries.

Example Item 12 (Table 3.12) which assessed the understanding of the properties of congruent triangles, was one of the most difficult geometry items, with an international average of 36%. Still, about two-thirds of the students responded correctly in Japan, Korea, and Singapore. Eighth graders in the United States (17%) had particular difficulty, and performance in Oregon (23%) and Missouri (14%) was similar to that in the United States.

Figure 3.2 presents the international difficulty map for the example items in geometry. Considering the international mean on the mathematics scale of 513, it can be seen that students performing above the mean were much more likely to understand the properties of geometric figures.

Table 3.7: Geometry

Percent Correct for Example Item 7 - Eighth Grade*

Country	Percent Correct	Example 7 Rotated 3-dimensional figure
‡ **UNITED STATES**	62 (2.5)	
‡ **MISSOURI**	61 (2.6)	
OREGON	69 (2.3)	
‡ Belgium (Fl)	83 (2.1)	
Canada	75 (2.1)	
Cyprus	43 (3.0)	
Czech Republic	87 (1.9)	
‡ England	77 (2.9)	
‡ France	77 (2.1)	
Hong Kong	75 (2.7)	
Hungary	71 (2.6)	
Iceland	81 (2.2)	
Iran, Islamic Rep.	42 (2.6)	
Ireland	75 (2.5)	
Japan	80 (1.3)	
Korea	74 (2.6)	
‡ Latvia (LSS)	81 (2.6)	
‡ Lithuania	69 (3.1)	
New Zealand	67 (2.3)	
Norway	78 (2.1)	
Portugal	58 (2.5)	
Russian Federation	75 (2.8)	
Singapore	79 (1.9)	
Slovak Republic	81 (2.1)	
Spain	71 (2.2)	
Sweden	53 (2.6)	
‡ Switzerland	82 (2.0)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	73 (1.7)	
Austria	80 (2.8)	
Belgium (Fr)	74 (2.4)	
Bulgaria	58 (5.3)	
Netherlands	77 (2.7)	
Scotland	72 (2.3)	
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	41 (3.6)	
‡ Germany	72 (2.7)	
Romania	53 (2.4)	
Slovenia	73 (2.5)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	73 (3.1)	
Greece	64 (2.7)	
Thailand	50 (2.5)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	57 (3.5)	
Kuwait	29 (3.3)	
South Africa	36 (2.3)	
International Average Percent Correct	68 (0.4)	

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

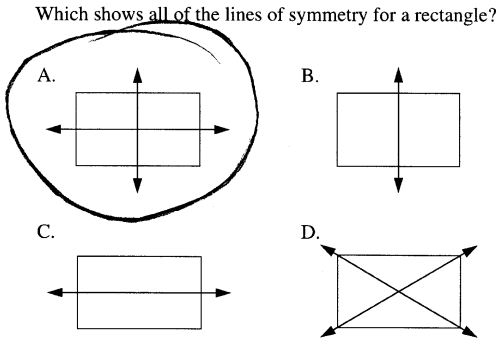
*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.8: Geometry

Percent Correct for Example Item 8 - Eighth Grade*

Country	Percent Correct	Example 8 Lines of symmetry
‡ **UNITED STATES**	70 (2.2)	
‡ **MISSOURI**	80 (2.0)	
OREGON	76 (2.0)	
‡ Belgium (Fl)	78 (3.3)	
Canada	76 (2.1)	
Cyprus	58 (2.2)	
Czech Republic	74 (2.6)	
‡ England	82 (2.6)	
‡ France	80 (2.3)	
Hong Kong	73 (2.4)	
Hungary	82 (2.1)	
Iceland	55 (3.5)	
Iran, Islamic Rep.	68 (3.3)	
Ireland	64 (2.6)	
Japan	77 (1.6)	
Korea	58 (2.7)	
‡ Latvia (LSS)	50 (3.1)	
‡ Lithuania	58 (3.6)	
New Zealand	80 (2.0)	
Norway	42 (2.7)	
Portugal	44 (2.7)	
Russian Federation	67 (3.3)	
Singapore	81 (2.1)	
Slovak Republic	75 (2.2)	
Spain	51 (2.5)	
Sweden	44 (2.4)	
‡ Switzerland	76 (2.6)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	69 (2.0)	
Austria	57 (3.9)	
Belgium (Fr)	80 (2.4)	
Bulgaria	78 (4.7)	
Netherlands	72 (3.9)	
Scotland	86 (1.7)	
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	44 (3.9)	
‡ Germany	64 (3.1)	
Romania	46 (2.7)	
Slovenia	69 (2.5)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	52 (3.2)	
Greece	62 (3.0)	
Thailand	80 (1.8)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	76 (3.5)	
Kuwait	61 (4.3)	
South Africa	29 (2.3)	
International Average Percent Correct	66 (0.4)	

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

Table 3.9: Geometry

Percent Correct for Example Item 9 - Eighth Grade*

Country	Percent Correct	Example 9 Ratio of side length to perimeter
‡ **UNITED STATES**	55 (1.9)	
‡ **MISSOURI**	56 (2.4)	
OREGON	63 (2.4)	
‡ Belgium (Fl)	72 (3.5)	
Canada	69 (1.8)	
Cyprus	55 (2.7)	
Czech Republic	60 (2.9)	
‡ England	52 (3.3)	
‡ France	69 (2.5)	
Hong Kong	71 (2.6)	
Hungary	55 (2.7)	
Iceland	32 (3.1)	
Iran, Islamic Rep.	50 (3.6)	
Ireland	54 (3.2)	
Japan	80 (1.6)	
Korea	78 (2.1)	
‡ Latvia (LSS)	54 (3.2)	
‡ Lithuania	46 (3.0)	
New Zealand	48 (2.5)	
Norway	41 (2.5)	
Portugal	48 (2.3)	
Russian Federation	55 (4.3)	
Singapore	80 (1.8)	
Slovak Republic	67 (2.3)	
Spain	55 (2.6)	
Sweden	47 (2.5)	
‡ Switzerland	55 (2.4)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	60 (2.1)	
Austria	69 (3.0)	
Belgium (Fr)	62 (3.1)	
Bulgaria	56 (3.4)	
Netherlands	60 (4.5)	
Scotland	48 (3.0)	
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	37 (4.2)	
‡ Germany	45 (3.3)	
Romania	59 (2.8)	
Slovenia	69 (2.7)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	35 (3.1)	
Greece	61 (2.2)	
Thailand	64 (2.3)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	69 (3.5)	
Kuwait	38 (4.8)	
South Africa	31 (2.5)	
International Average Percent Correct	56 (0.5)	

What is the ratio of the length of a side of a square to its perimeter?

A. $\frac{1}{1}$

B. $\frac{1}{2}$

C. $\frac{1}{3}$

D. $\frac{1}{4}$

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.10: Geometry

Percent Correct for Example Item 10 - Eighth Grade*

Country	Percent Correct	Example 10 Properties of parallelograms
‡ **UNITED STATES**	40 (2.2)	A quadrilateral MUST be a parallelogram if it has A. one pair of adjacent sides equal B. one pair of parallel sides C. a diagonal as axis of symmetry D. two adjacent angles equal E. two pairs of parallel sides
‡ **MISSOURI**	38 (2.7)	
OREGON	37 (2.1)	
‡ Belgium (Fl)	79 (2.0)	
Canada	48 (2.5)	
Cyprus	41 (3.0)	
Czech Republic	57 (3.0)	
‡ England	48 (3.4)	
‡ France	62 (3.0)	
Hong Kong	56 (2.5)	
Hungary	57 (2.6)	
Iceland	43 (3.3)	
Iran, Islamic Rep.	31 (2.4)	
Ireland	47 (2.9)	
Japan	– –	
Korea	79 (2.1)	
‡ Latvia (LSS)	51 (3.1)	
‡ Lithuania	47 (3.2)	
New Zealand	44 (2.8)	
Norway	45 (2.6)	
Portugal	33 (2.2)	
Russian Federation	69 (3.3)	
Singapore	57 (2.3)	
Slovak Republic	46 (3.3)	
Spain	40 (2.5)	
Sweden	44 (2.6)	
‡ Switzerland	52 (2.9)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	46 (2.1)	
Austria	48 (3.5)	
Belgium (Fr)	57 (2.5)	
Bulgaria	78 (4.5)	
Netherlands	37 (3.8)	
Scotland	42 (2.5)	
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	34 (3.9)	
‡ Germany	55 (3.2)	
Romania	67 (2.9)	
Slovenia	40 (2.9)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	43 (3.0)	
Greece	47 (2.7)	
Thailand	62 (2.4)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	57 (3.1)	
Kuwait	13 (2.7)	
South Africa	27 (2.0)	
International Average Percent Correct	49 (0.5)	

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

A dash (–) indicates data are not available. Internationally comparable data are unavailable for Japan on Example Item 10.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.11: Geometry

Percent Correct for Example Item 11 - Eighth Grade*

Country	Percent Correct	Example 11 Point on a line
‡ **UNITED STATES**	41 (1.8)	A straight line on a graph passes through the points (3,2) and (4,4). Which of these points also lies on the line? A. (1,1) B. (2,4) C. (5,6) D. (6,3) E. (6,5)
‡ **MISSOURI**	43 (2.5)	
OREGON	50 (2.3)	
‡ Belgium (Fl)	44 (3.5)	
Canada	49 (2.0)	
Cyprus	30 (2.5)	
Czech Republic	34 (3.1)	
‡ England	55 (3.7)	
‡ France	34 (2.5)	
Hong Kong	50 (2.8)	
Hungary	51 (2.6)	
Iceland	43 (3.4)	
Iran, Islamic Rep.	17 (2.4)	
Ireland	46 (2.6)	
Japan	47 (2.2)	
Korea	42 (3.2)	
‡ Latvia (LSS)	38 (3.0)	
‡ Lithuania	24 (2.8)	
New Zealand	52 (2.8)	
Norway	44 (3.1)	
Portugal	46 (2.5)	
Russian Federation	46 (3.3)	
Singapore	59 (2.3)	
Slovak Republic	40 (2.8)	
Spain	39 (2.6)	
Sweden	51 (2.3)	
‡ Switzerland	51 (2.7)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	51 (1.8)	
Austria	54 (3.3)	
Belgium (Fr)	23 (2.6)	
Bulgaria	38 (5.1)	
Netherlands	66 (4.5)	
Scotland	52 (3.1)	
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	28 (4.3)	
‡ Germany	38 (2.9)	
Romania	22 (2.3)	
Slovenia	32 (2.9)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	51 (3.7)	
Greece	25 (2.4)	
Thailand	44 (2.6)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	42 (3.6)	
Kuwait	24 (3.1)	
South Africa	25 (2.2)	
International Average Percent Correct	41 (0.5)	

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.12: Geometry

Percent Correct for Example Item 12 - Eighth Grade*

Country	Percent Correct
‡ **UNITED STATES**	17 (1.6)
‡ **MISSOURI**	14 (1.4)
OREGON	23 (2.0)
‡ Belgium (Fl)	43 (2.8)
Canada	29 (2.5)
Cyprus	41 (2.4)
Czech Republic	51 (3.0)
‡ England	31 (3.7)
‡ France	50 (2.8)
Hong Kong	61 (2.7)
Hungary	39 (2.8)
Iceland	43 (3.6)
Iran, Islamic Rep.	35 (2.8)
Ireland	34 (2.6)
Japan	69 (1.7)
Korea	66 (2.1)
‡ Latvia (LSS)	25 (2.9)
‡ Lithuania	27 (2.8)
New Zealand	26 (2.5)
Norway	30 (2.3)
Portugal	21 (2.3)
Russian Federation	39 (2.9)
Singapore	69 (2.3)
Slovak Republic	45 (2.5)
Spain	14 (1.9)
Sweden	34 (2.4)
‡ Switzerland	33 (2.8)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):	
Australia	34 (1.8)
Austria	29 (2.9)
Belgium (Fr)	32 (2.8)
Bulgaria	44 (5.1)
Netherlands	21 (3.0)
Scotland	29 (2.7)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):	
Colombia	12 (2.6)
‡ Germany	29 (3.0)
Romania	41 (2.9)
Slovenia	37 (3.3)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):	
Denmark	33 (3.2)
Greece	37 (2.3)
Thailand	33 (2.2)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):	
‡ Israel	43 (3.4)
Kuwait	20 (2.8)
South Africa	14 (1.8)
International Average Percent Correct	36 (0.4)

Example 12

Congruent triangles

These triangles are congruent. The measures of some of the sides and angles of the triangles are shown.

What is the value of x ?

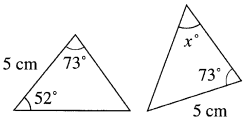
A. 52

B. 55

C. 65

D. 73

E. 75



*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

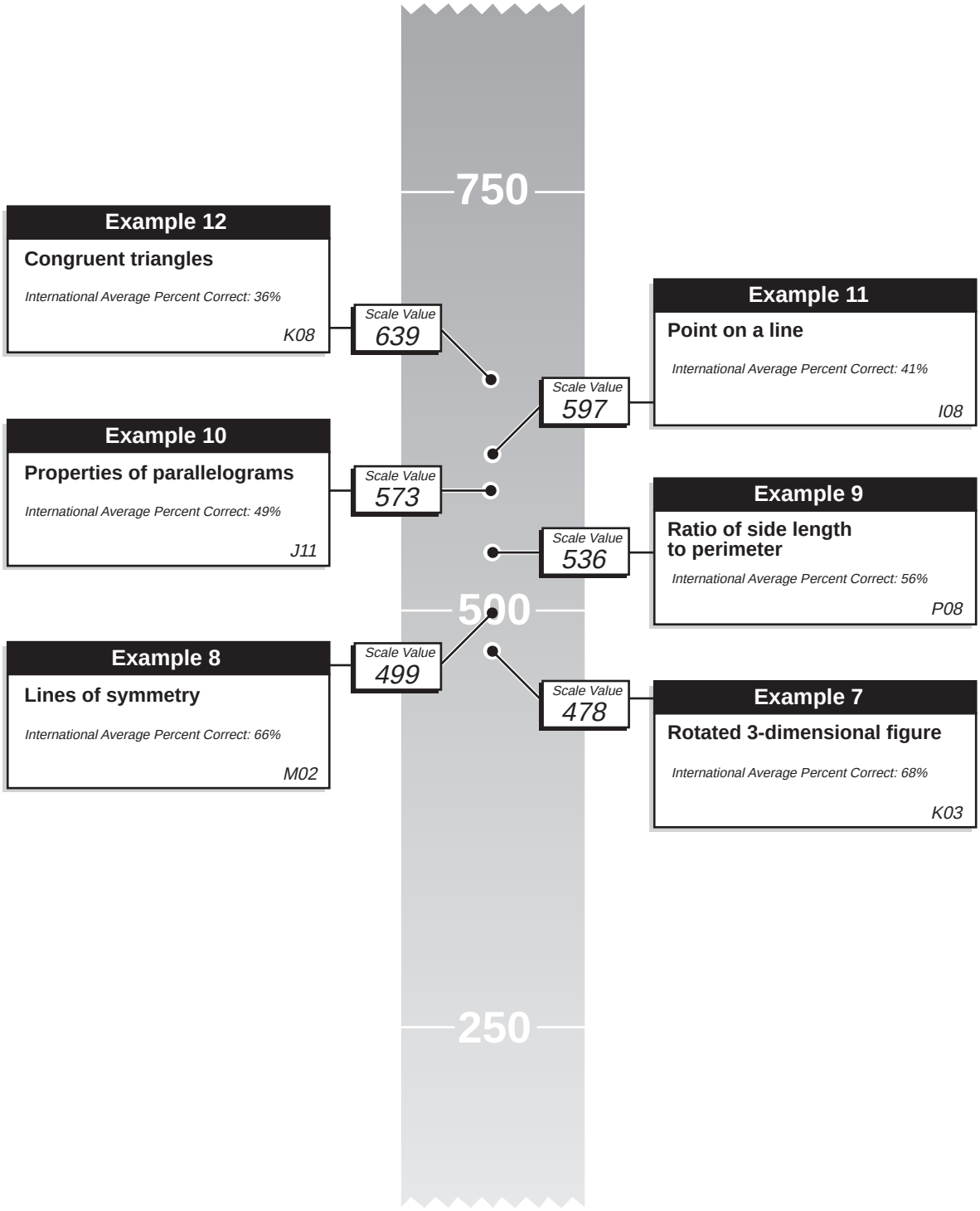
‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

Figure 3.2

International Difficulty Map for Geometry Example Items: Eighth Grade*



*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.
NOTE: Each item was placed onto the TIMSS international mathematics scale based on students' performance in both grades of TIMSS Population 2 (seventh and eighth grades in most countries). Items are shown at the point on the scale where students with that level of proficiency had a 65 percent probability of providing a correct response.

What Have Students Learned About Algebra?

To demonstrate their understanding of algebraic concepts, students were asked to solve a variety of problems involving patterns, relations, expressions, and equations. Example Items 13 through 17 illustrate the range of student performance.

As shown by Example Item 13 (Table 3.13), the easiest items measured concepts underlying algebra, such as the ability to detect patterns. Most student performed very well on this item (90% correct responses averaged across countries), with Missouri and Oregon performing above the international average at 94% and 95%, respectively.

Example Item 14 is a two-part item requiring students to supply their answers. As shown in Table 3.14, in the first part of the item, students generally were able to establish the number of small triangles in the figures (76% average correct). Of course, finding the answers of 4 and 9 could have been accomplished by actually counting the small triangles. In contrast, very few students demonstrated their ability to extend the pattern and determine that 64 small triangles would be needed for the 8th figure (international average of 26%). In only Japan (52%) and Singapore (50%) did at least half the students provide a correct response to this question. Similar to the performance of the countries, Missouri (75%) and Oregon (76%) both performed well on the first part of the item but less well on the second part of the item at 25% and 35%, respectively. It should be noted, however, that eighth graders in Oregon performed above the international average on the second part of the question.

Example Items 15, 16, and 17 required students to work with algebraic equations and expressions. The international results for Example Item 15, as shown in Table 3.15, indicate that students in most countries were relatively successful in solving a simple linear equation for x (on average, 73% correct). Missouri and Oregon both performed at about the international average on Item 15, with percents correct of 72% and 73%, respectively. As shown by the data for Example Item 16, (Table 3.16) students around the world had more difficulty recognizing that $m + m + m + m$ was equivalent to $4m$ (international average of 58%). Performance in Oregon (53%) and particularly in Missouri (42%) was below the international average. It should be noted, however, that three-fourths or more of the students answered this question correctly in the Czech Republic, Hong Kong, Japan, the Russian Federation, Singapore, the Slovak Republic, and Slovenia. Considering the performance on Example Item 16, it is not surprising that students had even more difficulty identifying the correct expression to represent the number of Clarissa's hats as required by Example Item 17 (Table 3.17). International performance on this item averaged 47%. In contrast to the international pattern, however, students in Oregon (54%) and Missouri (43%) performed about the same on Item 17 as they did on Item 16.

Figure 3.3, showing the relationship between performance on these items and performance on the mathematics scale, suggests that students in Missouri and Oregon and in most countries had considerable difficulty with all but the most straightforward algebra questions. Questions involving expressions and equations were most likely to be answered correctly by only the higher-performing students (students achieving significantly above the mean of 513).

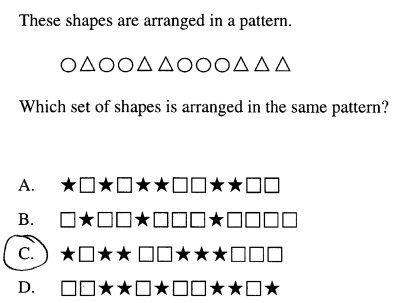
Table 3.13: Algebra

Percent Correct for Example Item 13 - Eighth Grade*

Country	Percent Correct
‡ **UNITED STATES**	93 (0.8)
‡ **MISSOURI**	94 (1.4)
OREGON	95 (0.9)
‡ Belgium (Fl)	94 (2.2)
Canada	97 (0.8)
Cyprus	83 (2.6)
Czech Republic	98 (0.6)
‡ England	95 (1.6)
‡ France	92 (1.4)
Hong Kong	90 (2.1)
Hungary	93 (1.3)
Iceland	83 (3.7)
Iran, Islamic Rep.	95 (1.3)
Ireland	94 (1.3)
Japan	96 (0.8)
Korea	97 (0.9)
‡ Latvia (LSS)	96 (1.2)
‡ Lithuania	91 (1.9)
New Zealand	94 (1.2)
Norway	92 (1.5)
Portugal	94 (1.3)
Russian Federation	95 (1.2)
Singapore	95 (0.8)
Slovak Republic	92 (1.5)
Spain	93 (1.3)
Sweden	89 (1.4)
‡ Switzerland	95 (1.4)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):	
Australia	93 (1.3)
Austria	95 (1.4)
Belgium (Fr)	96 (1.4)
Bulgaria	88 (3.4)
Netherlands	91 (1.9)
Scotland	94 (1.1)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):	
Colombia	55 (4.2)
‡ Germany	92 (1.6)
Romania	85 (2.0)
Slovenia	89 (1.6)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):	
Denmark	93 (1.8)
Greece	86 (1.6)
Thailand	96 (0.8)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):	
‡ Israel	91 (1.4)
Kuwait	78 (3.7)
South Africa	53 (3.3)
International Average Percent Correct	90 (0.3)

Example 13

Shapes in a pattern



SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.14: Algebra

Percent Correct for Example Item 14, Part A - Eighth Grade*

Country	Percent Correct
‡ **UNITED STATES**	75 (2.2)
‡ **MISSOURI**	75 (2.1)
OREGON	76 (2.5)
‡ Belgium (Fl)	83 (2.4)
Canada	82 (1.7)
Cyprus	69 (2.7)
Czech Republic	75 (2.4)
‡ England	86 (2.4)
‡ France	80 (2.1)
Hong Kong	82 (1.9)
Hungary	91 (1.4)
Iceland	77 (3.6)
Iran, Islamic Rep.	65 (2.8)
Ireland	73 (2.3)
Japan	94 (0.8)
Korea	84 (2.1)
‡ Latvia (LSS)	76 (2.7)
‡ Lithuania	66 (3.2)
New Zealand	81 (2.0)
Norway	77 (2.3)
Portugal	71 (2.6)
Russian Federation	76 (2.3)
Singapore	83 (1.5)
Slovak Republic	73 (2.4)
Spain	80 (2.0)
Sweden	75 (2.1)
‡ Switzerland	86 (1.7)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):	
Australia	80 (1.3)
Austria	91 (2.1)
Belgium (Fr)	84 (2.5)
Bulgaria	76 (3.5)
Netherlands	84 (2.5)
Scotland	89 (1.8)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):	
Colombia	46 (4.2)
‡ Germany	81 (2.4)
Romania	63 (2.6)
Slovenia	82 (2.4)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):	
Denmark	77 (2.9)
Greece	79 (2.2)
Thailand	86 (1.3)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):	
‡ Israel	78 (2.7)
Kuwait	34 (3.7)
South Africa	20 (2.5)
International Average Percent Correct	76 (0.4)

Example 14, Part A

Sequence of triangles: Chart finding pattern

Here is a sequence of three similar triangles. All of the small triangles are congruent.

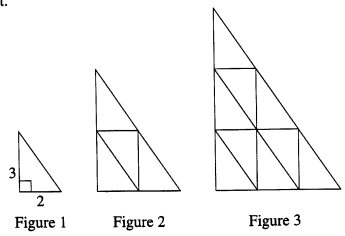


Figure 1 Figure 2 Figure 3

a. Complete the chart by finding how many small triangles make up each figure.

Figure	Number of small triangles
1	1
2	4
3	9

b. The sequence of similar triangles is extended to the 8th Figure. How many small triangles would be needed for Figure 8?

18
9+7+9+11+13+15
18 29
18
29
64
64 small triangls

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.14: Algebra (Continued)

Percent Correct for Example Item 14, Part B - Eighth Grade*

Country	Percent Correct
‡ **UNITED STATES**	25 (1.6)
‡ **MISSOURI**	25 (1.8)
OREGON	35 (2.6)
‡ Belgium (Fl)	31 (2.9)
Canada	33 (2.4)
Cyprus	20 (2.4)
Czech Republic	32 (3.4)
‡ England	42 (3.4)
‡ France	18 (2.5)
Hong Kong	48 (2.7)
Hungary	34 (2.8)
Iceland	16 (2.7)
Iran, Islamic Rep.	12 (2.7)
Ireland	25 (2.6)
Japan	52 (2.2)
Korea	38 (2.6)
‡ Latvia (LSS)	17 (2.4)
‡ Lithuania	13 (2.2)
New Zealand	31 (2.5)
Norway	22 (2.4)
Portugal	13 (1.8)
Russian Federation	22 (2.0)
Singapore	50 (2.8)
Slovak Republic	27 (2.4)
Spain	22 (2.0)
Sweden	17 (2.0)
‡ Switzerland	38 (2.5)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):	
Australia	32 (1.8)
Austria	35 (3.4)
Belgium (Fr)	22 (2.5)
Bulgaria	18 (3.5)
Netherlands	38 (3.8)
Scotland	35 (2.8)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):	
Colombia	11 (4.1)
‡ Germany	18 (2.6)
Romania	20 (2.4)
Slovenia	31 (3.2)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):	
Denmark	24 (3.4)
Greece	13 (2.1)
Thailand	26 (2.7)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):	
‡ Israel	25 (3.4)
Kuwait	20 (4.1)
South Africa	3 (1.3)
International Average Percent Correct	26 (0.4)

Example 14, Part B

Sequence of triangles: Extending pattern

Here is a sequence of three similar triangles. All of the small triangles are congruent.

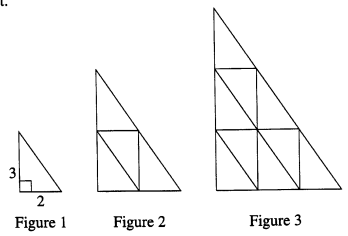
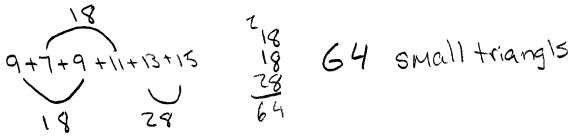


Figure 1 Figure 2 Figure 3

a. Complete the chart by finding how many small triangles make up each figure.

Figure	Number of small triangles
1	1
2	4
3	9

b. The sequence of similar triangles is extended to the 8th Figure. How many small triangles would be needed for Figure 8?



SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.15: Algebra

Percent Correct for Example Item 15 - Eighth Grade*

Country	Percent Correct	Example 15 Solve linear equation for x
‡ **UNITED STATES**	73 (2.3)	
‡ **MISSOURI**	72 (1.9)	
OREGON	73 (2.3)	If $3(x + 5) = 30$, then $x =$ A. 2 B. 5 C. 10 D. 95
‡ Belgium (Fl)	80 (2.8)	
Canada	73 (2.6)	
Cyprus	71 (3.2)	
Czech Republic	86 (2.2)	
‡ England	61 (3.4)	
‡ France	82 (2.3)	
Hong Kong	92 (1.9)	
Hungary	89 (1.7)	
Iceland	56 (3.4)	
Iran, Islamic Rep.	47 (3.7)	
Ireland	72 (3.0)	
Japan	90 (1.3)	
Korea	92 (1.6)	
‡ Latvia (LSS)	75 (2.5)	
‡ Lithuania	72 (3.4)	
New Zealand	69 (2.4)	
Norway	52 (2.5)	
Portugal	60 (2.2)	
Russian Federation	88 (1.7)	
Singapore	96 (0.9)	
Slovak Republic	84 (2.1)	
Spain	76 (2.3)	
Sweden	51 (2.7)	
‡ Switzerland	77 (2.2)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	73 (1.6)	
Austria	80 (2.1)	
Belgium (Fr)	76 (2.5)	
Bulgaria	84 (2.6)	
Netherlands	65 (4.3)	
Scotland	62 (2.8)	
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	43 (3.7)	
‡ Germany	79 (2.0)	
Romania	77 (2.7)	
Slovenia	86 (1.8)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	70 (3.3)	
Greece	75 (2.2)	
Thailand	79 (2.2)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	86 (2.9)	
Kuwait	50 (4.3)	
South Africa	39 (2.5)	
International Average Percent Correct	73 (0.4)	

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.16: Algebra

Percent Correct for Example Item 16 - Eighth Grade*

Country	Percent Correct	Example 16 Equivalent algebraic expressions
‡ **UNITED STATES**	46 (2.5)	If m represents a positive number, which of these is equivalent to $m + m + m + m$? A. $m + 4$ B. $4m$ C. m^4 D. $4(m + 1)$
‡ **MISSOURI**	42 (3.4)	
OREGON	53 (2.4)	
‡ Belgium (Fl)	69 (4.2)	
Canada	61 (2.1)	
Cyprus	59 (2.9)	
Czech Republic	75 (2.7)	
‡ England	42 (3.6)	
‡ France	65 (2.5)	
Hong Kong	79 (3.3)	
Hungary	72 (2.4)	
Iceland	59 (4.0)	
Iran, Islamic Rep.	34 (3.2)	
Ireland	53 (2.8)	
Japan	75 (1.9)	
Korea	65 (2.6)	
‡ Latvia (LSS)	58 (3.0)	
‡ Lithuania	56 (3.8)	
New Zealand	55 (2.6)	
Norway	52 (2.7)	
Portugal	42 (2.9)	
Russian Federation	75 (2.9)	
Singapore	82 (2.0)	
Slovak Republic	77 (2.6)	
Spain	59 (2.7)	
Sweden	51 (2.6)	
‡ Switzerland	54 (2.7)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	65 (1.8)	
Austria	73 (2.8)	
Belgium (Fr)	64 (2.7)	
Bulgaria	72 (3.1)	
Netherlands	51 (4.5)	
Scotland	53 (3.0)	
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	34 (4.5)	
‡ Germany	57 (3.3)	
Romania	64 (2.7)	
Slovenia	75 (2.7)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	36 (3.1)	
Greece	57 (2.5)	
Thailand	49 (3.2)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	70 (3.7)	
Kuwait	29 (3.0)	
South Africa	33 (2.7)	
International Average Percent Correct	58 (0.5)	

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.17: Algebra

Percent Correct for Example Item 17 - Eighth Grade*

Country	Percent Correct	Example 17 Expression representing number of hats
‡ **UNITED STATES**	49 (2.3)	Juan has 5 fewer hats than Maria, and Clarissa has 3 times as many hats as Juan. If Maria has n hats, which of these represents the number of hats that Clarissa has? A. $5 - 3n$ B. $3n$ C. $n - 5$ D. $3n - 5$ E. $3(n - 5)$
‡ **MISSOURI**	43 (3.2)	
OREGON	54 (2.4)	
‡ Belgium (Fl)	53 (3.8)	
Canada	45 (2.7)	
Cyprus	47 (3.0)	
Czech Republic	70 (3.7)	
‡ England	37 (3.0)	
‡ France	55 (2.8)	
Hong Kong	65 (3.2)	
Hungary	57 (3.0)	
Iceland	14 (3.2)	
Iran, Islamic Rep.	38 (3.8)	
Ireland	51 (2.6)	
Japan	57 (2.2)	
Korea	64 (2.7)	
‡ Latvia (LSS)	42 (3.3)	
‡ Lithuania	46 (3.5)	
New Zealand	38 (2.6)	
Norway	23 (2.3)	
Portugal	42 (2.3)	
Russian Federation	58 (3.8)	
Singapore	86 (1.7)	
Slovak Republic	66 (2.6)	
Spain	61 (2.3)	
Sweden	20 (2.0)	
‡ Switzerland	41 (3.1)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	45 (2.0)	
Austria	51 (3.1)	
Belgium (Fr)	46 (3.1)	
Bulgaria	64 (3.9)	
Netherlands	45 (4.0)	
Scotland	36 (3.1)	
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	33 (3.7)	
‡ Germany	41 (3.0)	
Romania	52 (3.0)	
Slovenia	55 (3.0)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	29 (2.8)	
Greece	36 (2.7)	
Thailand	46 (2.6)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	73 (3.3)	
Kuwait	27 (4.4)	
South Africa	19 (2.4)	
International Average Percent Correct	47 (0.5)	

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

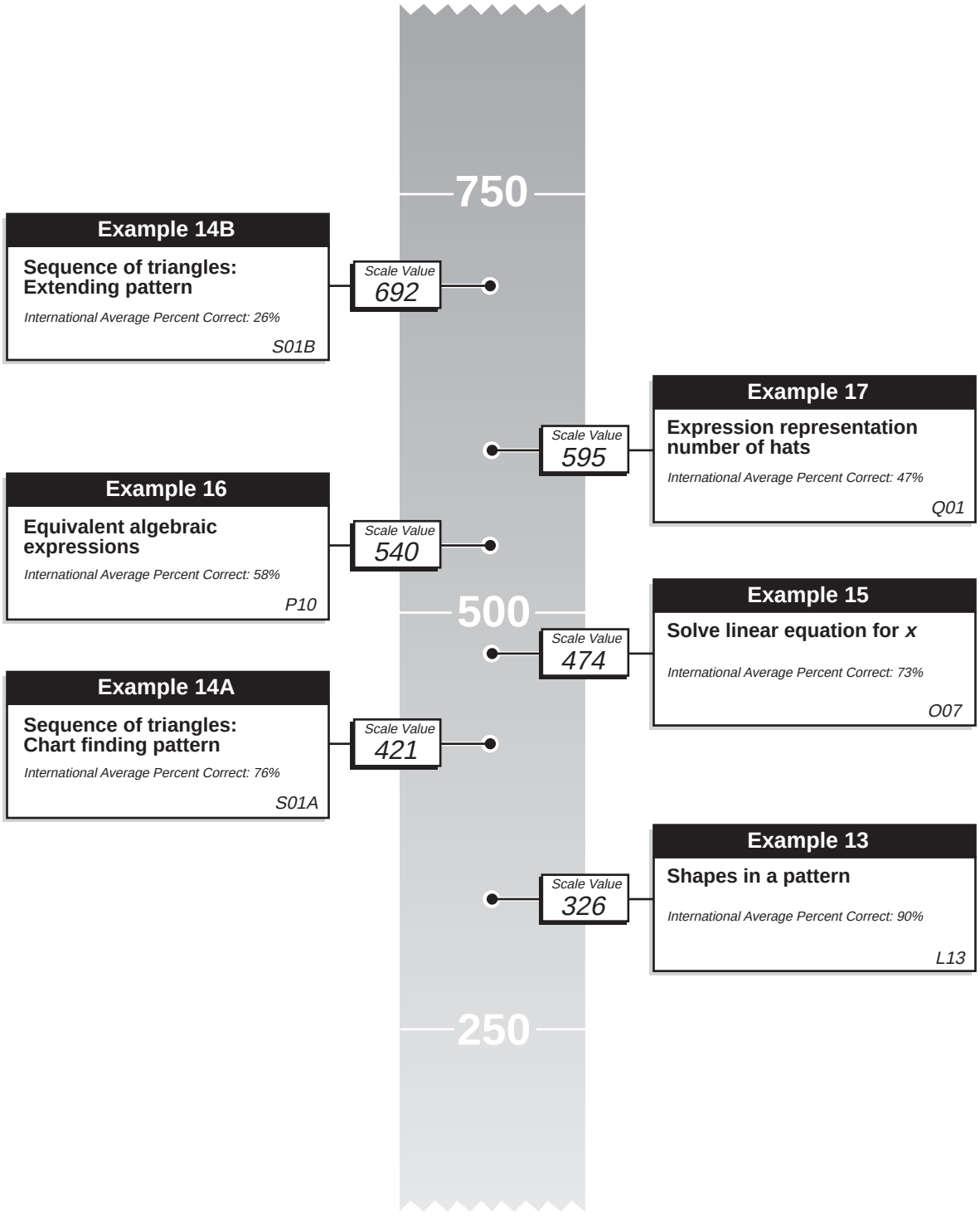
‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

Figure 3.3

International Difficulty Map for Algebra Example Items: Eighth Grade*



*Eighth grades in most countries; see Table 2 for information about the grades tested in each country.
NOTE: Each item was placed onto the TIMSS international mathematics scale based on students' performance in both grades of TIMSS Population 2 (seventh and eighth grades in most countries). Items are shown at the point on the scale where students with that level of proficiency had a 65 percent probability of providing a correct response.

What Have Students Learned About Data Representation, Analysis, and Probability?

As illustrated by Example Items 18 through 23, the types of items in this content area required students to represent and analyze data using charts, tables, and graphs and to demonstrate their understanding of basic concepts underlying uncertainty and probability.

Example Item 18 asked students to read a chart of daily temperatures. As can be seen from Table 3.18, performance on reading the chart of temperatures was high (international average of 87%). Performance also was relatively high on Example Item 19 (Table 3.19) which required students to complete a pictograph (international average of 81%). Eighth graders in Missouri and Oregon performed very well on both of these problems, with 90% or more of the students answering each question correctly.

Example Item 21, requiring students to read a line graph, posed a greater challenge for students. As indicated in Table 3.21, on average, 59% of the students internationally, answered this question correctly. Achievement in Missouri (72%) and Oregon (81%) were among the higher performing countries on this problem. There were large differences in performance among countries. Performance at 75% correct or better was achieved in Belgium (Flemish) (82%), France (81%), Japan (75%), Switzerland (77%), the Netherlands (76%), and Denmark (75%). Performance below 45% occurred in Cyprus (40%), Iran (25%), Colombia (20%), Romania (36%), South Africa (17%), and Kuwait (24%).

Example Items 20 and 22 assessed the area of probability. In general, students appeared to understand that the probability of picking the one red marble was highest for the fewest number of marbles (Example Item 20). The international average, as presented in Table 3.20, was 76%. Eighty-five percent or more of the students answered this question correctly in Missouri and Oregon, as well as in Belgium (Flemish and French), Bulgaria, Canada, England, Hong Kong, Korea, the Netherlands, Norway, Slovenia, Switzerland, and the United States. In contrast, in Example Item 22, students were asked to integrate their understanding of both cubes and probability which proved to be more difficult for them (Table 3.22). The international average of correct responses was 47%. Although the students performed quite well in Singapore (88%) and two-thirds or more answered correctly in Belgium (Flemish) (68%), Hong Kong (72%), Japan (75%), and Korea (68%), performance fell below 40% correct in a number of countries. While Missouri (46%) performed near the international average, Oregon fared better at 57%.

Example Item 23 required students to apply their mathematics understanding to an everyday situation – that of extracting and using appropriate information from a newspaper advertisement to determine which office space had the lower rent. Students were asked to show their work. To receive complete credit for the item students needed to indicate that Building A had the lower price and show accurate computations to support this conclusion. However, the scoring approach also provided partial credit for students able to show accurate computations about one of the buildings. As indicated in Table 3.23, the international average for fully correct responses (20%) was quite low. Students in Missouri and Oregon performed near the international average with 22% and 21%, respectively. Only in Singapore (55%) did more than half the students provide a complete solution to this problem, although performance in Japan (47%) and Korea (50%) also was higher than in other countries. On average internationally, about one-fourth of the students (27%) received partial credit. The corresponding figures were 31% in Missouri and 36% in Oregon.

As shown in Figure 3.4, the international difficulty map for data representation, analysis, and probability indicates that the higher performing students were more likely to demonstrate the ability to apply concepts and integrate their understandings.

Table 3.18: Data Representation, Analysis, and Probability

Percent Correct for Example Item 18 - Eighth Grade*

Country	Percent Correct
‡ **UNITED STATES**	90 (1.1)
‡ **MISSOURI**	93 (1.2)
OREGON	92 (1.1)
‡ Belgium (Fl)	91 (2.5)
Canada	92 (1.7)
Cyprus	78 (2.5)
Czech Republic	96 (0.8)
‡ England	91 (2.2)
‡ France	90 (1.7)
Hong Kong	79 (2.8)
Hungary	91 (1.4)
Iceland	90 (2.2)
Iran, Islamic Rep.	75 (2.9)
Ireland	92 (1.6)
Japan	93 (1.1)
Korea	85 (1.8)
‡ Latvia (LSS)	86 (2.2)
‡ Lithuania	87 (2.1)
New Zealand	93 (1.3)
Norway	92 (1.5)
Portugal	90 (1.6)
Russian Federation	91 (1.5)
Singapore	88 (1.4)
Slovak Republic	93 (1.4)
Spain	88 (1.7)
Sweden	94 (1.3)
‡ Switzerland	92 (1.8)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):	
Australia	92 (1.4)
Austria	91 (1.9)
Belgium (Fr)	90 (2.3)
Bulgaria	81 (2.8)
Netherlands	89 (2.4)
Scotland	91 (1.7)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):	
Colombia	71 (4.0)
‡ Germany	87 (2.2)
Romania	69 (2.8)
Slovenia	95 (1.2)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):	
Denmark	92 (2.1)
Greece	85 (1.7)
Thailand	86 (1.5)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):	
‡ Israel	89 (2.2)
Kuwait	82 (3.4)
South Africa	55 (2.6)
International Average Percent Correct	87 (0.3)

Example 18

Highest temperature on chart

This chart shows temperature readings made at different times on four days.

TEMPERATURES					
	6 a.m.	9 a.m.	Noon	3 p.m.	8 p.m.
Monday	15°	17°	20°	21°	19°
Tuesday	15°	15°	15°	10°	9°
Wednesday	8°	10°	14°	13°	15°
Thursday	8°	11°	14°	17°	20°

When was the highest temperature recorded?

A. Noon on Monday

(B) 3 p.m. on Monday

C. Noon on Tuesday

D. 3 p.m. on Wednesday

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.19: Data Representation, Analysis, and Probability

Percent Correct for Example Item 19 - Eighth Grade*

Country	Percent Correct
‡ **UNITED STATES**	89 (1.2)
‡ **MISSOURI**	93 (1.2)
OREGON	90 (1.3)
‡ Belgium (Fl)	86 (3.8)
Canada	89 (1.5)
Cyprus	82 (1.8)
Czech Republic	84 (2.3)
‡ England	92 (1.7)
‡ France	88 (1.6)
Hong Kong	81 (2.0)
Hungary	87 (1.7)
Iceland	87 (2.9)
Iran, Islamic Rep.	67 (2.9)
Ireland	89 (1.8)
Japan	94 (1.0)
Korea	90 (1.6)
‡ Latvia (LSS)	82 (1.9)
‡ Lithuania	75 (2.8)
New Zealand	92 (1.4)
Norway	86 (1.9)
Portugal	86 (1.8)
Russian Federation	78 (2.2)
Singapore	94 (1.1)
Slovak Republic	80 (2.0)
Spain	86 (1.7)
Sweden	87 (1.5)
‡ Switzerland	88 (2.1)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):	
Australia	88 (1.4)
Austria	87 (2.1)
Belgium (Fr)	82 (2.8)
Bulgaria	75 (4.1)
Netherlands	87 (3.6)
Scotland	88 (1.7)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):	
Colombia	64 (4.2)
‡ Germany	82 (2.7)
Romania	64 (2.7)
Slovenia	77 (2.0)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):	
Denmark	88 (2.2)
Greece	77 (2.5)
Thailand	94 (1.0)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):	
‡ Israel	87 (3.3)
Kuwait	29 (4.7)
South Africa	17 (3.1)
International Average Percent Correct	81 (0.4)

Example 19

Pictograph of number of students

The table shows the number of students in the 7th and 8th grades in a given school.

Grade	Number of Students
7	60
8	55

Complete the Grade 8 row in the pictograph below to represent the number of students in each grade.

One ☺ represents 10 students

Grade 7	☺☺☺☺☺☺
Grade 8	

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.20: Data Representation, Analysis, and Probability

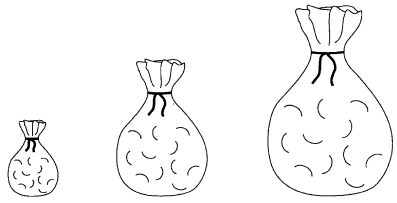
Percent Correct for Example Item 20 - Eighth Grade*

Country	Percent Correct
‡ **UNITED STATES**	86 (1.2)
‡ **MISSOURI**	87 (2.2)
OREGON	88 (1.0)
‡ Belgium (Fl)	86 (1.9)
Canada	90 (1.1)
Cyprus	68 (2.9)
Czech Republic	76 (2.8)
‡ England	86 (2.3)
‡ France	82 (2.3)
Hong Kong	89 (1.6)
Hungary	82 (2.1)
Iceland	77 (2.8)
Iran, Islamic Rep.	37 (3.1)
Ireland	82 (2.1)
Japan	83 (1.4)
Korea	91 (1.6)
‡ Latvia (LSS)	60 (3.0)
‡ Lithuania	68 (2.9)
New Zealand	82 (1.7)
Norway	85 (1.7)
Portugal	67 (2.3)
Russian Federation	70 (2.5)
Singapore	81 (1.9)
Slovak Republic	70 (2.6)
Spain	83 (2.0)
Sweden	81 (1.9)
‡ Switzerland	86 (1.4)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):	
Australia	84 (1.6)
Austria	82 (2.3)
Belgium (Fr)	85 (2.3)
Bulgaria	85 (3.8)
Netherlands	91 (1.9)
Scotland	82 (2.0)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):	
Colombia	47 (4.0)
‡ Germany	83 (2.2)
Romania	52 (2.7)
Slovenia	85 (2.2)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):	
Denmark	83 (2.2)
Greece	71 (1.9)
Thailand	76 (1.9)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):	
‡ Israel	77 (3.2)
Kuwait	53 (3.7)
South Africa	28 (2.8)
International Average Percent Correct	76 (0.4)

Example 20

Chance of picking red marble

There is only one red marble in each of these bags.



10 marbles 100 marbles 1000 marbles

Without looking in the bags, you are to pick a marble out of one of the bags. Which bag would give you the greatest chance of picking the red marble?

A. The bag with 10 marbles

B. The bag with 100 marbles

C. The bag with 1000 marbles

D. All bags would give the same chance.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.21: Data Representation, Analysis, and Probability

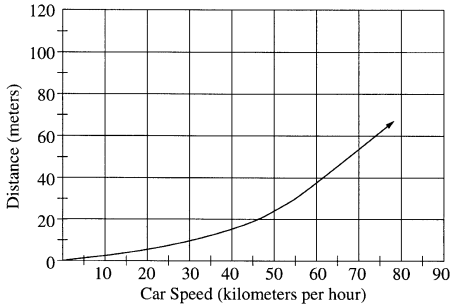
Percent Correct for Example Item 21 - Eighth Grade*

Country	Percent Correct
‡ **UNITED STATES**	72 (1.9)
‡ **MISSOURI**	72 (1.7)
OREGON	81 (1.8)
‡ Belgium (Fl)	82 (3.8)
Canada	66 (1.9)
Cyprus	40 (3.2)
Czech Republic	71 (2.8)
‡ England	69 (3.1)
‡ France	81 (2.5)
Hong Kong	65 (2.5)
Hungary	61 (2.7)
Iceland	56 (4.3)
Iran, Islamic Rep.	25 (2.8)
Ireland	63 (2.4)
Japan	75 (1.8)
Korea	67 (2.6)
‡ Latvia (LSS)	57 (3.0)
‡ Lithuania	53 (3.3)
New Zealand	66 (2.6)
Norway	73 (2.3)
Portugal	49 (2.6)
Russian Federation	49 (3.0)
Singapore	67 (2.0)
Slovak Republic	56 (2.8)
Spain	47 (2.6)
Sweden	74 (2.3)
‡ Switzerland	77 (2.3)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):	
Australia	72 (1.7)
Austria	74 (2.2)
Belgium (Fr)	64 (3.8)
Bulgaria	49 (4.3)
Netherlands	76 (3.8)
Scotland	70 (2.7)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):	
Colombia	20 (2.7)
‡ Germany	69 (3.2)
Romania	36 (2.8)
Slovenia	57 (2.9)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):	
Denmark	75 (2.8)
Greece	48 (2.8)
Thailand	56 (2.7)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):	
‡ Israel	56 (4.1)
Kuwait	24 (3.1)
South Africa	17 (2.3)
International Average Percent Correct	59 (0.4)

Example 21

Speed of car from graph

The graph shows the distance traveled before coming to a stop after the brakes are applied for a typical car traveling at different speeds.



A car traveling on a highway stopped 30 m after the brakes were applied. About how fast was the car traveling?

A. 48 km per hour

B. 55 km per hour

C. 70 km per hour

D. 160 km per hour

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.22: Data Representation, Analysis, and Probability

Percent Correct for Example Item 22 - Eighth Grade*

Country	Percent Correct	Example 22 Number of red cube faces
‡ **UNITED STATES**	47 (3.0)	Each of the six faces of a certain cube is painted either red or blue. When the cube is tossed, the probability of the cube landing with a red face up is $\frac{2}{3}$. How many faces are red? A. One B. Two C. Three (D.) Four E. Five
‡ **MISSOURI**	46 (3.5)	
OREGON	57 (2.6)	
‡ Belgium (Fl)	68 (2.7)	
Canada	57 (2.2)	
Cyprus	46 (3.0)	
Czech Republic	36 (3.2)	
‡ England	39 (3.1)	
‡ France	54 (3.0)	
Hong Kong	72 (2.7)	
Hungary	55 (2.8)	
Iceland	57 (4.2)	
Iran, Islamic Rep.	24 (3.9)	
Ireland	64 (3.3)	
Japan	75 (1.6)	
Korea	68 (3.2)	
‡ Latvia (LSS)	28 (3.0)	
‡ Lithuania	22 (2.9)	
New Zealand	52 (2.4)	
Norway	57 (2.6)	
Portugal	21 (1.9)	
Russian Federation	33 (2.6)	
Singapore	88 (1.7)	
Slovak Republic	43 (2.9)	
Spain	34 (2.6)	
Sweden	55 (2.7)	
‡ Switzerland	64 (3.0)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	53 (2.2)	
Austria	54 (3.3)	
Belgium (Fr)	61 (3.8)	
Bulgaria	46 (5.7)	
Netherlands	62 (3.6)	
Scotland	48 (3.3)	
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	15 (2.0)	
‡ Germany	45 (3.5)	
Romania	33 (2.8)	
Slovenia	42 (2.7)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	46 (2.9)	
Greece	38 (2.6)	
Thailand	54 (2.9)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	53 (4.4)	
Kuwait	19 (3.9)	
South Africa	15 (1.9)	
International Average Percent Correct	47 (0.5)	

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.23: Data Representation, Analysis, and Probability

Percent Correct for Example Item 23 - Eighth Grade*

Country	Percent Partially Correct	Percent Fully Correct
‡ **UNITED STATES**	36 (1.5)	18 (1.6)
‡ **MISSOURI**	31 (1.7)	22 (1.6)
OREGON	36 (1.5)	21 (1.6)
‡ Belgium (Fl)	28 (2.6)	23 (1.9)
Canada	33 (1.5)	24 (1.7)
Cyprus	25 (1.8)	8 (1.6)
Czech Republic	32 (2.8)	28 (2.6)
‡ England	30 (2.2)	20 (2.0)
‡ France	26 (1.7)	26 (2.1)
Hong Kong	26 (1.6)	37 (2.5)
Hungary	25 (1.9)	20 (1.6)
Iceland	26 (2.4)	15 (1.8)
Iran, Islamic Rep.	28 (1.8)	1 (0.4)
Ireland	35 (2.0)	25 (2.3)
Japan	24 (1.2)	47 (1.5)
Korea	21 (1.6)	50 (1.8)
‡ Latvia (LSS)	18 (1.8)	9 (1.2)
‡ Lithuania	19 (1.9)	7 (1.2)
New Zealand	28 (1.6)	22 (2.0)
Norway	28 (1.5)	23 (1.6)
Portugal	24 (1.4)	8 (0.9)
Russian Federation	28 (2.0)	14 (1.7)
Singapore	30 (1.5)	55 (2.0)
Slovak Republic	25 (1.6)	15 (1.7)
Spain	29 (1.5)	15 (1.3)
Sweden	31 (1.7)	23 (1.7)
‡ Switzerland	27 (1.7)	26 (1.5)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	29 (1.3)	22 (1.3)
Austria	31 (2.5)	25 (1.8)
Belgium (Fr)	29 (1.9)	20 (2.5)
Bulgaria	34 (3.8)	6 (1.4)
Netherlands	31 (2.2)	24 (2.6)
Scotland	28 (1.5)	20 (2.3)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	16 (1.9)	1 (0.5)
‡ Germany	24 (2.0)	14 (1.7)
Romania	20 (2.1)	12 (1.7)
Slovenia	25 (1.7)	20 (1.6)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	25 (1.7)	22 (2.2)
Greece	27 (1.3)	13 (1.2)
Thailand	26 (1.4)	21 (2.5)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	29 (2.2)	15 (2.5)
Kuwait	26 (2.5)	4 (1.2)
South Africa	19 (1.6)	2 (1.1)
International Average Percent Correct	27 (0.3)	20 (0.3)

Example 23

Price of renting office space

The following two advertisements appeared in a newspaper in a country where the units of currency are *zeds*.

BUILDING A	BUILDING B
Office space available	Office space available
85 - 95 square meters 475 *zeds* per month	35 - 260 square meters 90 *zeds* per square meter per year
100 - 120 square meters 800 *zeds* per month	

If a company is interested in renting an office of 110 square meters in that country for a year, at which office building, A or B, should they rent the office in order to get the lower price? Show your work.

Price of Renting a in Building A = 800 × 12
in a year = 9600 (zeds)

Price of Renting in Building B = 110 × 90
in a year = 9900 (zeds)

∴ 9600 < 9900

∴ They should rent the office at Building A in order to get the lower price.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

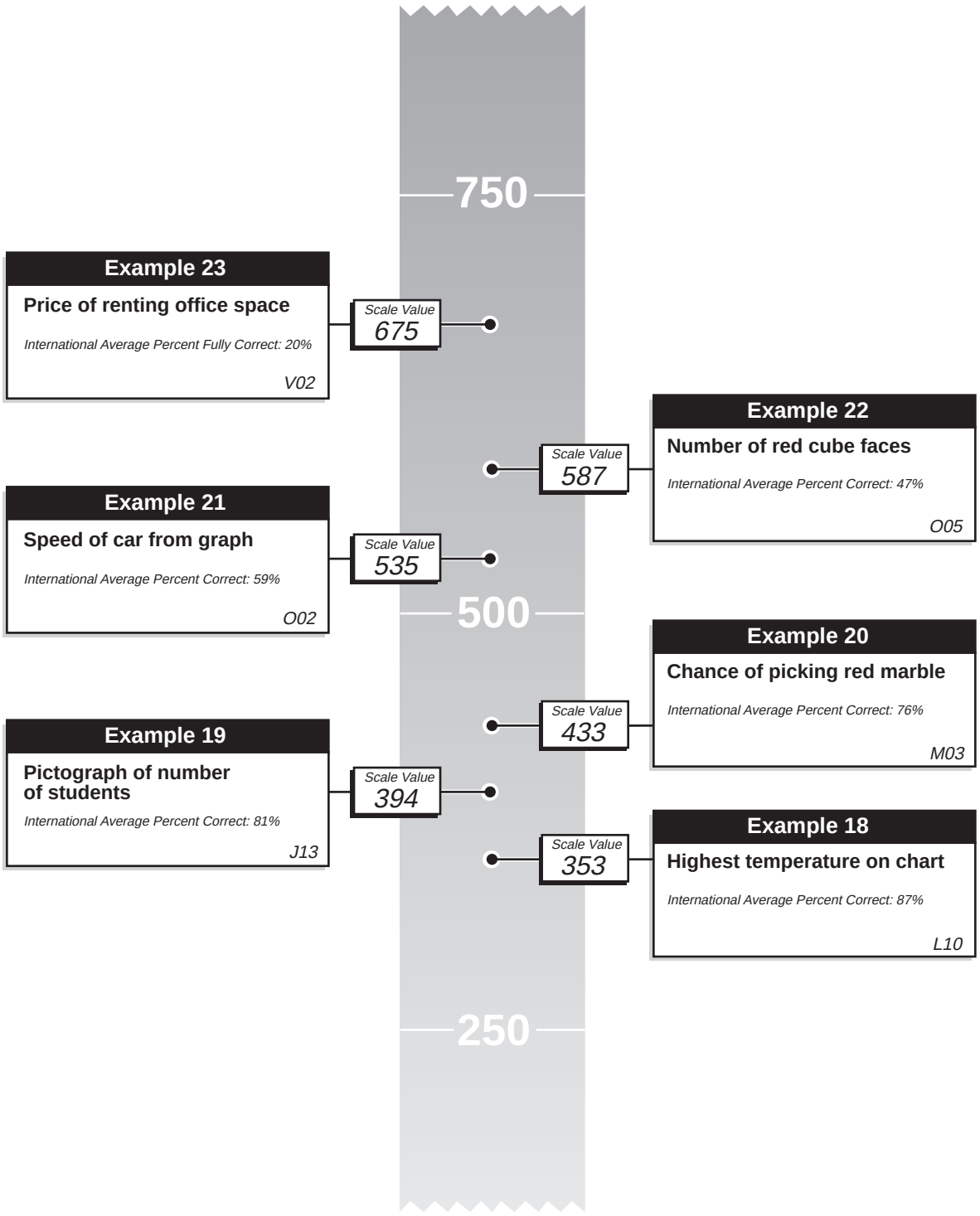
*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Figure 3.4

International Difficulty Map for Data Representation, Analysis, and Probability Example Items: Eighth Grade*



*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.
NOTE: Each item was placed onto the TIMSS international mathematics scale based on students' performance in both grades of TIMSS Population 2 (seventh and eighth grades in most countries). Items are shown at the point on the scale where students with that level of proficiency had a 65 percent probability of providing a correct response.

What Have Students Learned About Measurement?

The measurement items focused on students' understanding of units of length, weight, time, area, and volume as well as on interpreting scales of measures.

A more detailed look at performance on the example items suggests that students in many countries had a solid grasp of a variety of measuring units and how to interpret them. Most students in the TIMSS countries were able to read the weight shown on the scale (Example Item 24 presented in Table 3.24). The international average on this item was 87% with Missouri (90%) and Oregon (92%) performing above this average. Students internationally (75% on average) also did relatively well on Example Item 25 (Table 3.25) about pacing off the width of a room. This item required some thought to understand that the longer the paces, the fewer required to cross the room. The most prevalent misconception was to indicate that the greatest number of paces was related to the longest pace. Interestingly, students in both Missouri (55%) and Oregon (58%) performed significantly below the international average as did those in the United States (48%).

As shown in Table 3.26, Example Item 26 required familiarity with the number of degrees in circles or parts of circles to identify the angle closest to 30 degrees. On average, internationally, it was answered correctly by 65% of the students. Oregon, at 59%, performed about the same as the United States at 57%. However, Missouri performed significantly lower at 49%.

Internationally, approximately half the students (53%) were able to determine 10.5 cm as the length of the pencil (Example Item 27). Table 3.27 indicates that students in both Missouri (46%) and Oregon (54%) were in line with many countries, including the United States (45%). Across the countries, performance was generally consistent although students did particularly well in Switzerland (73%), Austria (73%), and Germany (72%). They had the most difficulty in South Africa (17%).

Example Item 28, presented in Table 3.28, was a two-part task that first required students to actually draw a new rectangle whose length was one and one-half times the length of a given rectangle and whose width was half the width of that rectangle. All correctly drawn and labeled 9 cm by 2 cm rectangles were given full credit and those with one dimension correctly shown were given partial credit. In the second part of the item, students were asked to determine the ratio of the area of the new rectangle to the area of the one shown. Most students had considerable difficulty with the first part of this multifaceted task, and even more trouble with the second part (even though the scoring for full credit permitted correct ratios based on incorrect drawings). On average, 31% of the students provided a correct drawing of the new rectangle. In only two countries did at least half the students correctly draw the new rectangle, Korea (54%) and Austria (51%). Only 24% of the students in Oregon were successful, and fewer than 20% in Missouri (18%), the United States (16%), Iceland (18%), Colombia (5%), South Africa (4%), and Kuwait (10%) responded correctly. Compared with 10% of the students receiving partial credit on average internationally, 7% of the eighth graders in both Oregon and Missouri received partial credit. Internationally, the second part of the item was very difficult. On average, just 10% of the students provided a correct ratio between the newly drawn and given rectangles. It is interesting to note that while both Missouri and Oregon performed below the international average on the first part of the item, they performed better in relation to the international average on the second part of the item, with Oregon performing significantly above it (17%).

The international difficulty map for the measurement items (Figure 3.5) indicates that only the students with higher-than-average mathematics scores internationally were likely to demonstrate an ability to use measurement skills in situations involving several steps.

Table 3.24: Measurement

Percent Correct for Example Item 24 - Eighth Grade*

Country	Percent Correct	Example 24 Weight shown on scale
‡ **UNITED STATES**	87 (1.7)	
‡ **MISSOURI**	90 (1.9)	
OREGON	92 (1.3)	
‡ Belgium (Fl)	98 (0.7)	
Canada	90 (1.6)	
Cyprus	72 (2.4)	
Czech Republic	92 (1.7)	
‡ England	94 (1.7)	
‡ France	94 (1.5)	
Hong Kong	91 (1.7)	
Hungary	92 (1.5)	
Iceland	88 (2.2)	
Iran, Islamic Rep.	71 (2.9)	
Ireland	91 (1.7)	
Japan	97 (0.6)	
Korea	95 (1.2)	
‡ Latvia (LSS)	84 (2.2)	
‡ Lithuania	84 (2.2)	
New Zealand	91 (1.4)	
Norway	88 (1.7)	
Portugal	84 (2.0)	
Russian Federation	92 (1.3)	
Singapore	96 (0.9)	
Slovak Republic	88 (1.6)	
Spain	83 (1.8)	
Sweden	92 (1.3)	
‡ Switzerland	97 (1.1)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	94 (0.9)	
Austria	90 (2.2)	
Belgium (Fr)	89 (2.7)	
Bulgaria	87 (4.4)	
Netherlands	97 (1.1)	
Scotland	92 (1.5)	
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	58 (4.5)	
‡ Germany	94 (1.6)	
Romania	74 (2.3)	
Slovenia	95 (1.3)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	88 (1.6)	
Greece	86 (1.7)	
Thailand	92 (1.1)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	86 (3.5)	
Kuwait	58 (2.9)	
South Africa	52 (2.5)	
International Average Percent Correct	87 (0.3)	

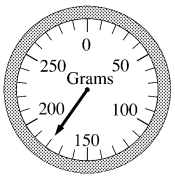
What is the weight (mass) shown on the scale?

A. 153 g

B. 160 g

C. 165 g

D. 180 g



SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.25: Measurement

Percent Correct for Example Item 25 - Eighth Grade*

Country	Percent Correct
‡ **UNITED STATES**	48 (2.6)
‡ **MISSOURI**	55 (3.0)
OREGON	58 (2.4)
‡ Belgium (Fl)	86 (2.7)
Canada	70 (2.3)
Cyprus	63 (2.9)
Czech Republic	94 (1.4)
‡ England	73 (3.5)
‡ France	81 (2.6)
Hong Kong	72 (2.8)
Hungary	59 (2.6)
Iceland	80 (4.0)
Iran, Islamic Rep.	57 (3.3)
Ireland	83 (2.0)
Japan	86 (1.3)
Korea	77 (2.2)
‡ Latvia (LSS)	91 (1.5)
‡ Lithuania	74 (3.4)
New Zealand	69 (2.3)
Norway	79 (2.2)
Portugal	79 (2.2)
Russian Federation	89 (1.5)
Singapore	77 (2.3)
Slovak Republic	88 (1.7)
Spain	81 (1.7)
Sweden	86 (1.8)
‡ Switzerland	87 (1.6)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):	
Australia	70 (1.9)
Austria	86 (2.3)
Belgium (Fr)	84 (2.0)
Bulgaria	77 (3.4)
Netherlands	82 (3.0)
Scotland	66 (3.0)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):	
Colombia	55 (3.8)
‡ Germany	79 (2.4)
Romania	70 (2.9)
Slovenia	90 (1.7)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):	
Denmark	80 (2.6)
Greece	70 (2.2)
Thailand	81 (1.8)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):	
‡ Israel	79 (3.3)
Kuwait	39 (3.8)
South Africa	23 (2.7)
International Average Percent Correct	75 (0.4)

Example 25

Measuring the width of a room

Four children measured the width of a room by counting how many paces it took them to cross it. The chart shows their measurements.

Name	Number of Paces
Stephen	10
Erlane	8
Ana	9
Carlos	7

Who had the longest pace?

A. Stephen

B. Erlane

C. Ana

(D.) Carlos

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

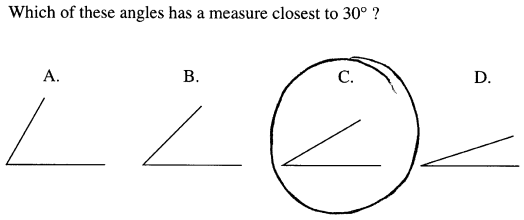
*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.26: Measurement

Percent Correct for Example Item 26 - Eighth Grade*

Country	Percent Correct	Example 26 Angle closest to 30 degrees
‡ **UNITED STATES**	57 (1.7)	
‡ **MISSOURI**	49 (2.9)	
OREGON	59 (1.9)	
‡ Belgium (Fl)	64 (3.2)	
Canada	65 (2.1)	
Cyprus	64 (2.8)	
Czech Republic	76 (3.0)	
‡ England	62 (2.9)	
‡ France	76 (2.5)	
Hong Kong	68 (2.3)	
Hungary	77 (2.3)	
Iceland	61 (4.4)	
Iran, Islamic Rep.	63 (2.7)	
Ireland	63 (2.6)	
Japan	76 (1.8)	
Korea	76 (2.2)	
‡ Latvia (LSS)	65 (3.0)	
‡ Lithuania	63 (2.9)	
New Zealand	63 (2.4)	
Norway	70 (2.0)	
Portugal	48 (2.8)	
Russian Federation	72 (2.8)	
Singapore	73 (1.9)	
Slovak Republic	74 (2.4)	
Spain	59 (2.3)	
Sweden	61 (2.5)	
‡ Switzerland	73 (2.4)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	64 (2.3)	
Austria	74 (3.1)	
Belgium (Fr)	67 (2.7)	
Bulgaria	78 (3.3)	
Netherlands	64 (3.3)	
Scotland	58 (2.7)	
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	37 (3.6)	
‡ Germany	63 (2.8)	
Romania	59 (2.9)	
Slovenia	77 (2.6)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	69 (3.1)	
Greece	64 (2.3)	
Thailand	78 (1.7)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	50 (4.2)	
Kuwait	49 (3.3)	
South Africa	34 (2.5)	
International Average Percent Correct	65 (0.4)	

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

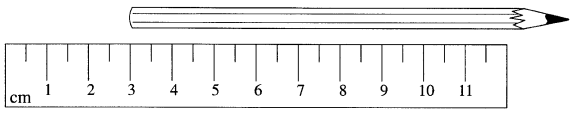
Table 3.27: Measurement

Percent Correct for Example Item 27 - Eighth Grade*

Country	Percent Correct
‡ **UNITED STATES**	45 (2.2)
‡ **MISSOURI**	46 (2.5)
OREGON	54 (1.8)
‡ Belgium (Fl)	69 (3.3)
Canada	53 (2.0)
Cyprus	40 (3.4)
Czech Republic	67 (2.6)
‡ England	52 (3.0)
‡ France	61 (2.6)
Hong Kong	60 (3.2)
Hungary	58 (2.6)
Iceland	27 (2.6)
Iran, Islamic Rep.	34 (3.3)
Ireland	52 (2.4)
Japan	64 (2.3)
Korea	60 (2.7)
‡ Latvia (LSS)	60 (2.5)
‡ Lithuania	41 (3.1)
New Zealand	52 (2.7)
Norway	62 (2.4)
Portugal	43 (2.7)
Russian Federation	59 (3.1)
Singapore	64 (2.3)
Slovak Republic	63 (2.8)
Spain	52 (2.6)
Sweden	67 (2.0)
‡ Switzerland	73 (2.6)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):	
Australia	55 (1.9)
Austria	73 (2.5)
Belgium (Fr)	57 (3.7)
Bulgaria	45 (4.5)
Netherlands	62 (3.3)
Scotland	45 (3.0)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):	
Colombia	29 (2.5)
‡ Germany	72 (3.0)
Romania	41 (2.6)
Slovenia	70 (2.8)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):	
Denmark	52 (3.2)
Greece	33 (2.5)
Thailand	57 (2.5)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):	
‡ Israel	44 (4.4)
Kuwait	31 (3.5)
South Africa	17 (2.1)
International Average Percent Correct	53 (0.4)

Example 27

Approximate length of pencil



Which of these is closest to the length of the pencil in the figure?

A. 9 cm

B. 10.5 cm

C. 12 cm

D. 13.5 cm

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

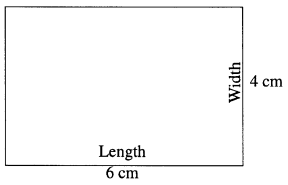
Table 3.28: Measurement

Percent Correct for Example Item 28, Part A - Eighth Grade*

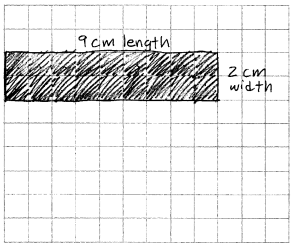
Country	Percent Partially Correct	Percent Fully Correct
‡ **UNITED STATES**	10 (1.0)	16 (1.6)
‡ **MISSOURI**	7 (0.7)	18 (1.5)
OREGON	7 (0.9)	24 (1.8)
‡ Belgium (Fl)	3 (0.8)	48 (2.2)
Canada	12 (1.1)	27 (1.7)
Cyprus	6 (0.9)	35 (2.1)
Czech Republic	22 (2.1)	36 (2.4)
‡ England	10 (1.3)	28 (2.1)
‡ France	9 (1.0)	43 (2.2)
Hong Kong	9 (0.9)	46 (2.8)
Hungary	4 (0.7)	43 (2.1)
Iceland	3 (1.1)	18 (2.3)
Iran, Islamic Rep.	6 (1.3)	24 (2.0)
Ireland	13 (1.4)	35 (2.5)
Japan	– –	– –
Korea	6 (1.1)	54 (2.1)
‡ Latvia (LSS)	8 (1.2)	31 (2.3)
‡ Lithuania	7 (1.0)	24 (2.1)
New Zealand	10 (1.0)	27 (1.7)
Norway	8 (1.1)	32 (1.7)
Portugal	8 (1.1)	22 (1.8)
Russian Federation	18 (1.7)	39 (2.8)
Singapore	– –	– –
Slovak Republic	16 (1.5)	35 (2.1)
Spain	9 (1.2)	28 (1.7)
Sweden	5 (0.7)	30 (1.9)
‡ Switzerland	8 (0.9)	47 (1.9)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	10 (0.8)	31 (1.6)
Austria	11 (1.7)	51 (2.8)
Belgium (Fr)	8 (1.0)	43 (2.5)
Bulgaria	12 (3.8)	27 (3.7)
Netherlands	8 (1.3)	40 (3.2)
Scotland	8 (1.1)	27 (2.7)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	4 (0.7)	5 (1.0)
‡ Germany	12 (1.5)	34 (2.6)
Romania	11 (1.3)	28 (2.1)
Slovenia	13 (1.8)	37 (2.3)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	14 (1.6)	24 (2.1)
Greece	8 (1.0)	23 (1.8)
Thailand	3 (0.6)	20 (1.7)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	1 (0.8)	48 (3.1)
Kuwait	7 (1.4)	10 (2.8)
South Africa	1 (0.5)	4 (1.3)
International Average Percent Correct	10 (0.2)	31 (0.4)

Example 28, Part A

New rectangle: Draw from ratio of sides



a. In the space below, draw a new rectangle whose length is one and one half times the length of the rectangle above, and whose width is half the width of the rectangle above. Show the length and width of the new rectangle in centimeters on the figure.



b. What is the ratio of the area of the new rectangle to the area of the first one?

Show your work. new Δ = 18 cm² ÷ 3 = 6/8 or 3/4
old Δ = 24 cm² ÷ 3 =
3 to 4

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected iin 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates are not available. Internationally comparable data are unavailable for Japan and Singapore on Example Item 28.

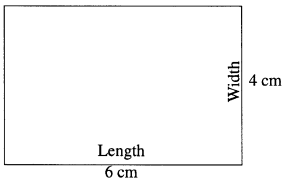
Table 3.28: Measurement (Continued)

Percent Correct for Example Item 28, Part B - Eighth Grade*

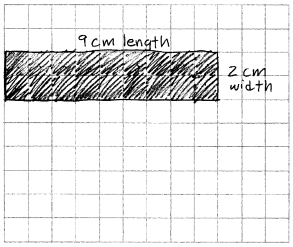
Country	Percent Partially Correct	Percent Fully Correct
‡ **UNITED STATES**	10 (1.0)	10 (0.9)
‡ **MISSOURI**	9 (0.9)	12 (1.5)
OREGON	13 (0.9)	17 (1.6)
‡ Belgium (Fl)	29 (2.4)	9 (1.2)
Canada	18 (1.7)	17 (1.2)
Cyprus	8 (1.2)	20 (1.8)
Czech Republic	24 (3.1)	13 (2.0)
‡ England	14 (1.6)	12 (1.9)
‡ France	21 (1.5)	6 (0.9)
Hong Kong	22 (1.6)	25 (2.4)
Hungary	15 (1.5)	9 (0.9)
Iceland	30 (3.4)	5 (1.4)
Iran, Islamic Rep.	4 (0.8)	8 (1.4)
Ireland	16 (1.5)	20 (1.8)
Japan	– –	– –
Korea	15 (1.5)	39 (2.5)
‡ Latvia (LSS)	10 (1.3)	6 (1.4)
‡ Lithuania	13 (1.4)	6 (1.0)
New Zealand	15 (1.5)	8 (1.4)
Norway	34 (1.8)	2 (0.5)
Portugal	9 (1.2)	2 (0.5)
Russian Federation	14 (3.2)	17 (2.0)
Singapore	– –	– –
Slovak Republic	9 (1.1)	15 (1.5)
Spain	12 (1.1)	2 (0.4)
Sweden	28 (1.4)	11 (1.2)
‡ Switzerland	21 (1.3)	7 (1.0)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	14 (1.3)	15 (1.2)
Austria	22 (2.0)	8 (1.3)
Belgium (Fr)	16 (1.6)	5 (1.1)
Bulgaria	21 (4.0)	10 (3.1)
Netherlands	25 (2.7)	8 (1.5)
Scotland	7 (1.0)	12 (2.2)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	2 (0.7)	0 (0.2)
‡ Germany	8 (1.0)	4 (0.8)
Romania	13 (1.4)	15 (1.9)
Slovenia	23 (2.0)	10 (1.4)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	20 (1.8)	5 (1.0)
Greece	6 (0.9)	12 (1.3)
Thailand	13 (1.3)	12 (1.5)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	18 (2.7)	7 (1.7)
Kuwait	10 (1.8)	6 (2.5)
South Africa	2 (0.7)	0 (0.2)
International Average Percent Correct	16 (0.3)	10 (0.2)

Example 28, Part B

New rectangle: Ratio of areas



a. In the space below, draw a new rectangle whose length is one and one half times the length of the rectangle above, and whose width is half the width of the rectangle above. Show the length and width of the new rectangle in centimeters on the figure.



b. What is the ratio of the area of the new rectangle to the area of the first one?

Show your work.

new Δ = 18cm² ÷ 3 = 6/8 or 3/4

old Δ = 24cm² ÷ 3 =

3 to 4

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

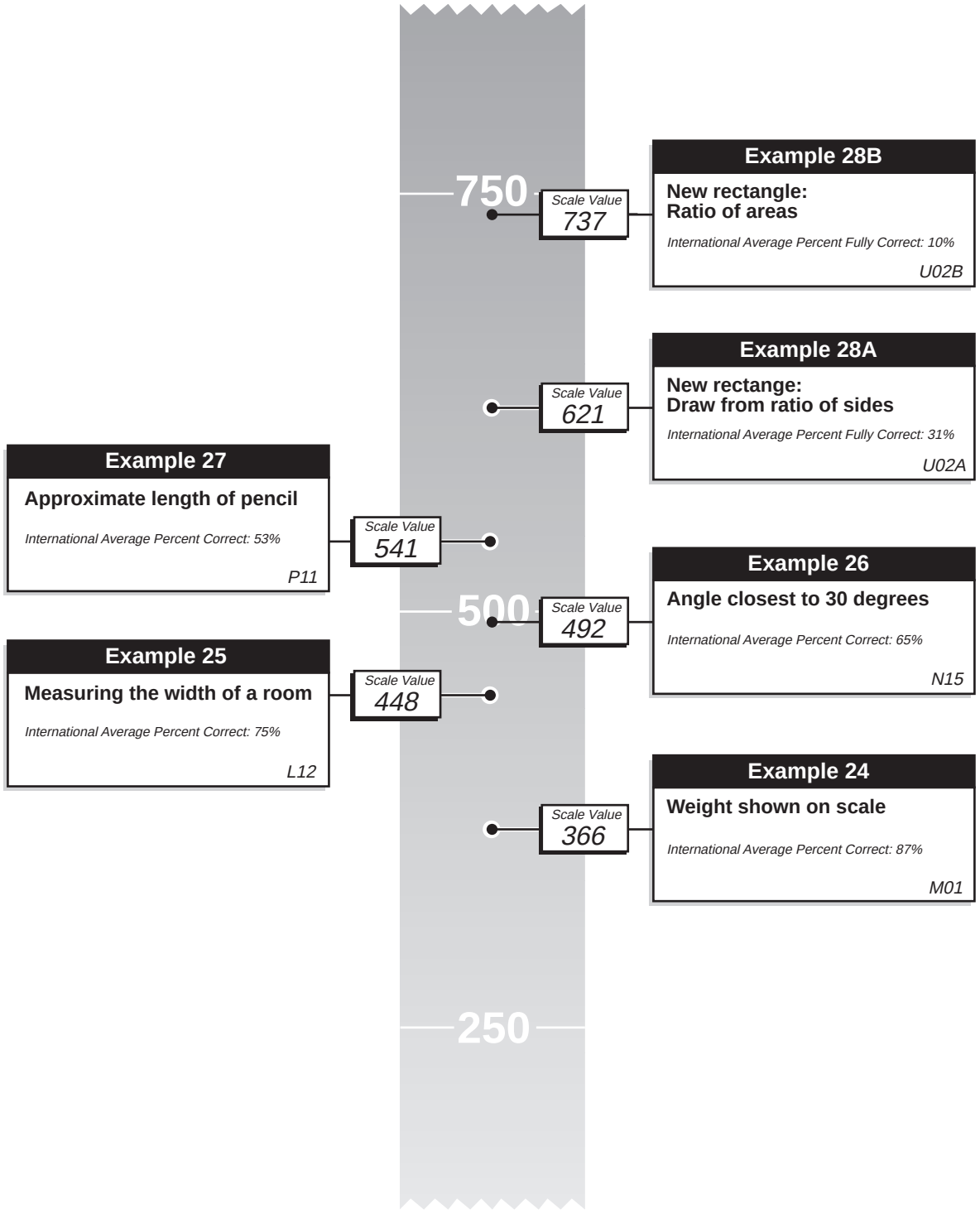
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates are not available. Internationally comparable data are unavailable for Japan and Singapore on Example Item 28.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

Figure 3.5

International Difficulty Map for Measurement Example Items: Eighth Grades*



*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.
NOTE: Each item was placed onto the TIMSS international mathematics scale based on students' performance in both grades of TIMSS Population 2 (seventh and eighth grades in most countries). Items are shown at the point on the scale where students with that level of proficiency had a 65 percent probability of providing a correct response.

What Have Students Learned About Proportionality?

A small set (11) of the mathematics items was designed to focus specifically on proportionality concepts and problems. Arguably, these items could have been classified in other content areas, usually fractions and number sense, but the decision was made to analyze them separately because they assess an important kind of mathematical reasoning. Example Items 29 through 33 illustrate these types of questions.

Example Item 29, the least difficult of the items shown here, was one of the few proportionality items answered correctly by the majority of students in most countries. As shown in Table 3.29, the item asked about adding 5 boys and 5 girls to a class that was three-fifths girls. On average, 65% of the students correctly answered that there would still be more girls than boys in the class. Missouri and Oregon performed near the international average at 60% and 69%, respectively, as did the United States at 62%.

Despite the overall difficulty encountered by students in this content area, there was an extremely large range in performance. As presented in Table 3.30, Example Item 30 required students to determine the ratio of red paint to the total amount of paint when different colors of paint are combined. The range of performance on this item varied from students performing very well in Singapore (95%) and Korea (87%) to students performing poorly in Lithuania (14%), Colombia (15%), and Kuwait (14%). Students in Missouri and Oregon both performed above the international average at 56%.

Example Item 31, asked students to determine the amount paid for a portion of items purchased. Again, the range in performance was broad, as can be seen in Table 3.31. The international average was 38% with both Missouri and Oregon performing below the international average at 24% and 26%, respectively.

As presented in Table 3.32, Example Item 32 required students to determine the number of girls in a class of 28 based on the ratio of girls to boys. This item clearly illustrates the extent of the difference in achievement levels. While the international average was 38%, the question was answered correctly by 92% of the students in Singapore compared to very few in Colombia (12%), Greece (13%), South Africa (9%), and Kuwait (12%). Students in Missouri (38%) and Oregon (42%) had performance in mid-range, close to the international average (38%). Both performed above the United States (34%).

It is clear from the results presented in Table 3.33 that Example Item 33 was the most difficult of the proportionality items presented in this report. Even Singapore (47%), who fared well in most of the proportionality items, performed less well on this item. The international average percent correct was 25%, with Missouri (20%) and Oregon (21%) performing near the international average.

As described previously in Chapter 2, this item group was relatively more difficult for students than those from the other content areas. Figure 3.6 shows the extreme difficulty of these items for students. Only those students scoring above 600 on the mathematics scale were likely to answer most of the proportionality questions correctly.

Table 3.29: Proportionality

Percent Correct for Example Item 29 - Eighth Grade*

Country	Percent Correct	Example 29 More boys or girls in class
‡ **UNITED STATES**	62 (2.2)	Three-fifths of the students in a class are girls. If 5 girls and 5 boys are added to the class, which statement is true of the class? (A) There are more girls than boys. B. There are the same number of girls as there are boys. C. There are more boys than girls. D. You cannot tell whether there are more girls or boys from the information given.
‡ **MISSOURI**	60 (2.7)	
OREGON	69 (2.1)	
‡ Belgium (Fl)	82 (2.9)	
Canada	66 (2.5)	
Cyprus	63 (2.7)	
Czech Republic	70 (2.7)	
‡ England	69 (3.3)	
‡ France	75 (2.4)	
Hong Kong	78 (1.7)	
Hungary	67 (2.3)	
Iceland	66 (4.6)	
Iran, Islamic Rep.	51 (3.2)	
Ireland	78 (2.4)	
Japan	82 (1.9)	
Korea	82 (2.2)	
‡ Latvia (LSS)	57 (3.4)	
‡ Lithuania	51 (3.0)	
New Zealand	70 (2.3)	
Norway	73 (2.4)	
Portugal	50 (2.6)	
Russian Federation	47 (2.5)	
Singapore	85 (1.7)	
Slovak Republic	62 (2.9)	
Spain	62 (3.0)	
Sweden	74 (2.0)	
‡ Switzerland	76 (2.2)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	74 (1.4)	
Austria	73 (2.7)	
Belgium (Fr)	76 (2.8)	
Bulgaria	57 (4.4)	
Netherlands	77 (2.7)	
Scotland	71 (2.7)	
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	30 (3.9)	
‡ Germany	67 (3.3)	
Romania	52 (3.0)	
Slovenia	66 (2.5)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	68 (2.9)	
Greece	59 (2.5)	
Thailand	56 (2.7)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	75 (4.0)	
Kuwait	25 (3.0)	
South Africa	31 (2.2)	
International Average Percent Correct	65 (0.4)	

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.30: Proportionality

Percent Correct for Example Item 30 - Eighth Grade*

Country	Percent Correct	Example 30 Ratio of red paint in mixture
‡ **UNITED STATES**	53 (1.8)	To mix a certain color of paint, Alana combines 5 liters of red paint, 2 liters of blue paint, and 2 liters of yellow paint. What is the ratio of red paint to the total amount of paint? A. $\frac{5}{2}$ B. $\frac{9}{4}$ C. $\frac{5}{4}$ D. $\frac{5}{9}$
‡ **MISSOURI**	56 (2.1)	
OREGON	56 (1.9)	
‡ Belgium (Fl)	48 (2.4)	
Canada	56 (1.8)	
Cyprus	34 (2.1)	
Czech Republic	29 (1.9)	
‡ England	39 (2.7)	
‡ France	51 (2.5)	
Hong Kong	70 (2.4)	
Hungary	36 (2.1)	
Iceland	49 (4.1)	
Iran, Islamic Rep.	31 (2.3)	
Ireland	42 (2.3)	
Japan	66 (1.4)	
Korea	87 (1.4)	
‡ Latvia (LSS)	27 (1.9)	
‡ Lithuania	14 (1.5)	
New Zealand	47 (1.9)	
Norway	37 (2.0)	
Portugal	21 (1.6)	
Russian Federation	39 (2.6)	
Singapore	95 (0.8)	
Slovak Republic	32 (2.1)	
Spain	34 (1.7)	
Sweden	64 (1.7)	
‡ Switzerland	42 (1.9)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	42 (2.0)	
Austria	21 (1.9)	
Belgium (Fr)	49 (2.9)	
Bulgaria	37 (3.8)	
Netherlands	65 (2.7)	
Scotland	38 (2.2)	
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	15 (2.1)	
‡ Germany	26 (2.1)	
Romania	39 (2.4)	
Slovenia	39 (2.2)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	31 (2.1)	
Greece	50 (2.1)	
Thailand	55 (2.4)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	39 (4.2)	
Kuwait	14 (2.0)	
South Africa	16 (1.5)	
International Average Percent Correct	42 (0.4)	

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

Table 3.31: Proportionality

Percent Correct for Example Item 31 - Eighth Grade*

Country	Percent Correct	Example 31 Amount paid for portion of items
‡ **UNITED STATES**	23 (2.2)	Peter bought 70 items and Sue bought 90 items. Each item cost the same and the items cost $800 altogether. How much did Sue pay? Answer: Sue paid $450
‡ **MISSOURI**	24 (2.1)	
OREGON	26 (2.1)	
‡ Belgium (Fl)	58 (4.1)	
Canada	26 (2.3)	
Cyprus	30 (3.0)	
Czech Republic	63 (2.8)	
‡ England	17 (2.9)	
‡ France	54 (2.9)	
Hong Kong	62 (3.2)	
Hungary	42 (2.5)	
Iceland	25 (4.1)	
Iran, Islamic Rep.	19 (2.6)	
Ireland	41 (3.3)	
Japan	71 (2.0)	
Korea	62 (2.5)	
‡ Latvia (LSS)	39 (2.9)	
‡ Lithuania	36 (3.2)	
New Zealand	22 (2.0)	
Norway	27 (2.4)	
Portugal	20 (2.5)	
Russian Federation	49 (3.8)	
Singapore	83 (1.8)	
Slovak Republic	54 (2.7)	
Spain	42 (2.7)	
Sweden	30 (2.0)	
‡ Switzerland	60 (2.4)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	31 (1.8)	
Austria	67 (3.0)	
Belgium (Fr)	41 (3.1)	
Bulgaria	34 (4.4)	
Netherlands	41 (3.7)	
Scotland	19 (2.6)	
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	7 (1.6)	
‡ Germany	37 (3.4)	
Romania	32 (2.6)	
Slovenia	52 (3.0)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	28 (2.6)	
Greece	39 (2.7)	
Thailand	43 (2.9)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	42 (4.8)	
Kuwait	2 (0.8)	
South Africa	2 (0.8)	
International Average Percent Correct	38 (0.4)	

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Table 3.32: Proportionality

Percent Correct for Example Item 32 - Eighth Grade*

Country	Percent Correct	Example 32 Number of girls from boy/girl ratio
‡ **UNITED STATES**	34 (2.3)	A class has 28 students. The ratio of girls to boys is 4 : 3. How many girls are in the class? $\frac{28}{7} \times 4 = 4 \times 4$ Answer: 16
‡ **MISSOURI**	38 (1.9)	
OREGON	42 (2.2)	
‡ Belgium (Fl)	34 (3.7)	
Canada	43 (2.4)	
Cyprus	24 (2.6)	
Czech Republic	60 (3.7)	
‡ England	42 (3.4)	
‡ France	43 (3.1)	
Hong Kong	63 (3.3)	
Hungary	57 (2.6)	
Iceland	18 (3.1)	
Iran, Islamic Rep.	22 (2.4)	
Ireland	56 (2.9)	
Japan	53 (1.8)	
Korea	64 (2.6)	
‡ Latvia (LSS)	32 (3.1)	
‡ Lithuania	30 (2.7)	
New Zealand	37 (2.5)	
Norway	19 (2.2)	
Portugal	17 (1.8)	
Russian Federation	37 (3.1)	
Singapore	92 (1.3)	
Slovak Republic	58 (2.7)	
Spain	24 (2.2)	
Sweden	24 (2.0)	
‡ Switzerland	38 (2.5)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	50 (2.3)	
Austria	46 (2.6)	
Belgium (Fr)	48 (3.1)	
Bulgaria	54 (4.3)	
Netherlands	43 (4.6)	
Scotland	37 (3.3)	
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	12 (2.0)	
‡ Germany	30 (3.4)	
Romania	29 (2.7)	
Slovenia	43 (2.7)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	35 (3.5)	
Greece	13 (1.9)	
Thailand	48 (2.7)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	22 (3.4)	
Kuwait	12 (3.7)	
South Africa	9 (1.7)	
International Average Percent Correct	38 (0.4)	

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

Table 3.33: Proportionality

Percent Correct for Example Item 33 - Eighth Grade*

Country	Percent Correct	Example 33 Missing values in proportionality table
‡ **UNITED STATES**	20 (1.6)	
‡ **MISSOURI**	20 (1.9)	
OREGON	21 (1.9)	
‡ Belgium (Fl)	33 (2.9)	
Canada	26 (2.1)	
Cyprus	24 (2.4)	
Czech Republic	30 (3.2)	
‡ England	18 (3.0)	
‡ France	33 (2.6)	
Hong Kong	38 (2.9)	
Hungary	24 (2.4)	
Iceland	14 (3.2)	
Iran, Islamic Rep.	31 (4.3)	
Ireland	25 (2.1)	
Japan	49 (2.2)	
Korea	41 (2.6)	
‡ Latvia (LSS)	21 (2.6)	
‡ Lithuania	14 (2.2)	
New Zealand	19 (2.1)	
Norway	15 (1.8)	
Portugal	21 (2.3)	
Russian Federation	27 (2.3)	
Singapore	47 (2.8)	
Slovak Republic	27 (2.9)	
Spain	10 (1.5)	
Sweden	14 (1.8)	
‡ Switzerland	29 (2.4)	
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):		
Australia	22 (1.7)	
Austria	18 (2.1)	
Belgium (Fr)	19 (2.6)	
Bulgaria	44 (6.4)	
Netherlands	29 (3.1)	
Scotland	15 (2.4)	
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):		
Colombia	11 (2.2)	
‡ Germany	18 (2.2)	
Romania	29 (2.9)	
Slovenia	24 (2.1)	
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):		
Denmark	13 (2.3)	
Greece	30 (2.3)	
Thailand	39 (2.5)	
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):		
‡ Israel	17 (2.8)	
Kuwait	15 (2.5)	
South Africa	13 (1.4)	
International Average Percent Correct	25 (0.4)	

The table shows the values of x and y, where x is proportional to y.

x	3	6	P
y	7	Q	35

What are the values of P and Q ?

A. $P = 14$ and $Q = 31$

B. $P = 10$ and $Q = 14$

C. $P = 10$ and $Q = 31$

D. $P = 14$ and $Q = 15$

(E.) $P = 15$ and $Q = 14$

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

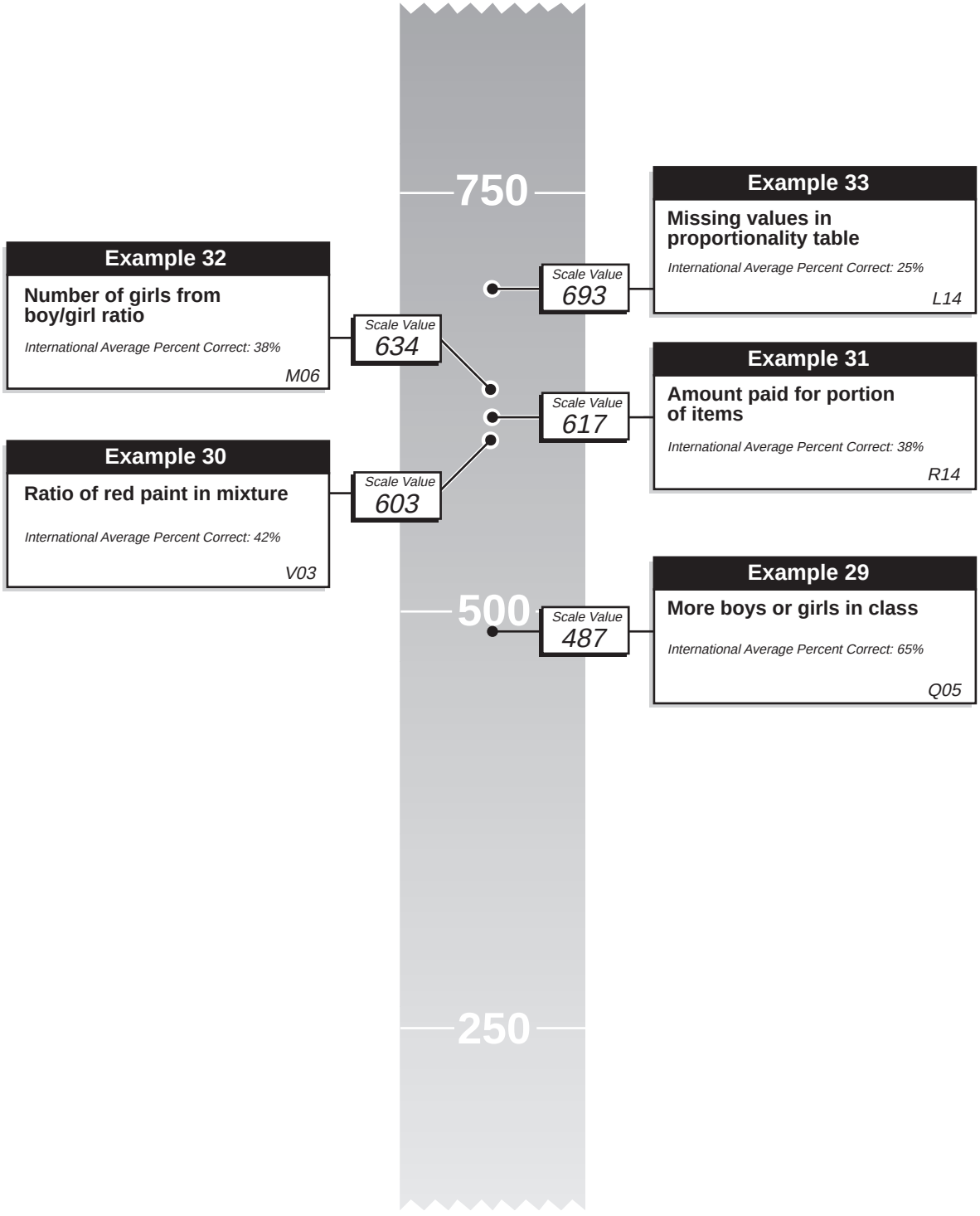
*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Figure 3.6

International Difficulty Map for Proportionality Example Items: Eighth Grade*



*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.
NOTE: Each item was placed onto the TIMSS international mathematics scale based on students' performance in both grades of TIMSS Population 2 (seventh and eighth grades in most countries). Items are shown at the point on the scale where students with that level of proficiency had a 65 percent probability of providing a correct response.

Chapter 4

Students' Backgrounds and Attitudes Toward Mathematics

To provide an educational context for interpreting the mathematics achievement results, TIMSS collected a full range of descriptive information from students about their backgrounds, as well as their activities in and out of school. This chapter presents students' responses to a selected subset of these questions. In an effort to explore the degree to which the students' home and social environment fostered academic development, some of the questions presented herein address the availability of educational resources in the home. Another group of questions is provided to help examine whether or not students typically spend their out-of-school time in ways that support their in-school academic performance. Because students' attitudes and opinions about mathematics reflect what happens in school and their perceptions of the value of mathematics in broader social contexts, results also are described for several questions from the affective domain. More specifically, these questions asked students to express their opinions about the abilities necessary for success in mathematics, provide information about what motivates them to do well in mathematics, and indicate their attitudes towards mathematics.

What Educational Resources Do Students Have in Their Homes?

Students were asked about the availability at home of three types of educational resources – a dictionary, a study desk or table for their own use, and a computer. Table 4.1 reveals that similar to the results in most countries, students in Missouri and Oregon, with all three of these educational study aids had higher mathematics achievement than students who did not have ready access to these study aids. Nearly all of the students (97%) in both Missouri and Oregon reported having a dictionary in their home, which corresponded to the results in many countries including the United States. There was more variation among countries in the percentage of students reporting their own study desk or table, but 89% to 90% so reported in Missouri, Oregon, and the United States. Of the three study aids, the most variation was in the number of students reporting having a home computer. About three-fourths of the eighth graders in Oregon (76%) reported having a computer in the home as did 64% of the students in Missouri. Even though the percentage of home computers in Oregon was notably larger than that reported by U.S. students as a whole (59%), it was consistent with some TIMSS countries. In several countries, more than 70% of students reported having a computer in the home, including the more than 85% who so reported in England, the Netherlands, and Scotland.

Table 4.1

Students' Reports on Educational Aids in the Home: Dictionary, Study Desk/Table and Computer - Mathematics - Eighth Grade*

Country	Have All Three Educational Aids		Do Not Have All Three Educational Aids		Have Dictionary	Have Study Desk/Table for Own Use	Have Computer
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Percent of Students	Percent of Students
UNITED STATES	56 (1.7)	521 (4.7)	44 (1.7)	474 (4.2)	97 (0.4)	90 (0.7)	59 (1.7)
MISSOURI	59 (1.9)	522 (7.0)	41 (1.9)	482 (6.4)	97 (0.5)	90 (0.8)	64 (1.9)
OREGON	70 (1.9)	538 (7.8)	30 (1.9)	495 (7.2)	97 (0.3)	89 (0.8)	76 (1.8)
Australia	66 (1.2)	542 (4.3)	34 (1.2)	509 (4.5)	88 (0.7)	97 (0.3)	73 (1.2)
Austria	56 (1.5)	548 (3.6)	44 (1.5)	530 (3.9)	98 (0.3)	93 (0.8)	59 (1.5)
Belgium (Fl)	64 (1.3)	577 (4.9)	36 (1.3)	547 (7.2)	99 (0.5)	96 (0.5)	67 (1.3)
Belgium (Fr)	58 (1.4)	541 (3.3)	42 (1.4)	510 (4.8)	97 (0.5)	96 (0.5)	60 (1.4)
Canada	57 (1.4)	539 (2.4)	43 (1.4)	513 (3.2)	97 (0.4)	89 (0.6)	61 (1.3)
Colombia	10 (1.2)	407 (9.3)	90 (1.2)	383 (3.4)	96 (0.5)	84 (1.0)	11 (1.2)
Cyprus	37 (0.9)	486 (2.8)	63 (0.9)	468 (2.4)	97 (0.3)	96 (0.5)	39 (0.9)
Czech Republic	33 (1.3)	583 (5.8)	67 (1.3)	555 (5.0)	94 (0.6)	90 (0.6)	36 (1.2)
Denmark	66 (1.5)	510 (3.0)	34 (1.5)	492 (4.6)	85 (1.1)	98 (0.3)	76 (1.2)
England	80 (1.0)	512 (3.1)	20 (1.0)	485 (5.6)	98 (0.4)	90 (0.8)	89 (0.8)
France	49 (1.3)	547 (3.6)	51 (1.3)	531 (3.6)	99 (0.2)	96 (0.4)	50 (1.3)
Germany	66 (1.1)	515 (4.3)	34 (1.1)	500 (5.5)	98 (0.4)	93 (0.6)	71 (1.0)
Greece	28 (1.0)	502 (5.4)	72 (1.0)	478 (2.8)	97 (0.3)	93 (0.5)	29 (1.0)
Hong Kong	33 (1.8)	606 (7.3)	67 (1.8)	582 (6.5)	99 (0.1)	80 (1.1)	39 (1.9)
Hungary	32 (1.2)	574 (3.7)	68 (1.2)	523 (3.4)	77 (1.2)	92 (0.7)	37 (1.2)
Iceland	72 (1.6)	490 (5.2)	28 (1.6)	479 (4.5)	95 (0.5)	96 (0.6)	77 (1.4)
Iran, Islamic Rep.	1 (0.3)	~ ~	99 (0.3)	430 (2.2)	54 (1.5)	40 (2.0)	4 (0.4)
Ireland	67 (1.2)	536 (5.2)	33 (1.2)	514 (6.3)	99 (0.3)	86 (0.9)	78 (1.1)
Israel	75 (2.1)	534 (5.8)	25 (2.1)	497 (8.8)	100 (0.2)	98 (0.4)	76 (2.1)
Japan	– –	– –	– –	– –	– –	– –	– –
Korea	38 (1.2)	635 (3.6)	62 (1.2)	591 (2.7)	98 (0.2)	95 (0.4)	39 (1.2)
Kuwait	38 (2.4)	398 (3.0)	62 (2.4)	389 (2.7)	84 (1.0)	73 (2.2)	53 (2.0)
Latvia (LSS)	13 (0.8)	492 (5.4)	87 (0.8)	495 (3.1)	94 (0.6)	98 (0.3)	13 (0.9)
Lithuania	35 (1.3)	485 (4.0)	65 (1.3)	474 (4.0)	88 (1.0)	95 (0.6)	42 (1.4)
Netherlands	83 (1.3)	545 (8.2)	17 (1.3)	524 (7.7)	100 (0.1)	99 (0.2)	85 (1.2)
New Zealand	56 (1.4)	522 (5.0)	44 (1.4)	491 (4.6)	99 (0.2)	91 (0.6)	60 (1.3)
Norway	63 (1.1)	512 (2.7)	37 (1.1)	489 (2.9)	97 (0.3)	98 (0.2)	64 (1.1)
Portugal	35 (1.8)	471 (3.6)	65 (1.8)	446 (2.2)	98 (0.4)	84 (0.9)	39 (1.8)
Romania	8 (1.0)	531 (8.5)	92 (1.0)	479 (3.8)	60 (1.6)	69 (1.3)	19 (1.2)
Russian Federation	30 (1.4)	541 (5.5)	70 (1.4)	534 (6.1)	88 (1.1)	95 (0.7)	35 (1.5)
Scotland	74 (1.2)	506 (5.8)	26 (1.2)	480 (6.6)	96 (0.5)	84 (1.2)	90 (0.6)
Singapore	47 (1.5)	657 (5.0)	53 (1.5)	631 (5.1)	99 (0.1)	92 (0.5)	49 (1.5)
Slovak Republic	27 (1.2)	570 (4.3)	73 (1.2)	539 (3.6)	96 (0.5)	86 (0.9)	31 (1.2)
Slovenia	43 (1.4)	563 (3.7)	57 (1.4)	525 (3.4)	94 (0.5)	93 (0.6)	47 (1.3)
Spain	40 (1.3)	501 (2.9)	60 (1.3)	479 (2.1)	99 (0.1)	93 (0.5)	42 (1.2)
Sweden	58 (1.3)	532 (2.9)	42 (1.3)	501 (3.5)	94 (0.4)	100 (0.1)	60 (1.3)
Switzerland	63 (1.2)	555 (3.2)	37 (1.2)	531 (3.6)	97 (0.4)	95 (0.4)	66 (1.2)
Thailand	4 (0.8)	577 (14.9)	96 (0.8)	521 (5.4)	68 (2.1)	66 (2.1)	4 (0.9)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1). Background data for Bulgaria and South Africa not available.

A dash (–) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

The number of books in the home can be an indicator of a home environment that values literacy, the acquisition of knowledge, and general academic support. Table 4.2 presents students' reports about the number of books in their homes in relation to their achievement on the TIMSS mathematics test. As in most countries, the more books students in Missouri and Oregon reported having in the home, the higher their mathematics achievement. Although the main purpose of the question was to gain some information about the relative importance of academic pursuits in the students' home environments rather than to determine the actual number of books in students' homes, there was a substantial amount of variation from country to country in students' reports about the number of books in their homes. In Colombia, Hong Kong, Iran, Kuwait, Romania, and Thailand, 40% or more of the students reported 25 or fewer books in the home. Conversely, 40% or more of the students in Australia, Hungary, Latvia (LSS), New Zealand, Norway, and Sweden reported three or more bookcases in their homes. Thirty-one percent of the eighth graders in the U.S. reported having three or more bookcases in the home, and the results for Missouri (28%) resembled those for the United States. In Oregon, more students (38%) than in the U.S. as a whole reported having three or more bookcases in their homes.

Information about their parents' educational levels was gathered by asking students to indicate the highest level of education completed by their fathers and mothers. Table 4.3 presents the relationship between students' mathematics achievement and their reports of the highest level of education of either parent. Results are presented at three educational levels: finished university, finished upper secondary school but not university, and finished primary school but not upper secondary school. As shown in Figure 4.1, these three educational levels are based on internationally-defined categories, which may not be strictly comparable across countries due to differences in national education systems. Although the majority of countries translated and defined the educational categories used in their questionnaires to be comparable to the internationally-defined levels, some countries used modified response options to conform to their national education systems. Also, for a few countries, the percentages of students responding to this question fell below 85%. When this happened, the percentages shown in the table are annotated with an "r" for a response rate of 70% to 84% or an "s" if the response rate was from 50% to 69%.

Despite the different educational approaches, structures, and organizations across the TIMSS countries, it is clear from the data in Table 4.3 that parents' education is positively related to students' mathematics achievement. In every country, as well as in Missouri and Oregon, the pattern was for those students whose parents had more education to also be those who had higher achievement in mathematics. As indicated by the results, there was variation among countries in the percentages of students reporting that they did not know their parents' educational levels, as well as in the percentages of students reporting that their parents had completed successively higher educational levels. For example, in Canada, Israel, Lithuania, the Russian Federation, and the United States, more than 30% of the students reported that at least one of their parents had finished university, and only relatively small percentages (12% or fewer) reported that they did not know the educational levels of their parents.

Table 4.2

Students' Reports on the Number of Books in the Home - Mathematics - Eighth Grade*

Country	None or Very Few (0-10 Books)		About One Shelf (11-25 Books)		About One Bookcase (26-100 Books)		About Two Bookcases (101-200 Books)		Three or More Bookcases (More than 200 Books)	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
UNITED STATES	8 (0.8)	435 (4.5)	13 (0.8)	462 (5.2)	28 (0.9)	491 (3.5)	21 (0.6)	517 (5.2)	31 (1.5)	531 (5.1)
MISSOURI	9 (1.0)	454 (5.8)	13 (1.0)	459 (7.4)	30 (1.0)	502 (5.9)	21 (1.2)	514 (7.2)	28 (1.5)	539 (8.4)
OREGON	6 (0.7)	461 (9.1)	10 (0.9)	474 (8.0)	24 (1.1)	513 (7.4)	21 (1.1)	533 (8.3)	38 (2.0)	553 (8.3)
Australia	3 (0.3)	449 (7.2)	7 (0.6)	482 (5.4)	24 (0.8)	512 (3.7)	25 (0.6)	534 (4.1)	42 (1.4)	555 (4.7)
Austria	11 (1.0)	485 (5.8)	17 (1.1)	505 (4.8)	31 (1.2)	534 (3.9)	17 (0.9)	567 (5.7)	24 (1.4)	579 (4.5)
Belgium (Fl)	11 (1.2)	521 (11.6)	18 (0.8)	549 (8.0)	33 (1.0)	571 (4.9)	18 (1.0)	587 (4.9)	21 (0.9)	575 (7.1)
Belgium (Fr)	7 (0.7)	461 (11.5)	10 (0.7)	484 (6.0)	28 (1.1)	517 (4.7)	21 (0.9)	537 (4.0)	34 (1.5)	555 (4.1)
Canada	4 (0.3)	505 (8.4)	10 (0.7)	510 (5.7)	28 (1.0)	528 (3.4)	25 (0.8)	532 (3.2)	33 (1.4)	534 (3.4)
Colombia	26 (1.5)	376 (5.5)	31 (1.1)	375 (3.7)	27 (1.3)	395 (3.8)	9 (0.7)	404 (7.7)	7 (1.0)	402 (10.4)
Cyprus	6 (0.6)	428 (7.6)	18 (0.8)	448 (3.4)	34 (0.8)	479 (2.9)	23 (0.8)	494 (3.8)	20 (0.8)	490 (4.0)
Czech Republic	1 (0.2)	~ ~	4 (0.5)	506 (8.1)	30 (1.5)	539 (4.9)	32 (0.9)	569 (6.4)	34 (1.8)	588 (5.8)
Denmark	3 (0.6)	452 (13.5)	9 (0.8)	471 (6.8)	30 (1.2)	494 (3.3)	21 (0.9)	506 (4.4)	37 (1.5)	522 (3.8)
England	6 (0.6)	431 (7.7)	13 (1.0)	463 (5.2)	27 (1.3)	495 (4.0)	22 (0.8)	518 (5.1)	32 (1.5)	540 (4.3)
France	5 (0.5)	511 (9.1)	17 (1.0)	520 (3.8)	36 (1.1)	536 (3.7)	21 (1.0)	559 (4.8)	20 (1.2)	547 (4.7)
Germany	8 (0.8)	447 (6.4)	14 (1.1)	464 (4.5)	26 (1.0)	499 (4.4)	19 (0.9)	532 (5.8)	33 (1.7)	542 (5.4)
Greece	5 (0.4)	450 (5.7)	22 (0.9)	454 (3.3)	43 (0.9)	485 (3.4)	18 (0.7)	509 (5.8)	12 (0.7)	519 (5.8)
Hong Kong	21 (1.2)	559 (9.4)	29 (1.0)	594 (5.9)	29 (0.9)	599 (7.4)	10 (0.7)	602 (7.8)	10 (0.9)	606 (9.2)
Hungary	4 (0.6)	455 (10.7)	8 (0.7)	479 (6.1)	25 (1.0)	517 (4.2)	21 (1.0)	545 (4.1)	42 (1.4)	569 (3.8)
Iceland	1 (0.2)	~ ~	5 (0.8)	465 (9.6)	29 (1.4)	477 (4.9)	28 (1.2)	486 (5.7)	37 (1.7)	501 (6.6)
Iran, Islamic Rep.	37 (1.8)	415 (2.9)	32 (0.9)	432 (2.3)	17 (0.9)	438 (3.3)	6 (0.5)	437 (6.8)	7 (0.7)	452 (5.3)
Ireland	7 (0.6)	468 (7.6)	16 (0.8)	491 (5.9)	34 (1.0)	530 (5.0)	21 (0.7)	550 (5.1)	22 (1.2)	555 (6.3)
Israel	4 (0.6)	482 (14.7)	13 (1.6)	498 (7.7)	31 (1.9)	514 (7.1)	26 (1.4)	539 (8.0)	25 (2.0)	542 (7.6)
Japan	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –
Korea	10 (0.6)	535 (6.1)	12 (0.8)	560 (6.4)	33 (0.9)	599 (3.6)	23 (0.8)	634 (3.6)	21 (0.9)	652 (4.1)
Kuwait	22 (1.5)	382 (3.0)	27 (1.4)	389 (3.4)	28 (1.3)	400 (4.2)	10 (0.8)	404 (5.3)	13 (1.2)	402 (4.0)
Latvia (LSS)	1 (0.3)	~ ~	4 (0.6)	448 (7.9)	17 (1.0)	471 (4.3)	21 (1.1)	484 (5.0)	57 (1.4)	509 (3.5)
Lithuania	3 (0.4)	415 (7.1)	17 (0.9)	442 (4.5)	35 (1.2)	470 (4.1)	21 (0.9)	496 (4.6)	24 (1.1)	507 (5.2)
Netherlands	8 (1.0)	488 (10.7)	16 (1.3)	507 (10.1)	34 (1.3)	538 (7.3)	19 (0.9)	558 (7.7)	22 (1.7)	577 (7.4)
New Zealand	3 (0.4)	441 (8.2)	7 (0.6)	452 (6.5)	24 (0.8)	488 (4.7)	25 (0.7)	516 (4.8)	41 (1.4)	531 (5.2)
Norway	2 (0.3)	~ ~	6 (0.4)	467 (5.2)	25 (0.9)	483 (3.0)	22 (0.7)	504 (3.2)	45 (1.2)	524 (3.1)
Portugal	10 (0.8)	428 (2.9)	26 (1.3)	443 (2.7)	32 (1.0)	454 (2.6)	15 (0.8)	472 (3.4)	17 (1.4)	475 (4.3)
Romania	24 (1.3)	459 (7.0)	22 (1.3)	466 (5.2)	19 (1.0)	476 (4.8)	11 (0.7)	498 (5.5)	24 (1.7)	523 (5.4)
Russian Federation	2 (0.3)	~ ~	11 (0.8)	495 (10.6)	36 (1.3)	523 (5.2)	24 (0.8)	550 (4.4)	26 (1.3)	562 (4.8)
Scotland	11 (1.2)	441 (4.8)	17 (1.1)	468 (4.7)	28 (1.0)	490 (4.5)	19 (1.0)	525 (5.9)	25 (2.0)	540 (8.0)
Singapore	11 (0.8)	611 (4.8)	22 (0.9)	622 (5.5)	41 (0.8)	648 (4.8)	14 (0.7)	665 (6.8)	12 (1.0)	674 (6.1)
Slovak Republic	2 (0.3)	~ ~	11 (0.6)	497 (6.8)	45 (1.1)	541 (3.2)	23 (0.9)	562 (4.3)	18 (1.0)	581 (5.9)
Slovenia	2 (0.4)	~ ~	15 (0.9)	500 (4.8)	38 (1.2)	532 (3.5)	22 (0.9)	560 (4.7)	22 (1.1)	571 (4.4)
Spain	4 (0.4)	443 (6.1)	18 (1.1)	460 (3.1)	33 (1.0)	482 (2.6)	20 (0.8)	498 (3.2)	26 (1.2)	513 (3.0)
Sweden	3 (0.3)	468 (8.3)	8 (0.7)	464 (5.0)	24 (1.0)	503 (4.3)	24 (0.8)	524 (3.3)	41 (1.5)	541 (3.5)
Switzerland	8 (1.0)	480 (6.9)	16 (0.9)	511 (4.7)	30 (1.0)	542 (3.1)	20 (0.9)	568 (3.7)	26 (1.2)	579 (4.7)
Thailand	19 (1.2)	506 (4.7)	30 (1.0)	514 (5.1)	33 (1.2)	528 (6.5)	9 (0.6)	537 (8.1)	9 (1.0)	553 (9.2)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1). Background data for Bulgaria and South Africa not available.

A dash (–) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

Table 4.3

Students' Reports on the Highest Level of Education of Either Parent[1]

Mathematics - Eighth Grade*

Country		Finished University[2]		Finished Upper Secondary School But Not University[3]		Finished Primary School But Not Upper Secondary School[4]		Do Not Know	
		Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
UNITED STATES		33 (1.4)	527 (5.9)	54 (1.3)	494 (4.0)	7 (0.8)	455 (4.8)	5 (0.4)	489 (8.5)
MISSOURI		29 (2.1)	530 (9.8)	60 (1.8)	499 (5.9)	6 (0.7)	466 (11.7)	5 (0.6)	482 (12.3)
OREGON		37 (2.7)	556 (8.4)	55 (2.3)	513 (7.6)	4 (0.5)	469 (12.3)	4 (0.6)	505 (14.5)
Australia		28 (1.4)	572 (4.4)	37 (0.9)	528 (4.4)	24 (0.9)	510 (3.6)	11 (0.6)	494 (4.9)
Austria		10 (0.7)	574 (7.2)	70 (1.1)	547 (3.7)	8 (0.9)	496 (7.4)	12 (0.9)	513 (6.1)
Belgium (Fl)		20 (1.6)	599 (6.0)	34 (1.3)	572 (5.3)	21 (2.4)	538 (10.3)	25 (1.4)	548 (5.9)
Belgium (Fr)		27 (1.6)	557 (3.9)	34 (1.3)	537 (3.9)	11 (1.3)	491 (6.2)	27 (1.6)	501 (7.4)
Canada		37 (1.3)	544 (3.4)	39 (1.2)	526 (2.9)	13 (0.9)	510 (5.1)	10 (0.5)	504 (4.2)
Colombia		15 (1.6)	410 (8.2)	28 (1.6)	396 (4.3)	47 (2.3)	378 (4.1)	10 (0.9)	371 (6.8)
Cyprus	r	15 (0.9)	521 (4.8)	29 (1.1)	502 (4.0)	52 (1.4)	455 (2.9)	4 (0.5)	454 (8.8)
Czech Republic		21 (1.7)	604 (7.5)	47 (1.5)	571 (4.9)	25 (1.5)	532 (4.1)	7 (0.8)	516 (7.8)
Denmark		13 (1.0)	528 (5.5)	46 (1.5)	512 (3.5)	8 (0.7)	488 (8.0)	33 (1.7)	498 (4.0)
England		– –	– –	– –	– –	– –	– –	– –	– –
France	r	13 (1.2)	576 (5.8)	36 (1.3)	549 (3.6)	19 (1.2)	530 (4.1)	31 (1.3)	529 (3.8)
Germany		11 (1.0)	553 (8.5)	32 (1.3)	526 (5.0)	38 (1.6)	504 (4.2)	19 (1.3)	488 (6.7)
Greece		18 (1.1)	537 (6.3)	39 (1.3)	492 (4.5)	40 (1.8)	462 (2.9)	3 (0.3)	457 (8.1)
Hong Kong		7 (1.0)	638 (8.6)	30 (1.2)	607 (6.6)	55 (1.8)	584 (5.9)	7 (0.7)	554 (12.6)
Hungary	r	24 (1.8)	594 (4.9)	66 (1.7)	539 (3.2)	11 (0.9)	492 (6.0)	– –	– –
Iceland		25 (2.8)	505 (7.0)	44 (2.0)	495 (4.7)	15 (1.4)	467 (6.8)	15 (1.0)	472 (6.5)
Iran, Islamic Rep.	r	3 (0.6)	468 (7.1)	21 (1.8)	447 (2.5)	68 (2.2)	426 (2.5)	7 (1.0)	424 (5.6)
Ireland		17 (1.3)	564 (7.6)	46 (1.0)	535 (4.7)	26 (1.2)	510 (5.7)	10 (0.7)	499 (6.6)
Israel		37 (2.5)	552 (7.8)	45 (2.2)	518 (5.8)	10 (1.3)	486 (5.9)	8 (0.9)	506 (8.5)
Japan		– –	– –	– –	– –	– –	– –	– –	– –
Korea		22 (1.3)	654 (5.1)	47 (1.3)	607 (2.8)	26 (1.1)	575 (4.2)	5 (0.5)	573 (9.3)
Kuwait	s	3 (1.3)	429 (11.8)	3 (0.9)	387 (11.3)	92 (2.2)	390 (2.9)	1 (0.7)	~ ~
Latvia (LSS)	r	27 (1.5)	528 (5.5)	49 (1.4)	493 (3.7)	13 (1.0)	470 (6.2)	11 (1.0)	473 (6.4)
Lithuania	s	37 (1.6)	508 (4.4)	44 (1.6)	474 (4.1)	7 (1.0)	449 (6.3)	12 (1.2)	472 (6.4)
Netherlands		12 (1.4)	570 (10.6)	55 (1.8)	549 (7.7)	10 (0.7)	524 (9.2)	23 (1.4)	522 (7.8)
New Zealand		25 (1.3)	543 (6.0)	38 (1.1)	504 (4.4)	15 (0.8)	491 (5.7)	21 (1.1)	494 (5.4)
Norway		25 (1.2)	524 (4.5)	38 (1.1)	505 (3.1)	9 (0.6)	487 (4.6)	27 (1.2)	495 (3.2)
Portugal		9 (1.2)	494 (4.6)	13 (1.0)	473 (4.0)	73 (2.0)	447 (2.1)	5 (0.4)	452 (5.8)
Romania		10 (1.3)	517 (8.7)	47 (1.5)	497 (4.9)	33 (1.9)	467 (7.2)	10 (0.9)	460 (6.5)
Russian Federation		34 (1.8)	565 (4.9)	54 (1.6)	526 (6.4)	5 (0.5)	484 (8.0)	6 (0.8)	519 (10.8)
Scotland		14 (1.4)	559 (8.4)	33 (1.4)	499 (5.3)	14 (0.8)	485 (5.5)	39 (1.3)	487 (5.6)
Singapore		8 (1.0)	692 (7.5)	69 (1.0)	645 (5.0)	23 (1.2)	623 (4.9)	– –	– –
Slovak Republic		20 (1.4)	588 (5.4)	50 (1.1)	551 (3.2)	23 (1.2)	517 (4.5)	6 (0.5)	521 (7.5)
Slovenia		19 (1.1)	583 (4.4)	59 (1.4)	542 (3.4)	18 (1.3)	503 (4.6)	4 (0.4)	522 (9.0)
Spain		15 (1.2)	517 (3.6)	21 (0.9)	502 (3.3)	54 (1.8)	479 (2.3)	10 (0.8)	478 (3.5)
Sweden		22 (1.2)	544 (3.9)	34 (1.1)	524 (3.4)	9 (0.6)	494 (4.6)	35 (1.1)	511 (3.4)
Switzerland		11 (0.8)	588 (5.4)	61 (1.3)	552 (2.6)	13 (0.9)	520 (5.1)	15 (1.0)	534 (4.7)
Thailand		9 (1.4)	571 (9.5)	14 (1.4)	544 (8.9)	73 (2.6)	513 (4.4)	3 (0.5)	524 (12.3)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

[1]The response categories were defined by each country to conform to their own educational system and may not be strictly comparable across countries. See Figure 4.1 for country modifications to the definitions of educational levels. Also, no response category was provided for students whose parents had no formal education or did not finish primary school, except in France where a small percentage of students in this category are included in the missing responses.

[2]In most countries, defined as completion of at least a 4-year degree program at a university or an equivalent institute of higher education.

[3]Finished upper secondary school with or without some tertiary education not equivalent to a university degree. In most countries, finished secondary corresponds to completion of an upper-secondary track terminating after 11 to 13 years of schooling.

[4]Finished primary school or some secondary school not equivalent to completion of upper secondary.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1). Background data for Bulgaria and South Africa not available.

A dash (–) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

An "r" indicates a 70-84% student response rate. An "s" indicates a 50-69% student response rate.

Data for Singapore not obtained from students; entered at ministry level.

Figure 4.1

Country Modifications to the Definitions of Educational Levels for Parents' Highest Level of Education†

Finished Primary School But Not Upper Secondary School

Internationally-Defined Levels: *Finished Primary School or Finished Some Secondary School*

Countries with Modified Nationally-Defined Levels:

- Austria: *Compulsory (Pfichtschulabschluß; 9 grades)*
- Denmark: *Basic school (Folkeskolen, Realeksamen; 9 or 10 grades)*
- France: *Lower secondary (Collége, CAP)*
- Germany: *Lower secondary (Hauptschulabschluß; 9 or 10 grades) or Medium secondary (Fachoberschulreife, Realschulabschluß or Polytechnische Oberschule; 10 grades)*
- Hungary: *Some or all of general school (8 grades)*
- Norway: *Compulsory (9 grades) or some upper secondary*
- Scotland: *Some secondary School*
- Singapore: *Primary school*
- Sweden: *Compulsory (9 grades) or started upper secondary*
- Switzerland: *Compulsory (9 grades)*

Finished Upper Secondary School[1] But Not University

Internationally-Defined Levels: *Finished Secondary School or Some Vocational/Technical Education After Secondary School or Some University*

Countries with Modified Nationally-Defined Levels:

- Austria: *Upper secondary tracks: apprenticeship (Berufsschul-/Lehrabschluß), medium vocational (Handelsschule, Fachschule), higher vocational (HAK, HTL, etc.), or higher academic (Gymnasium, Realgymnasium)*
- Cyprus *Upper secondary tracks: academic or technical/vocational or Postsecondary: finished college.*
- Denmark: *Upper secondary tracks: academic or general/vocational (gymnasium, hf, htx, hhx) or vocational training (erhvervsfaglig uddannelse) Postsecondary: medium-cycle higher education (mellemlang uddannselse)*
- France: *Upper secondary tracks: BEP (11 grades) or baccalauréat (général, technologique or professionnel; 12 or 13 grades) Postsecondary: 2 or 3 years university study after baccalauréat (BTS, DUT, Licence)*
- Germany: *Upper secondary tracks: general/academic or apprenticeship/vocational training (Lehrabschluß, Berufsfachschule, Postsecondary: Higher vocational schools (Fachhochschulabschluß)*
- Hungary: *Upper secondary tracks: apprenticeship (general + 3 years) or final exam in secondary (general + 4 years)*
- Sweden: *Upper secondary tracks: academic or vocational (gymnasieutbildning or yrkesinriktad utbildning) Postsecondary: less than 3 years of university studies*
- Switzerland: *Upper secondary tracks: occupational (apprentissage, école professionnelle), academic (gymnase, baccalauréat, maturité cantonale) or teacher training (école normale, formation d'enseignant) Postsecondary: Applied science university (haute école professionnelle ou commerciale)*

Finished University

Internationally-Defined Levels: *Finished University*

Countries with Modified Nationally-Defined Levels:

- Austria: *University (master's degree)*
- Canada: *University or college*
- Cyprus: *University degree or post-graduate studies*
- France: *4 years university study after baccalauréat*
- Germany: *University, technical university, teacher college or pedagologic institute*
- Hungary: *University or college diploma*
- New Zealand: *University or teachers' college*
- Norway: *University or college*
- Portugal *University or polytechnic*
- Sweden: *3 years university studies or more*
- Switzerland: *University or institute of technology*
- United States: *Bachelor's degree at college or university*

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

† Educational levels were translated and defined in most countries to be comparable to the internationally-defined levels. Countries that used modified response options to conform to their national education systems are indicated to aid in the interpretation of the reporting categories presented in Table 4.3.

[1]Upper secondary corresponds to ISCED level 3 tracks terminating after 11 to 13 years in most countries (Education at a Glance, OECD, 1995).

The state results bracketed those for the United States, with 37% of the eighth graders in Oregon and 29% of those in Missouri reporting that at least one parent had finished university compared to 33% for the United States. For the U.S. and the states, 4% to 5% of the eighth graders did not know their parents' educational level. In contrast, almost all students (90% or more) in Hong Kong, Iran, Kuwait, Portugal, and Thailand also reported knowing their parents' educational levels, but for these countries, fewer than 10% of students reported that either parent had finished university.

Students who speak a language at home that is different from the language of the school may sometimes be at a disadvantage in learning situations. Table 4.4 presents eighth graders' responses to the question of how often they spoke the language of the TIMSS mathematics test at home. In 25 of the TIMSS countries including the United States, 90% or more of the eighth graders responded that at home they always or almost always spoke the language in which they were tested. The results for Missouri (96%) and Oregon (93%) resembled those for the United States. In most of the countries, students tested in the language almost always spoken in the home had higher mathematics achievement than their counterparts who reported speaking the language of the test only sometimes or never.

Table 4.4

Students' Reports on Frequency with Which They Speak the Language of the Test at Home - Mathematics - Eighth Grade*

Country		Always or Almost Always		Sometimes		Never	
		Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
UNITED STATES		90 (1.4)	505 (4.3)	9 (1.3)	465 (7.1)	1 (0.2)	~ ~
MISSOURI		96 (0.5)	508 (6.4)	3 (0.4)	474 (17.9)	1 (0.2)	~ ~
OREGON		93 (0.8)	530 (7.6)	6 (0.7)	476 (11.0)	1 (0.3)	~ ~
Australia		91 (1.0)	536 (4.1)	7 (0.9)	505 (8.3)	1 (0.2)	~ ~
Austria		89 (1.2)	547 (3.1)	8 (1.0)	472 (9.6)	3 (0.5)	494 (9.9)
Belgium (Fl)		87 (1.3)	570 (5.6)	9 (0.8)	534 (11.7)	4 (0.7)	556 (12.5)
Belgium (Fr)		90 (1.3)	533 (3.3)	8 (1.0)	473 (7.2)	2 (0.5)	~ ~
Canada		90 (0.9)	531 (2.3)	9 (0.8)	511 (6.8)	1 (0.2)	~ ~
Colombia		96 (0.5)	386 (3.4)	3 (0.5)	375 (10.4)	1 (0.2)	~ ~
Cyprus		91 (0.7)	480 (2.0)	7 (0.6)	451 (8.0)	2 (0.4)	~ ~
Czech Republic		99 (0.2)	565 (4.9)	1 (0.2)	~ ~	0 (0.1)	~ ~
Denmark	r	95 (1.0)	508 (2.7)	4 (0.9)	454 (15.2)	1 (0.3)	~ ~
England		96 (0.7)	510 (2.7)	3 (0.7)	486 (14.9)	0 (0.1)	~ ~
France		94 (0.6)	541 (3.1)	5 (0.6)	509 (9.2)	1 (0.2)	~ ~
Germany	r	87 (1.2)	515 (4.3)	10 (1.0)	469 (8.2)	3 (0.4)	443 (8.7)
Greece		96 (0.5)	488 (3.0)	3 (0.3)	444 (7.3)	1 (0.3)	~ ~
Hong Kong	r	2 (0.3)	~ ~	65 (1.5)	604 (6.5)	33 (1.5)	589 (8.1)
Hungary	r	99 (0.3)	543 (3.3)	1 (0.2)	~ ~	1 (0.2)	~ ~
Iceland		96 (0.7)	489 (4.4)	3 (0.6)	488 (16.8)	1 (0.3)	~ ~
Iran, Islamic Rep.		53 (2.8)	436 (2.6)	33 (2.2)	419 (3.8)	13 (1.3)	421 (4.9)
Ireland		98 (0.7)	530 (5.0)	2 (0.6)	~ ~	1 (0.2)	~ ~
Israel		87 (1.9)	525 (6.8)	10 (1.5)	515 (10.9)	3 (0.6)	530 (14.3)
Japan		– –	– –	– –	– –	– –	– –
Korea		96 (0.4)	610 (2.5)	3 (0.4)	564 (9.3)	0 (0.1)	~ ~
Kuwait		52 (2.9)	395 (3.3)	34 (1.7)	390 (2.7)	14 (2.4)	392 (4.3)
Latvia (LSS)		98 (0.6)	495 (3.2)	2 (0.5)	~ ~	0 (0.1)	~ ~
Lithuania		98 (0.5)	478 (3.6)	1 (0.4)	~ ~	0 (0.2)	~ ~
Netherlands		91 (1.3)	545 (7.7)	7 (1.0)	516 (9.4)	2 (0.6)	~ ~
New Zealand		91 (0.7)	512 (4.4)	8 (0.7)	486 (8.4)	1 (0.2)	~ ~
Norway	r	94 (0.8)	512 (2.3)	4 (0.6)	468 (11.1)	2 (0.4)	~ ~
Portugal		98 (0.3)	457 (2.6)	2 (0.3)	~ ~	0 (0.1)	~ ~
Romania		82 (2.0)	484 (4.2)	13 (1.0)	479 (9.2)	5 (1.7)	452 (12.5)
Russian Federation		97 (0.6)	537 (5.5)	2 (0.4)	~ ~	1 (0.3)	~ ~
Scotland		94 (0.6)	504 (5.8)	3 (0.4)	459 (11.7)	3 (0.4)	443 (10.8)
Singapore		20 (1.3)	658 (6.8)	71 (1.1)	639 (4.9)	9 (0.5)	642 (5.9)
Slovak Republic		89 (1.8)	550 (3.6)	9 (1.4)	525 (6.9)	2 (0.5)	~ ~
Slovenia		93 (0.8)	543 (3.2)	5 (0.7)	517 (7.4)	1 (0.3)	~ ~
Spain		79 (1.5)	491 (2.2)	9 (0.7)	481 (3.3)	12 (1.1)	476 (4.1)
Sweden	r	91 (1.1)	526 (3.0)	7 (0.9)	486 (10.0)	2 (0.3)	~ ~
Switzerland		81 (1.4)	559 (2.6)	14 (0.9)	497 (5.9)	5 (0.9)	488 (9.9)
Thailand		75 (2.5)	528 (6.8)	19 (1.9)	509 (6.0)	6 (0.8)	505 (7.2)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1). Background data for Bulgaria and South Africa not available.

A dash (–) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

What Are the Academic Expectations of Students, Their Families, and Their Friends?

Tables 4.5, 4.6, and 4.7 present students' reports about how they themselves, their mothers, and their friends feel about the importance of doing well in various academic and non-academic activities. The first three questions asked about the degree of agreement with the importance of doing well in the academic subjects of mathematics, science, and language, respectively. Nearly all eighth graders in the U.S. (96% to 97%) as well as in Missouri (95% to 97%) and Oregon (94% to 96%) agreed that it was important to do well in each of these three subjects. In almost every country, nearly all students agreed or strongly agreed that it was important to do well in mathematics. The percentages were in the high 90s for many countries and exceeded 90% in virtually all countries. Similarly, approximately the same high percentages of students were in agreement with the importance of doing well in language. In many countries, somewhat fewer eighth-grade students agreed with the importance of doing well in science. Still, the percentages were relatively high, ranging from more than 90% agreement in a number of countries to a low of 68% in Switzerland and 72% in Germany.

For the most part, eighth-grade students including those in Missouri and Oregon, indicated that their mothers' opinions about the importance of these academic activities corresponded very closely to their own feelings (Table 4.6). In contrast, however, students reported that their friends were not in as much agreement about the importance of academic success (Table 4.7). Although students' friends purportedly were in general agreement with the importance of doing well in mathematics, the percentages were generally in the 80s rather than the 90s. In the United States, Oregon, and Missouri, only 75% to 76% of the eighth graders reported that their friends felt it was important to do well in mathematics. According to students, their friends were in the lowest degree of agreement about doing well in mathematics in Germany and Sweden (70% for both countries).

As with the students' reports about their own feelings and those of their mothers, students indicated a close alignment in their friends' degree of agreement about the importance of academic success in mathematics and in language. Apparently, even though the relative importance varies from group to group, students, their mothers, and their friends find it very nearly equally important to do well in mathematics and language. The results for the United States, Missouri, and Oregon, as presented in Table 4.7, were consistent with this pattern, with 72% to 74% of the students reporting their friends felt it was important to do well in language. According to students in some countries, however, their friends do not have nearly the same positive feeling about the importance of doing well in science. In a number of countries fewer than two-thirds of eighth-graders reported that their friends agreed or strongly agreed it was important to do well in science. In the United States, Missouri, and Oregon, however, eighth graders' friends reportedly feel nearly as positive about doing well in science as they do about mathematics and language. From 69% to 73% of the students reported that their friends felt it was important to do well in science (Table 4.7).

For purposes of comparison, eighth-grade students also were asked about the importance of two non-academic activities – having time to have fun and being good at sports. As can be seen in Table 4.5, in Missouri and Oregon, as well as in most countries including the United States, very high percentages of the students (more than 90%) felt it was important to have time to have fun. The percentages in agreement were similar to those agreeing that it was important to do well in mathematics and language. Generally, there was less agreement about the importance of being good at sports. In the United States, Missouri, and Oregon, 83% to 88% of the eighth graders reported it was important to be good in sports (Table 4.5).

In nearly all countries, 80% or more of the students reported that their mothers agreed that it was important to have time to have fun (Table 4.6). For the United States, Missouri, and Oregon these figures were 93% to 94%. The exceptions were Hong Kong (74%), Iran (79%), Korea (58%), Kuwait (63%), and Singapore (79%), where students reported from 8% to 29% lower agreement for their mothers than for themselves. According to students, their mothers give a moderate to high degree of support to the importance of being good at sports. In nearly all countries, the percentages of students reporting such agreement were in the 70s, 80s, and 90s. In the United States, Missouri, and Oregon, from 78% to 81% of the eighth graders reported that their mothers felt it was important to be good in sports.

As might be anticipated, students reported that most of their friends agreed that it was important to have fun – more than 90% in almost all countries (Table 4.7). In the United States, Missouri, and Oregon, 98% to 99% of the eight graders reported that their friends thought it was important to have time to have fun, and 86% to 90% that their friends thought it was important to be good at sports. Internationally, students reported that their friends generally were in moderate agreement that it was important to do well in sports. The percentages of their friends' agreement as reported by students ranged from a low of 64% in Germany to a high of 96% in Colombia.

In summary, students in Missouri and Oregon reported views about the importance of doing well academically that were consistent with those reported by students in the United States as a whole. Considering that the students' reports about their friends might be a better indicator than the students' reports about their own views, it is disturbing to note that the friends of U.S. eighth graders reportedly place a relatively low importance on the value of doing well in mathematics compared to many other countries. In contrast, U.S. eighth graders seem to have views about doing well in science that are more consistent with students in other countries, or even more positive. Whereas eighth graders in a number of other countries reported that their friends placed less importance on doing well in science than in mathematics and language, the U.S. results were similar for the three academic areas. U.S. eighth graders, including those in Missouri and Oregon, reported that nearly all of their friends think it is important to have fun, but this is consistent with the results for many other countries. U.S. eighth graders, however, were in higher ranges of having friends who placed importance on doing well in sports.

Table 4.5

Students' Reports on Whether They Agree or Strongly Agree That It Is Important to Do Various Activities - Mathematics - Eighth Grade*

Country	Percent of Students				
	Do Well in Mathematics	Do Well in Science	Do Well in Language	Have Time to Have Fun	Be Good at Sports
UNITED STATES	97 (0.3)	96 (0.5)	96 (0.3)	99 (0.2)	88 (0.6)
MISSOURI	97 (0.4)	97 (0.5)	95 (0.5)	99 (0.2)	86 (0.7)
OREGON	96 (0.4)	94 (0.5)	94 (0.6)	99 (0.3)	83 (1.2)
Australia	96 (0.4)	89 (0.6)	95 (0.4)	98 (0.2)	85 (0.6)
Austria	94 (0.5)	82 (1.2)	93 (0.6)	98 (0.3)	82 (0.9)
Belgium (Fl)	98 (0.3)	93 (0.6)	98 (0.4)	98 (0.3)	80 (1.0)
Belgium (Fr)	98 (0.3)	94 (0.7)	98 (0.3)	98 (0.4)	87 (0.8)
Canada	98 (0.2)	94 (0.7)	97 (0.3)	99 (0.2)	86 (0.6)
Colombia	99 (0.2)	99 (0.2)	99 (0.2)	98 (0.3)	97 (0.3)
Cyprus	94 (0.5)	86 (1.0)	94 (0.6)	94 (0.5)	85 (1.0)
Czech Republic	98 (0.5)	88 (1.0)	98 (0.3)	98 (0.3)	84 (0.9)
Denmark	97 (0.4)	87 (1.0)	97 (0.4)	99 (0.3)	83 (0.8)
England	99 (0.2)	96 (0.5)	99 (0.3)	99 (0.3)	80 (1.1)
France	97 (0.4)	83 (1.2)	97 (0.5)	97 (0.4)	80 (0.8)
Germany	93 (0.6)	72 (1.0)	91 (0.6)	97 (0.4)	72 (1.1)
Greece	96 (0.4)	93 (0.5)	96 (0.4)	96 (0.4)	91 (0.6)
Hong Kong	96 (0.5)	90 (0.9)	96 (0.5)	94 (0.5)	83 (0.9)
Hungary	95 (0.5)	86 (0.8)	95 (0.5)	96 (0.5)	78 (0.9)
Iceland	97 (1.0)	90 (1.2)	97 (1.0)	98 (0.4)	90 (1.6)
Iran, Islamic Rep.	97 (0.4)	98 (0.4)	96 (0.6)	87 (1.1)	95 (0.7)
Ireland	97 (0.3)	86 (1.1)	96 (0.4)	99 (0.2)	85 (0.8)
Israel	98 (0.5)	85 (1.0)	89 (1.5)	98 (0.5)	84 (1.3)
Japan	92 (0.4)	87 (0.6)	91 (0.5)	99 (0.1)	83 (0.7)
Korea	94 (0.5)	91 (0.6)	93 (0.6)	87 (0.8)	86 (0.8)
Kuwait	96 (0.5)	96 (0.6)	96 (0.6)	85 (1.3)	81 (1.1)
Latvia (LSS)	97 (0.4)	84 (1.0)	97 (0.3)	97 (0.4)	87 (0.8)
Lithuania	93 (0.6)	78 (1.1)	96 (0.4)	94 (0.6)	93 (0.5)
Netherlands	97 (0.6)	95 (0.7)	99 (0.3)	98 (0.6)	78 (1.2)
New Zealand	97 (0.3)	92 (0.6)	96 (0.5)	99 (0.3)	86 (0.7)
Norway	96 (0.5)	92 (0.6)	96 (0.5)	99 (0.1)	79 (0.9)
Portugal	97 (0.3)	97 (0.3)	99 (0.2)	93 (0.5)	94 (0.5)
Romania	88 (0.8)	86 (0.8)	88 (0.8)	86 (1.0)	80 (1.1)
Russian Federation	97 (0.4)	95 (0.6)	97 (0.5)	98 (0.4)	88 (0.9)
Scotland	98 (0.4)	92 (0.7)	98 (0.3)	98 (0.3)	82 (0.9)
Singapore	99 (0.2)	99 (0.2)	100 (0.1)	96 (0.3)	89 (0.6)
Slovak Republic	96 (0.4)	86 (0.8)	96 (0.4)	98 (0.2)	91 (0.5)
Slovenia	96 (0.5)	86 (0.9)	96 (0.4)	95 (0.5)	87 (0.7)
Spain	99 (0.2)	99 (0.2)	99 (0.2)	99 (0.1)	95 (0.3)
Sweden	92 (0.6)	84 (0.8)	90 (0.6)	99 (0.2)	84 (0.7)
Switzerland	96 (0.4)	68 (1.1)	94 (0.4)	95 (0.6)	78 (0.9)
Thailand	93 (0.6)	94 (0.5)	96 (0.4)	95 (0.3)	91 (0.5)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95, Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1). Background data for Bulgaria and South Africa not available.

Table 4.6

Students' Reports on Whether Their Mothers Agree or Strongly Agree That It Is Important to Do Various Activities - Mathematics - Eighth Grade*

Country	Percent of Students				
	Do Well in Mathematics	Do Well in Science	Do Well in Language	Have Time to Have Fun	Be Good at Sports
UNITED STATES	98 (0.2)	97 (0.2)	98 (0.2)	93 (0.4)	81 (0.8)
MISSOURI	97 (0.4)	98 (0.3)	97 (0.4)	94 (0.6)	78 (0.9)
OREGON	97 (0.5)	97 (0.4)	97 (0.5)	94 (0.5)	78 (1.6)
Australia	98 (0.2)	94 (0.4)	98 (0.2)	94 (0.4)	83 (0.7)
Austria	96 (0.4)	81 (1.0)	95 (0.5)	90 (0.7)	56 (1.1)
Belgium (Fl)	97 (0.4)	93 (0.8)	98 (0.4)	94 (0.5)	73 (1.2)
Belgium (Fr)	99 (0.3)	98 (0.3)	99 (0.3)	95 (0.6)	85 (0.7)
Canada	99 (0.1)	98 (0.3)	99 (0.1)	96 (0.4)	83 (0.7)
Colombia	99 (0.4)	99 (0.3)	99 (0.2)	93 (0.6)	94 (1.0)
Cyprus	95 (0.4)	89 (0.8)	95 (0.5)	91 (0.6)	80 (0.8)
Czech Republic	99 (0.2)	93 (0.8)	98 (0.3)	90 (0.7)	74 (1.1)
Denmark	99 (0.3)	95 (0.6)	99 (0.3)	98 (0.3)	81 (1.0)
England	99 (0.3)	96 (0.5)	99 (0.3)	94 (0.6)	74 (1.2)
France	98 (0.3)	88 (0.9)	99 (0.3)	91 (0.7)	74 (1.0)
Germany	94 (0.8)	71 (1.4)	93 (0.7)	88 (0.7)	48 (1.2)
Greece	96 (0.3)	94 (0.5)	96 (0.4)	89 (0.6)	83 (0.7)
Hong Kong	93 (0.6)	86 (0.7)	93 (0.6)	74 (0.9)	71 (1.3)
Hungary	96 (0.4)	85 (0.8)	96 (0.4)	96 (0.4)	73 (1.1)
Iceland	97 (0.8)	95 (1.3)	98 (0.5)	95 (0.7)	87 (1.6)
Iran, Islamic Rep.	96 (0.5)	96 (0.5)	95 (0.5)	79 (1.8)	90 (1.5)
Ireland	98 (0.3)	89 (1.0)	98 (0.2)	94 (0.5)	83 (0.8)
Israel	99 (0.4)	89 (0.9)	93 (0.6)	95 (0.7)	79 (1.4)
Japan	– –	– –	– –	– –	– –
Korea	96 (0.4)	92 (0.5)	94 (0.5)	58 (1.1)	72 (0.9)
Kuwait	91 (0.9)	r 91 (0.9)	r 91 (1.0)	r 63 (1.8)	r 69 (1.5)
Latvia (LSS)	97 (0.4)	85 (1.1)	97 (0.5)	90 (0.8)	82 (0.9)
Lithuania	91 (0.6)	77 (1.1)	95 (0.5)	86 (0.8)	87 (0.9)
Netherlands	96 (0.5)	94 (0.7)	97 (0.4)	96 (0.4)	63 (1.4)
New Zealand	98 (0.3)	95 (0.4)	97 (0.3)	95 (0.5)	86 (0.8)
Norway	97 (0.4)	95 (0.5)	97 (0.4)	97 (0.3)	71 (1.1)
Portugal	96 (0.4)	98 (0.3)	98 (0.3)	87 (0.7)	91 (0.6)
Romania	93 (0.5)	94 (0.6)	90 (0.7)	83 (1.0)	76 (1.0)
Russian Federation	96 (0.3)	95 (0.4)	97 (0.4)	92 (0.6)	84 (0.7)
Scotland	98 (0.3)	93 (0.6)	99 (0.2)	94 (0.5)	77 (1.0)
Singapore	99 (0.2)	99 (0.2)	99 (0.1)	79 (0.8)	84 (0.8)
Slovak Republic	99 (0.2)	94 (0.5)	99 (0.2)	95 (0.4)	88 (0.6)
Slovenia	91 (0.7)	85 (0.7)	92 (0.6)	88 (0.7)	81 (0.9)
Spain	99 (0.2)	99 (0.2)	99 (0.2)	96 (0.4)	93 (0.5)
Sweden	96 (0.4)	92 (0.5)	95 (0.4)	97 (0.3)	83 (0.7)
Switzerland	96 (0.3)	69 (1.0)	95 (0.4)	83 (0.9)	59 (1.1)
Thailand	94 (0.5)	95 (0.4)	96 (0.4)	84 (0.9)	90 (0.5)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Data are reported as percent of students.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

A dash (–) indicates data are not available.

An "r" indicates a 70-84% student response rate.

Table 4.7

Students' Reports on Whether Their Friends Agree or Strongly Agree That It Is Important to Do Various Activities - Mathematics - Eighth Grade*

Country	Percent of Students				
	Do Well in Mathematics	Do Well in Science	Do Well in Language	Have Time to Have Fun	Be Good at Sports
UNITED STATES	75 (1.0)	69 (1.2)	73 (0.9)	98 (0.2)	90 (0.7)
MISSOURI	76 (1.1)	73 (1.3)	74 (1.2)	98 (0.3)	87 (0.9)
OREGON	75 (1.2)	70 (1.4)	72 (1.0)	99 (0.2)	86 (1.3)
Australia	78 (0.8)	64 (1.0)	76 (0.8)	98 (0.2)	83 (0.8)
Austria	77 (1.2)	45 (1.8)	74 (1.1)	97 (0.4)	79 (1.2)
Belgium (Fl)	84 (1.7)	70 (1.6)	83 (1.8)	98 (0.4)	76 (1.5)
Belgium (Fr)	86 (1.1)	78 (1.3)	87 (0.9)	97 (0.4)	84 (1.2)
Canada	80 (0.8)	68 (1.3)	78 (0.8)	99 (0.2)	87 (0.6)
Colombia	95 (0.5)	93 (0.6)	95 (0.5)	97 (0.4)	96 (0.4)
Cyprus	85 (0.8)	71 (1.1)	85 (0.9)	91 (0.6)	82 (1.0)
Czech Republic	84 (1.3)	61 (1.5)	84 (1.2)	98 (0.3)	82 (1.1)
Denmark	94 (0.6)	82 (1.0)	95 (0.6)	99 (0.2)	92 (0.7)
England	88 (0.9)	80 (1.1)	88 (0.9)	99 (0.3)	79 (1.2)
France	85 (1.3)	53 (1.5)	88 (1.1)	97 (0.4)	80 (1.0)
Germany	70 (1.3)	35 (1.4)	68 (1.3)	94 (0.5)	64 (1.3)
Greece	87 (0.7)	82 (0.8)	89 (0.6)	96 (0.3)	85 (0.8)
Hong Kong	86 (0.9)	74 (1.3)	87 (0.9)	93 (0.5)	76 (1.0)
Hungary	81 (0.9)	66 (1.2)	83 (0.8)	94 (0.5)	74 (1.1)
Iceland	85 (1.4)	65 (2.0)	85 (1.1)	98 (0.4)	89 (1.2)
Iran, Islamic Rep.	95 (0.5)	95 (0.9)	93 (0.6)	87 (1.3)	93 (0.9)
Ireland	80 (0.9)	59 (1.4)	78 (0.8)	99 (0.2)	85 (0.7)
Israel	93 (1.1)	56 (2.5)	75 (2.0)	98 (0.5)	79 (1.9)
Japan	90 (0.5)	83 (0.7)	88 (0.6)	99 (0.2)	81 (0.7)
Korea	86 (0.8)	79 (0.9)	81 (0.8)	88 (0.7)	78 (1.0)
Kuwait	90 (0.8)	90 (0.8)	86 (1.0)	77 (1.3)	78 (1.5)
Latvia (LSS)	86 (0.9)	53 (1.3)	87 (1.0)	97 (0.4)	87 (0.8)
Lithuania	83 (0.9)	55 (1.3)	88 (0.9)	95 (0.5)	90 (0.7)
Netherlands	87 (0.9)	82 (1.2)	90 (0.7)	97 (0.6)	66 (1.2)
New Zealand	77 (1.0)	66 (1.2)	76 (1.0)	98 (0.3)	87 (0.8)
Norway	84 (0.8)	72 (1.2)	83 (0.9)	99 (0.2)	83 (1.0)
Portugal	89 (0.7)	88 (0.8)	93 (0.4)	92 (0.6)	94 (0.5)
Romania	87 (0.8)	80 (1.0)	88 (0.8)	86 (1.0)	81 (1.0)
Russian Federation	88 (0.8)	81 (0.8)	88 (0.8)	97 (0.4)	84 (0.8)
Scotland	81 (1.2)	70 (1.3)	82 (1.0)	98 (0.3)	84 (0.8)
Singapore	97 (0.4)	96 (0.5)	98 (0.2)	96 (0.3)	86 (0.8)
Slovak Republic	83 (0.7)	60 (1.3)	84 (0.7)	98 (0.2)	92 (0.5)
Slovenia	77 (1.2)	56 (1.6)	78 (1.1)	95 (0.5)	81 (0.9)
Spain	91 (0.6)	89 (0.7)	91 (0.5)	99 (0.2)	94 (0.4)
Sweden	70 (1.2)	61 (1.4)	68 (1.2)	97 (0.3)	75 (0.8)
Switzerland	85 (0.8)	40 (1.4)	82 (1.0)	93 (0.8)	75 (1.1)
Thailand	93 (0.6)	94 (0.5)	95 (0.4)	95 (0.4)	91 (0.4)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Data are reported as percent of students.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

How Do Students Spend Their Out-of-School Time During the School Week?

Even though education may be thought to be the dominant activity of school-aged children, young people actually spend much more of their time outside of school. Some of this out-of-school time is spent at furthering academic development – for example, in studying or doing homework in school subjects. Table 4.8 presents eighth-grade students' reports about the average number of hours per day they spend studying or doing homework in mathematics, science, and other subjects. Students in many countries reported spending roughly an hour per day studying mathematics. The eighth graders in Missouri reported .7 hours per day and those in Oregon .8 hours per day, both consistent with the .8 hours reported by U.S. eighth graders. Eighth-graders in the Czech Republic, Denmark, Germany, the Netherlands, and Scotland were at the lower end of the range, reporting an average of about one-half hour per day (.5 to .6 of an hour). Those in Iran and Romania were at the top end, reporting about two hours of mathematics homework per day (2.0 and 1.8 hours, respectively). On average, students in nearly all countries reported spending somewhat less time per day studying science.

Participating countries showed some variation in the amount of time students spent doing homework each day across all school subjects. The most common response about the amount of homework done, reported by eighth graders in about half the countries, was an average of two to three hours per day, but there was a range. Students in Iran, Kuwait, and Romania reported spending the most time on homework, five or more hours per day. Students in the Czech Republic, Denmark, and Scotland reported spending the least amount of time per day on homework, less than two hours. Those in the U.S. reported spending 2.3 hours per day on homework, compared to 1.9 hours for the eighth graders in Missouri and 2.2 hours for those in Oregon.

The students also were asked about a variety of other ways they could spend their time out of school. Eighth graders were asked about watching television, playing computer games, playing or talking with friends, doing jobs at home, playing sports, and reading books for enjoyment. Their reports about the amount of time spent daily in each of these activities are shown in Table 4.9. Granted, some television programming and some computer games are targeted at developing children's academic abilities, and leisure reading also can be related to higher academic achievement. Still, much fare on television is not educationally related, and eighth-grade students in many countries reported spending nearly as much time each day watching television – an average of two to three hours per day – as they did doing homework. The reports for Missouri were consistent with those of the U.S. as a whole, with students reporting that they watched 2.6 hours of television or videos on average each day. Eighth graders in Oregon reported less daily viewing on average, two hours each day. Eighth-graders in many countries also appear to spend several hours per day playing or talking with friends, and nearly two hours playing sports. Those in the United States, Oregon, and Missouri reported about two and one-half hours per day playing or talking with friends, and about two hours playing sports. The time spent on leisure activities is not additive, because students often do these activities simultaneously (e.g., talk with friends and watch television). Nevertheless, it does appear that in most countries at least as much time is spent in these largely non-academic activities as in studying and doing homework, and probably more time.

Table 4.8

Students' Reports on How They Spend Their Daily Out-of-School Study Time[1]

Mathematics - Eighth Grade*

Country	Average Hours Each Day Studying Mathematics or Doing Mathematics Homework After School	Average Hours Each Day Studying Science or Doing Science Homework After School	Average Hours Each Day Studying or Doing Homework in Other School Subjects	Total Hours Each Day on Average
UNITED STATES	0.8 (0.02)	0.6 (0.01)	0.9 (0.02)	2.3 (0.04)
MISSOURI	0.7 (0.03)	0.5 (0.02)	0.7 (0.03)	1.9 (0.07)
OREGON	0.8 (0.03)	0.5 (0.03)	0.9 (0.03)	2.2 (0.07)
Australia	0.7 (0.02)	0.5 (0.01)	0.9 (0.02)	2.0 (0.04)
Austria	0.8 (0.02)	0.7 (0.03)	0.8 (0.02)	2.4 (0.07)
Belgium (Fl)	1.1 (0.03)	0.8 (0.02)	1.5 (0.03)	3.4 (0.07)
Belgium (Fr)	1.0 (0.02)	0.8 (0.02)	1.2 (0.03)	3.0 (0.07)
Canada	0.7 (0.02)	0.6 (0.02)	0.9 (0.03)	2.2 (0.07)
Colombia	1.3 (0.06)	1.2 (0.06)	2.0 (0.07)	4.6 (0.15)
Cyprus	1.2 (0.02)	0.9 (0.02)	1.5 (0.03)	3.6 (0.06)
Czech Republic	0.6 (0.02)	0.6 (0.02)	0.6 (0.02)	1.8 (0.05)
Denmark	0.5 (0.02)	0.3 (0.02)	0.5 (0.02)	1.4 (0.05)
England	– –	– –	– –	– –
France	0.9 (0.02)	0.6 (0.01)	1.2 (0.03)	2.7 (0.05)
Germany	0.6 (0.02)	0.6 (0.02)	0.8 (0.02)	2.0 (0.05)
Greece	1.2 (0.03)	1.2 (0.03)	2.0 (0.05)	4.4 (0.08)
Hong Kong	0.9 (0.02)	0.6 (0.02)	1.1 (0.03)	2.5 (0.06)
Hungary	0.8 (0.02)	1.1 (0.02)	1.2 (0.03)	3.1 (0.06)
Iceland	0.9 (0.03)	0.6 (0.03)	0.9 (0.03)	2.4 (0.07)
Iran, Islamic Rep.	2.0 (0.05)	1.9 (0.05)	2.5 (0.05)	6.4 (0.13)
Ireland	0.7 (0.02)	0.6 (0.01)	1.4 (0.03)	2.7 (0.05)
Israel	1.0 (0.04)	0.6 (0.03)	1.2 (0.05)	2.8 (0.10)
Japan	0.8 (0.01)	0.6 (0.01)	1.0 (0.02)	2.3 (0.04)
Korea	0.8 (0.02)	0.6 (0.02)	1.1 (0.02)	2.5 (0.05)
Kuwait	1.6 (0.04)	1.5 (0.05)	2.3 (0.06)	5.3 (0.13)
Latvia (LSS)	0.9 (0.02)	0.6 (0.02)	1.2 (0.03)	2.7 (0.05)
Lithuania	0.8 (0.02)	0.7 (0.02)	1.2 (0.04)	2.7 (0.06)
Netherlands	0.6 (0.01)	0.6 (0.01)	1.0 (0.03)	2.2 (0.04)
New Zealand	0.7 (0.02)	0.6 (0.01)	0.9 (0.02)	2.1 (0.05)
Norway	0.7 (0.02)	0.6 (0.01)	1.0 (0.02)	2.3 (0.04)
Portugal	1.0 (0.02)	0.9 (0.02)	1.1 (0.02)	3.0 (0.05)
Romania	1.8 (0.07)	1.6 (0.06)	1.6 (0.06)	5.0 (0.18)
Russian Federation	0.9 (0.02)	1.0 (0.02)	1.0 (0.02)	2.9 (0.05)
Scotland	0.6 (0.02)	0.5 (0.01)	0.7 (0.02)	1.8 (0.04)
Singapore	1.4 (0.02)	1.3 (0.02)	1.9 (0.03)	4.6 (0.04)
Slovak Republic	0.7 (0.01)	0.8 (0.02)	0.9 (0.02)	2.4 (0.04)
Slovenia	0.9 (0.02)	1.0 (0.02)	0.9 (0.02)	2.9 (0.05)
Spain	1.2 (0.02)	1.0 (0.02)	1.4 (0.03)	3.6 (0.06)
Sweden	0.7 (0.01)	0.7 (0.01)	0.9 (0.02)	2.3 (0.04)
Switzerland	0.9 (0.02)	0.7 (0.01)	1.0 (0.02)	2.7 (0.04)
Thailand	1.2 (0.03)	1.0 (0.02)	1.3 (0.02)	3.5 (0.06)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

[1]Average hours based on: No Time = 0; Less Than 1 Hour = .5; 1-2 Hours =1.5; 3-5 Hours = 4; More Than 5 Hours = 7.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

A dash (–) indicates data are not available.

Table 4.9

Students' Reports on How They Spend Their Daily Leisure Time[1]
Mathematics - Eighth Grade*

Country	Average Hours Each Day Watching Television or Videos	Average Hours Each Day Playing Computer Games	Average Hours Each Day Playing or Talking with Friends	Average Hours Each Day Doing Jobs at Home	Average Hours Each Day Playing Sports	Average Hours Each Day Reading a Book for Enjoyment
UNITED STATES	2.6 (0.07)	0.7 (0.03)	2.5 (0.06)	1.2 (0.04)	2.2 (0.05)	0.7 (0.02)
MISSOURI	2.6 (0.07)	0.7 (0.03)	2.6 (0.10)	1.3 (0.05)	2.0 (0.05)	0.6 (0.02)
OREGON	2.0 (0.08)	0.7 (0.04)	2.4 (0.07)	1.2 (0.05)	1.9 (0.06)	0.8 (0.03)
Australia	2.4 (0.05)	0.6 (0.02)	1.4 (0.03)	0.9 (0.02)	1.6 (0.03)	0.6 (0.02)
Austria	1.9 (0.06)	0.6 (0.03)	2.9 (0.08)	0.8 (0.03)	1.9 (0.07)	0.8 (0.03)
Belgium (Fl)	2.0 (0.05)	0.5 (0.06)	1.6 (0.05)	1.1 (0.03)	1.8 (0.07)	0.7 (0.03)
Belgium (Fr)	1.9 (0.08)	0.7 (0.03)	1.7 (0.10)	0.8 (0.03)	1.8 (0.04)	0.8 (0.03)
Canada	2.3 (0.04)	0.5 (0.02)	2.2 (0.05)	1.0 (0.02)	1.9 (0.03)	0.8 (0.02)
Colombia	2.2 (0.07)	r 0.4 (0.06)	1.9 (0.06)	2.3 (0.07)	1.9 (0.06)	0.9 (0.05)
Cyprus	2.3 (0.04)	0.8 (0.03)	1.7 (0.04)	1.0 (0.03)	1.4 (0.04)	0.8 (0.02)
Czech Republic	2.6 (0.05)	0.6 (0.03)	2.9 (0.09)	1.3 (0.04)	1.9 (0.06)	1.0 (0.03)
Denmark	2.2 (0.06)	0.7 (0.03)	2.8 (0.07)	1.1 (0.04)	1.7 (0.06)	0.7 (0.03)
England	2.7 (0.07)	0.9 (0.05)	2.5 (0.06)	0.8 (0.03)	1.5 (0.05)	0.7 (0.03)
France	1.5 (0.04)	0.5 (0.02)	1.5 (0.05)	0.9 (0.03)	1.7 (0.04)	0.8 (0.03)
Germany	1.9 (0.04)	0.8 (0.04)	3.5 (0.07)	0.9 (0.02)	1.7 (0.04)	0.7 (0.02)
Greece	2.1 (0.04)	0.7 (0.03)	1.5 (0.04)	0.9 (0.03)	1.8 (0.04)	1.0 (0.03)
Hong Kong	2.6 (0.05)	0.8 (0.03)	1.2 (0.04)	0.7 (0.02)	0.9 (0.03)	0.9 (0.02)
Hungary	3.0 (0.06)	0.7 (0.03)	2.3 (0.05)	2.0 (0.04)	1.7 (0.04)	1.2 (0.04)
Iceland	2.2 (0.05)	0.7 (0.06)	3.1 (0.06)	0.8 (0.03)	1.8 (0.06)	0.9 (0.06)
Iran, Islamic Rep.	1.8 (0.06)	r 0.2 (0.02)	1.2 (0.04)	1.8 (0.06)	1.2 (0.09)	1.1 (0.04)
Ireland	2.1 (0.03)	0.5 (0.03)	1.5 (0.06)	0.9 (0.03)	1.4 (0.05)	0.6 (0.02)
Israel	3.3 (0.10)	0.9 (0.04)	2.4 (0.08)	1.2 (0.05)	1.9 (0.09)	1.0 (0.04)
Japan	2.6 (0.04)	0.6 (0.02)	1.9 (0.04)	0.6 (0.01)	1.3 (0.03)	0.9 (0.02)
Korea	2.0 (0.04)	0.3 (0.02)	0.9 (0.03)	0.5 (0.02)	0.5 (0.02)	0.8 (0.03)
Kuwait	1.9 (0.09)	0.7 (0.04)	1.5 (0.06)	1.2 (0.06)	1.5 (0.06)	1.0 (0.04)
Latvia (LSS)	2.6 (0.05)	0.7 (0.04)	2.1 (0.06)	1.5 (0.04)	1.2 (0.04)	1.1 (0.03)
Lithuania	2.8 (0.05)	0.9 (0.04)	2.7 (0.06)	1.2 (0.03)	1.2 (0.04)	1.0 (0.03)
Netherlands	2.5 (0.09)	0.7 (0.04)	2.8 (0.08)	0.9 (0.04)	1.8 (0.06)	0.6 (0.03)
New Zealand	2.5 (0.05)	0.7 (0.03)	1.5 (0.04)	0.9 (0.02)	1.5 (0.04)	0.8 (0.02)
Norway	2.5 (0.04)	0.8 (0.03)	3.2 (0.06)	1.1 (0.03)	1.9 (0.05)	0.7 (0.02)
Portugal	2.0 (0.04)	0.7 (0.03)	1.7 (0.05)	1.0 (0.04)	1.7 (0.04)	0.7 (0.02)
Romania	1.9 (0.06)	0.6 (0.05)	1.5 (0.06)	1.9 (0.08)	1.3 (0.05)	1.3 (0.07)
Russian Federation	2.9 (0.05)	1.0 (0.04)	2.9 (0.05)	1.5 (0.03)	1.0 (0.03)	1.3 (0.04)
Scotland	2.7 (0.05)	1.0 (0.04)	2.8 (0.08)	0.7 (0.02)	1.9 (0.05)	0.7 (0.02)
Singapore	2.7 (0.05)	0.6 (0.03)	1.5 (0.04)	1.0 (0.03)	0.7 (0.03)	1.1 (0.02)
Slovak Republic	2.7 (0.05)	0.6 (0.03)	2.9 (0.07)	1.5 (0.05)	1.8 (0.04)	1.0 (0.03)
Slovenia	2.0 (0.04)	0.6 (0.02)	1.7 (0.05)	1.6 (0.05)	1.6 (0.03)	0.9 (0.02)
Spain	1.8 (0.05)	0.3 (0.02)	1.8 (0.06)	1.1 (0.03)	1.7 (0.04)	0.6 (0.02)
Sweden	2.3 (0.04)	0.6 (0.02)	2.3 (0.05)	0.9 (0.02)	1.6 (0.04)	0.7 (0.02)
Switzerland	1.3 (0.03)	0.4 (0.02)	2.4 (0.05)	1.0 (0.03)	1.8 (0.03)	0.8 (0.02)
Thailand	2.1 (0.07)	0.3 (0.02)	1.2 (0.03)	1.6 (0.03)	1.1 (0.02)	1.0 (0.02)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

[1]Average hours based on: No Time = 0; Less Than 1 Hour = .5; 1-2 Hours = 1.5; 3-5 Hours = 4; More Than 5 Hours = 7.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

An "r" indicates a 70 - 84% student response rate.

Table 4.10 shows the relationship between time spent doing homework in all subjects and students' average mathematics achievement. The relationship was curvilinear in many countries, with the highest achievement being associated with a moderate amount of homework per day (less than one hour). This pattern was noted in the United States as well as in Missouri and Oregon. In all three instances, the students who did some amount of mathematics homework each night had higher achievement than their counterparts who reported doing no homework. However, the students who reported one hour or more of homework did not have higher achievement than those who reported less than one hour of homework each night, and the results indicate somewhat lower achievement. The curvilinear pattern suggests that, compared to their higher-achieving counterparts, the lower-performing students may do less homework, either because they do not do it or because their teachers do not assign it, or more homework, perhaps because they need to spend the extra time to keep up academically. A direct positive relationship between time spent doing homework and mathematics achievement was found only in Korea, Romania, and Thailand. The only inverse relationships were noted for Denmark, and to a lesser extent for Slovenia. Clearly, different countries have different policies and practices about assigning homework.

The relationship between mathematics achievement and amount of time spent watching television each day was more consistent across countries than that with doing homework (see Table 4.11). In about half the TIMSS countries, the highest mathematics achievement was associated with watching from one to two hours of television per day. This was the most common response, reflecting from 33% to 54% of the students for all countries. Watching television for one to two hours each day also was the most common response for eighth graders in Missouri (40%) and in Oregon (42%). In Missouri, as for the United States, the pattern was consistent with that of students having the highest mathematics achievement. In Oregon, however, where 32% of the students reported watching less than one hour of television each night, there was a direct relationship between less television viewing per night and higher mathematics achievement. That watching less than one hour of television per day generally was associated with lower average mathematics achievement than watching one to two hours in many countries most likely has little to do with the influence of television viewing on mathematics achievement. For these students, low television viewing may be a surrogate socio-economic indicator, suggesting something about children's access to television sets across countries. Because students with fewer socio-economic advantages generally perform less well than their counterparts academically, it may be that students who reported less than one hour watching television each day simply do not have television sets in their homes, or come from homes with only one television set, where they have less opportunity to spend a lot of time watching their choice of programming.

Table 4.10

Students' Reports on Total Amount of Out-of-School Time Spent Studying Mathematics or Doing Mathematics Homework on a Normal School Day - Mathematics - Eighth Grade*

Country	No Time		Less Than 1 Hour		One Hour or More		Average Hours[1]
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	
UNITED STATES	18 (1.1)	467 (6.3)	55 (1.0)	513 (4.1)	27 (1.0)	502 (5.8)	0.8 (0.02)
MISSOURI	25 (1.7)	481 (6.9)	53 (1.5)	515 (6.7)	22 (1.7)	512 (10.3)	0.7 (0.03)
OREGON	17 (1.4)	482 (8.5)	57 (1.6)	538 (7.7)	27 (1.8)	528 (10.5)	0.8 (0.03)
Australia	16 (1.1)	483 (5.5)	63 (1.0)	545 (4.0)	21 (0.9)	527 (4.9)	0.7 (0.02)
Austria	7 (0.7)	527 (9.0)	66 (0.9)	548 (3.5)	27 (1.1)	528 (5.0)	0.8 (0.02)
Belgium (Fl)	3 (0.4)	518 (14.3)	51 (1.4)	576 (7.2)	46 (1.5)	557 (4.8)	1.1 (0.03)
Belgium (Fr)	8 (0.8)	475 (6.6)	51 (1.2)	546 (3.9)	41 (1.3)	517 (4.1)	1 (0.02)
Canada	15 (1.2)	521 (4.9)	61 (1.1)	538 (2.8)	24 (1.2)	509 (3.3)	0.7 (0.02)
Colombia	5 (0.6)	377 (5.1)	44 (1.7)	393 (3.0)	51 (1.8)	388 (3.9)	1.3 (0.06)
Cyprus	10 (0.6)	438 (5.5)	43 (1.0)	492 (2.5)	47 (0.8)	470 (2.6)	1.2 (0.02)
Czech Republic	14 (1.2)	554 (7.7)	70 (1.1)	572 (5.0)	16 (1.0)	539 (8.7)	0.6 (0.02)
Denmark	34 (1.8)	522 (4.3)	50 (1.7)	504 (3.9)	16 (1.0)	468 (4.3)	0.5 (0.02)
England	– –	– –	– –	– –	– –	– –	– –
France	10 (0.8)	507 (7.4)	57 (1.3)	548 (3.5)	33 (1.3)	534 (3.5)	0.9 (0.02)
Germany	16 (1.1)	479 (6.5)	66 (1.3)	523 (4.5)	18 (0.8)	494 (4.9)	0.6 (0.02)
Greece	6 (0.5)	450 (7.6)	42 (1.1)	493 (3.6)	51 (1.2)	485 (3.1)	1.2 (0.03)
Hong Kong	14 (1.1)	537 (9.4)	52 (1.0)	595 (6.6)	34 (1.2)	605 (6.4)	0.9 (0.02)
Hungary	4 (0.4)	495 (8.8)	68 (1.1)	544 (3.7)	28 (1.2)	533 (4.6)	0.8 (0.02)
Iceland	5 (1.0)	469 (14.0)	64 (1.9)	498 (4.3)	32 (1.4)	477 (5.6)	0.9 (0.03)
Iran, Islamic Rep.	1 (0.3)	~ ~	20 (1.0)	434 (2.8)	79 (1.1)	430 (2.4)	2 (0.05)
Ireland	6 (0.6)	475 (8.4)	71 (1.2)	539 (5.0)	23 (1.2)	517 (6.6)	0.7 (0.02)
Israel	5 (0.8)	527 (15.4)	53 (2.4)	540 (6.7)	41 (2.5)	505 (5.4)	1 (0.04)
Japan	14 (0.8)	579 (5.3)	56 (0.9)	609 (2.4)	30 (1.0)	610 (2.5)	0.8 (0.01)
Korea	20 (1.1)	578 (3.8)	47 (1.2)	605 (3.2)	33 (1.2)	630 (4.0)	0.8 (0.02)
Kuwait	5 (0.6)	372 (7.7)	37 (1.6)	400 (4.5)	58 (1.7)	390 (2.3)	1.6 (0.04)
Latvia (LSS)	4 (0.5)	473 (8.6)	64 (1.3)	505 (3.1)	32 (1.2)	481 (4.2)	0.9 (0.02)
Lithuania	8 (0.8)	465 (7.1)	68 (1.3)	484 (3.6)	24 (1.1)	474 (5.3)	0.8 (0.02)
Netherlands	6 (0.9)	538 (15.9)	83 (1.3)	548 (7.3)	11 (1.0)	498 (8.9)	0.6 (0.01)
New Zealand	13 (1.1)	474 (5.6)	69 (1.3)	520 (4.8)	18 (1.0)	494 (5.1)	0.7 (0.02)
Norway	7 (0.6)	481 (6.7)	72 (1.1)	513 (2.5)	21 (1.0)	483 (3.4)	0.7 (0.02)
Portugal	6 (0.5)	445 (5.6)	57 (1.2)	462 (2.7)	37 (1.1)	449 (2.9)	1 (0.02)
Romania	11 (0.8)	451 (9.0)	26 (1.5)	469 (5.6)	63 (1.8)	496 (4.2)	1.8 (0.07)
Russian Federation	6 (0.6)	500 (9.0)	59 (1.1)	540 (4.7)	36 (1.2)	540 (7.5)	0.9 (0.02)
Scotland	18 (1.5)	466 (5.5)	69 (1.3)	508 (6.2)	14 (1.0)	502 (6.4)	0.6 (0.02)
Singapore	4 (0.4)	609 (8.8)	19 (0.9)	655 (6.6)	77 (1.0)	643 (4.7)	1.4 (0.02)
Slovak Republic	9 (0.7)	547 (9.3)	71 (0.9)	554 (3.3)	20 (1.0)	526 (4.2)	0.7 (0.01)
Slovenia	6 (0.7)	555 (8.6)	59 (1.1)	552 (3.7)	35 (1.1)	520 (3.5)	0.9 (0.02)
Spain	4 (0.5)	445 (6.6)	44 (1.1)	496 (2.6)	52 (1.2)	484 (2.4)	1.2 (0.02)
Sweden	12 (0.9)	515 (5.8)	70 (1.0)	526 (2.9)	19 (0.9)	501 (4.4)	0.7 (0.01)
Switzerland	4 (0.3)	536 (7.7)	57 (1.3)	556 (3.5)	39 (1.3)	534 (3.5)	0.9 (0.02)
Thailand	4 (0.4)	496 (9.1)	40 (1.5)	513 (4.9)	55 (1.8)	533 (6.7)	1.2 (0.03)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

[1]Average hours based on: No time = 0; Less than 1 hour = 0.5; 1-2 hours = 1.5; 3-4 hours = 3.5; More than 4 hours = 5.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1). Background data for Bulgaria and South Africa not available.

A dash (–) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

Table 4.11

Students' Reports on the Hours Spent Each Day Watching Television and Videos
Mathematics - Eighth Grade*

Country	Less than 1 Hour		1 to 2 Hours		3 to 5 Hours		More than 5 Hours	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
UNITED STATES	22 (0.8)	504 (5.7)	40 (0.9)	513 (5.1)	25 (0.6)	501 (4.2)	13 (1.0)	461 (4.6)
MISSOURI	22 (1.1)	508 (7.6)	40 (1.6)	521 (6.8)	26 (1.1)	499 (7.4)	12 (0.9)	462 (8.3)
OREGON	32 (1.4)	537 (10.2)	42 (1.0)	531 (6.9)	19 (1.1)	519 (7.4)	8 (1.0)	475 (10.1)
Australia	24 (0.9)	539 (6.0)	41 (0.8)	539 (4.1)	27 (0.8)	528 (3.8)	9 (0.6)	487 (5.5)
Austria	25 (1.4)	540 (5.4)	53 (1.1)	546 (4.2)	17 (1.0)	539 (5.2)	5 (0.6)	497 (8.6)
Belgium (Fl)	24 (1.2)	580 (6.7)	52 (1.2)	575 (6.2)	19 (1.0)	535 (7.1)	5 (0.5)	514 (12.1)
Belgium (Fr)	33 (1.3)	536 (4.2)	44 (1.8)	536 (4.9)	17 (1.3)	522 (4.0)	6 (1.0)	445 (9.0)
Canada	22 (0.7)	522 (2.9)	46 (0.8)	534 (3.5)	25 (0.7)	532 (3.0)	7 (0.6)	504 (5.2)
Colombia	31 (1.5)	384 (4.9)	39 (1.2)	397 (3.3)	20 (1.2)	391 (5.2)	11 (1.0)	374 (5.3)
Cyprus	25 (1.1)	466 (4.4)	45 (1.1)	486 (2.7)	21 (0.8)	479 (3.7)	9 (0.7)	441 (5.7)
Czech Republic	15 (0.8)	556 (7.5)	45 (1.2)	575 (6.2)	31 (1.2)	562 (4.3)	9 (0.8)	531 (8.9)
Denmark	28 (1.1)	499 (3.9)	42 (1.2)	507 (4.0)	22 (1.0)	510 (4.5)	8 (0.7)	488 (6.0)
England	20 (1.3)	500 (8.1)	37 (1.2)	515 (3.9)	31 (1.2)	516 (3.7)	11 (0.9)	481 (6.1)
France	42 (1.3)	546 (3.9)	45 (1.1)	539 (2.9)	9 (0.7)	532 (5.5)	4 (0.5)	494 (10.8)
Germany	31 (1.0)	510 (6.2)	47 (1.1)	517 (4.5)	16 (0.8)	511 (5.9)	6 (0.6)	467 (7.4)
Greece	32 (0.9)	486 (3.5)	42 (0.7)	489 (3.7)	17 (0.7)	486 (4.9)	9 (0.5)	470 (5.7)
Hong Kong	22 (0.9)	582 (7.7)	39 (0.9)	599 (6.8)	28 (1.0)	599 (6.5)	11 (0.8)	556 (9.1)
Hungary	11 (0.7)	550 (6.2)	41 (1.1)	552 (4.0)	33 (0.9)	537 (3.9)	15 (1.0)	496 (5.2)
Iceland	24 (1.3)	475 (7.4)	47 (1.3)	494 (4.5)	22 (1.2)	498 (5.7)	7 (0.8)	473 (11.8)
Iran, Islamic Rep.	32 (1.3)	421 (3.1)	46 (0.9)	434 (2.9)	17 (0.9)	438 (4.1)	5 (0.6)	425 (7.9)
Ireland	20 (0.8)	517 (6.4)	51 (1.1)	539 (5.2)	23 (0.8)	531 (5.3)	5 (0.5)	486 (8.5)
Israel	9 (1.4)	506 (17.0)	33 (2.1)	536 (7.0)	44 (1.7)	525 (5.4)	14 (1.2)	505 (7.8)
Japan	9 (0.5)	606 (5.7)	53 (0.9)	615 (2.1)	30 (0.8)	596 (3.4)	9 (0.5)	569 (5.1)
Korea	32 (1.0)	612 (4.6)	40 (1.0)	618 (3.4)	20 (0.8)	595 (5.3)	7 (0.6)	570 (6.9)
Kuwait	39 (2.1)	386 (2.8)	38 (1.3)	398 (3.8)	14 (1.2)	400 (3.9)	9 (1.0)	384 (4.4)
Latvia (LSS)	16 (1.0)	474 (4.4)	44 (1.1)	500 (3.7)	29 (1.2)	509 (4.2)	10 (0.7)	475 (5.1)
Lithuania	12 (0.7)	469 (6.2)	44 (1.3)	480 (4.6)	32 (1.2)	483 (4.0)	12 (0.9)	472 (5.8)
Netherlands	17 (1.8)	544 (14.0)	47 (1.7)	556 (7.0)	27 (1.5)	529 (6.3)	9 (0.9)	496 (7.3)
New Zealand	24 (1.0)	506 (6.4)	38 (0.9)	521 (4.8)	26 (0.9)	510 (4.7)	12 (0.8)	474 (5.7)
Norway	15 (0.7)	508 (4.2)	48 (1.0)	509 (2.5)	30 (1.0)	503 (3.7)	7 (0.4)	470 (6.0)
Portugal	27 (1.0)	450 (3.3)	48 (0.9)	458 (2.9)	20 (0.8)	460 (3.3)	5 (0.5)	440 (5.3)
Romania	38 (1.4)	475 (5.6)	39 (1.2)	489 (5.5)	16 (0.9)	495 (5.6)	8 (0.7)	470 (7.7)
Russian Federation	12 (1.0)	515 (6.9)	42 (1.4)	538 (5.9)	32 (1.0)	547 (4.8)	14 (0.9)	535 (7.5)
Scotland	15 (0.7)	488 (7.2)	43 (1.0)	504 (6.9)	31 (1.0)	508 (5.9)	11 (0.7)	472 (4.8)
Singapore	7 (0.6)	657 (7.2)	50 (1.1)	650 (5.2)	37 (1.2)	636 (5.2)	6 (0.5)	619 (8.6)
Slovak Republic	14 (0.7)	561 (7.4)	47 (1.0)	550 (3.5)	28 (0.9)	547 (4.1)	11 (0.8)	523 (5.6)
Slovenia	23 (1.1)	546 (4.1)	54 (1.1)	541 (3.4)	19 (0.9)	540 (4.7)	4 (0.4)	518 (9.9)
Spain	33 (1.2)	481 (3.0)	46 (1.0)	494 (2.4)	17 (0.8)	489 (3.9)	4 (0.5)	464 (5.1)
Sweden	16 (0.7)	518 (4.9)	51 (0.9)	528 (3.3)	27 (0.8)	514 (3.7)	6 (0.5)	478 (5.5)
Switzerland	45 (1.5)	556 (4.1)	44 (1.3)	543 (3.2)	9 (0.7)	528 (6.6)	2 (0.2)	~ ~
Thailand	28 (1.4)	510 (4.7)	46 (1.0)	524 (6.4)	19 (1.1)	540 (7.3)	8 (0.7)	521 (6.9)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1). Background data for Bulgaria and South Africa not available.

A tilde (~) indicates insufficient data to report achievement.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

In general, beyond one to two hours of television viewing per day, the more television eighth graders reported watching, the lower their mathematics achievement. In all countries students watching more than five hours of television per day had the lowest average mathematics achievement. Countries where 10% or more of the students reported watching more than five hours of television each day included Colombia, England, Hong Kong, Hungary, Israel, Latvia (LSS), Lithuania, New Zealand, the Russian Federation, Scotland, the Slovak Republic, and the United States. In Missouri, 12% reported watching more than 5 hours each day, and in Oregon 8% did.

How Do Students Perceive Success in Mathematics?

Table 4.12 presents eighth-grade students' perceptions about doing well in mathematics. In all except four countries, the majority of students agreed or strongly agreed that they did well in mathematics. The four exceptions, where more than 50% of the students disagreed or strongly disagreed about doing well, were Hong Kong (62%), Japan (55%), Korea (62%), and Lithuania (51%). Notably, three of those countries were among the very highest performing countries. Countries where 80% or more of the eighth graders felt they were usually good at mathematics represented a range in mathematics performance – Australia, Canada, Colombia, Denmark, England, Greece, Iceland, Iran, Israel, Kuwait, New Zealand, Scotland, Sweden, and the United States. Eighty-four percent so agreed in Missouri and 85% in Oregon, compared with 86% in the United States as a whole.

Figure 4.2 indicates that, internationally, eighth-grade girls had lower self-perceptions than boys about how well they usually do in mathematics. This figure and the distributions shown in Table 4.12 also show that, on average, both boys and girls in the participating countries tended to agree (or sometimes disagree) about usually doing well in mathematics rather than report the extremes of strongly agreeing or disagreeing. For most countries both boys and girls tended to indicate that they did well in mathematics – a perception that did not always coincide with their achievement on the TIMSS mathematics test. Interestingly, in looking at Figure 4.2, it is apparent that the U.S. has among the most positive self-perceptions about doing well in mathematics, and that the results for Oregon and Missouri are consistent with those of the United States. Also, Missouri and Oregon as well as the United States are among the few participants where there is no gender gap in perceptions between boys and girls.

Students were asked about the necessity of various attributes or activities to do well in mathematics (see Table 4.13). There was enormous variation from country to country in the percentage of eighth-grade students agreeing that natural talent or ability were important to do well in mathematics. Forty-eight percent in Oregon and 51% in Missouri so agreed compared to 50% in the United States. Fewer than 50% of the students agreed in England, France, Iceland, the Netherlands, and Sweden compared to 90% or more in Colombia, Denmark, Hungary, and Iran. Internationally, relatively few students agreed that good luck was important to do well. Twenty-seven percent in Oregon and 30% in Missouri so agreed, compared to 32% in the United States. The countries where more than 50% of the eighth graders agreed that good luck was needed to do well in mathematics included Colombia, the Czech Republic, Hungary, Iran, Japan, Korea, Kuwait, Latvia (LSS), Lithuania, Romania, the Russian Federation, and the Slovak Republic.

Table 4.12

Students' Self-Perceptions About Usually Doing Well in Mathematics

Eighth Grade*

Country	Strongly Disagree		Disagree		Agree		Strongly Agree	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
UNITED STATES	3 (0.3)	430 (5.1)	11 (0.6)	462 (4.8)	52 (0.9)	491 (4.3)	34 (1.0)	534 (5.9)
MISSOURI	3 (0.5)	442 (10.0)	12 (0.9)	453 (7.6)	50 (1.3)	491 (7.5)	34 (1.4)	549 (7.5)
OREGON	3 (0.4)	450 (11.5)	12 (1.1)	478 (6.9)	49 (1.7)	508 (7.1)	36 (2.2)	571 (9.1)
Australia	3 (0.3)	457 (7.9)	17 (0.7)	487 (5.6)	60 (0.8)	530 (3.9)	20 (0.9)	586 (4.7)
Austria	3 (0.4)	512 (10.1)	21 (1.1)	508 (5.4)	45 (1.2)	535 (4.0)	31 (1.4)	572 (4.3)
Belgium (Fl)	5 (0.4)	512 (6.7)	29 (1.0)	548 (5.9)	48 (1.1)	567 (6.4)	17 (0.9)	609 (7.2)
Belgium (Fr)	3 (0.4)	467 (7.8)	19 (1.3)	505 (5.4)	48 (1.3)	528 (3.8)	29 (1.5)	550 (5.0)
Canada	3 (0.3)	480 (9.0)	13 (0.6)	480 (4.9)	49 (1.1)	514 (2.3)	35 (1.1)	570 (3.4)
Colombia	2 (0.4)	~ ~	17 (1.3)	373 (3.7)	51 (1.9)	385 (4.6)	30 (1.4)	398 (5.3)
Cyprus	5 (0.4)	411 (7.6)	18 (0.8)	432 (3.7)	46 (1.0)	469 (2.6)	31 (1.0)	521 (4.4)
Czech Republic	2 (0.3)	~ ~	37 (1.4)	516 (4.2)	48 (1.4)	584 (5.2)	13 (1.0)	640 (8.0)
Denmark	1 (0.2)	~ ~	8 (0.6)	431 (7.0)	53 (1.4)	492 (3.0)	38 (1.3)	537 (4.0)
England	1 (0.2)	~ ~	6 (0.6)	475 (8.3)	69 (1.0)	500 (3.0)	24 (1.0)	538 (5.8)
France	6 (0.7)	495 (6.1)	26 (1.1)	513 (4.0)	46 (1.0)	548 (3.4)	22 (0.8)	564 (5.1)
Germany	7 (0.5)	474 (7.1)	24 (1.0)	491 (5.2)	33 (1.1)	511 (5.1)	36 (1.1)	529 (5.3)
Greece	2 (0.3)	~ ~	16 (0.7)	454 (3.6)	55 (0.8)	481 (3.2)	27 (0.8)	515 (4.2)
Hong Kong	11 (0.9)	536 (9.5)	51 (1.2)	577 (6.7)	33 (1.2)	620 (6.7)	5 (0.5)	643 (8.2)
Hungary	3 (0.3)	469 (11.7)	25 (0.9)	490 (4.2)	57 (1.0)	545 (3.4)	15 (0.8)	608 (4.8)
Iceland	3 (0.6)	421 (10.1)	14 (1.4)	447 (4.9)	55 (1.6)	486 (4.5)	28 (1.8)	519 (9.5)
Iran, Islamic Rep.	1 (0.4)	~ ~	8 (0.7)	403 (4.3)	62 (1.4)	423 (2.6)	29 (1.4)	450 (3.7)
Ireland	3 (0.3)	475 (7.7)	18 (1.0)	492 (5.5)	61 (0.9)	530 (5.2)	18 (1.0)	572 (7.6)
Israel	2 (0.4)	~ ~	12 (1.3)	494 (10.1)	45 (1.9)	513 (6.2)	41 (1.9)	549 (8.3)
Japan	10 (0.5)	523 (3.7)	45 (0.7)	577 (2.3)	40 (0.7)	650 (2.5)	4 (0.3)	669 (7.8)
Korea	9 (0.5)	535 (5.7)	53 (1.0)	572 (3.0)	32 (0.9)	669 (3.0)	6 (0.6)	702 (5.7)
Kuwait	3 (0.7)	364 (11.4)	9 (0.8)	382 (4.4)	49 (1.3)	386 (2.7)	39 (1.3)	405 (3.4)
Latvia (LSS)	2 (0.3)	~ ~	43 (1.2)	471 (3.5)	43 (1.2)	505 (3.7)	12 (0.8)	542 (5.5)
Lithuania	5 (0.5)	446 (7.5)	46 (1.2)	454 (3.4)	38 (1.2)	492 (4.3)	11 (0.8)	544 (6.0)
Netherlands	4 (0.5)	487 (12.4)	21 (1.4)	504 (7.1)	43 (1.3)	537 (8.4)	32 (1.6)	580 (7.3)
New Zealand	2 (0.3)	~ ~	13 (0.8)	466 (6.1)	62 (0.9)	501 (4.5)	22 (0.8)	559 (5.5)
Norway	3 (0.3)	434 (7.4)	18 (0.9)	455 (3.2)	58 (1.0)	504 (2.2)	21 (0.8)	555 (4.4)
Portugal	7 (0.5)	419 (3.6)	37 (1.1)	435 (2.3)	42 (1.1)	463 (2.5)	14 (0.8)	502 (5.2)
Romania	6 (0.6)	455 (12.0)	25 (1.0)	459 (4.6)	49 (0.9)	488 (4.3)	20 (1.0)	505 (6.3)
Russian Federation	2 (0.3)	~ ~	37 (1.4)	501 (7.1)	43 (1.1)	547 (5.1)	18 (0.8)	590 (4.9)
Scotland	2 (0.3)	~ ~	10 (0.8)	455 (5.5)	66 (1.3)	491 (4.8)	22 (1.3)	553 (9.3)
Singapore	6 (0.4)	587 (9.0)	38 (1.2)	624 (5.2)	46 (1.1)	659 (4.9)	11 (0.6)	677 (6.2)
Slovak Republic	1 (0.2)	~ ~	28 (1.1)	496 (3.8)	55 (1.1)	555 (3.8)	15 (0.7)	619 (5.2)
Slovenia	2 (0.3)	~ ~	24 (1.1)	497 (4.0)	53 (1.0)	538 (3.6)	21 (0.9)	602 (4.2)
Spain	5 (0.5)	441 (4.6)	23 (1.0)	456 (2.6)	45 (1.1)	488 (2.6)	27 (1.0)	522 (3.4)
Sweden	2 (0.3)	~ ~	16 (0.7)	475 (3.4)	61 (0.9)	517 (3.0)	21 (0.8)	565 (3.8)
Switzerland	3 (0.4)	497 (10.1)	21 (0.9)	528 (4.0)	47 (0.9)	541 (3.0)	28 (1.1)	575 (3.3)
Thailand	2 (0.3)	~ ~	38 (1.5)	510 (5.1)	45 (1.1)	529 (6.6)	15 (0.9)	537 (7.4)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

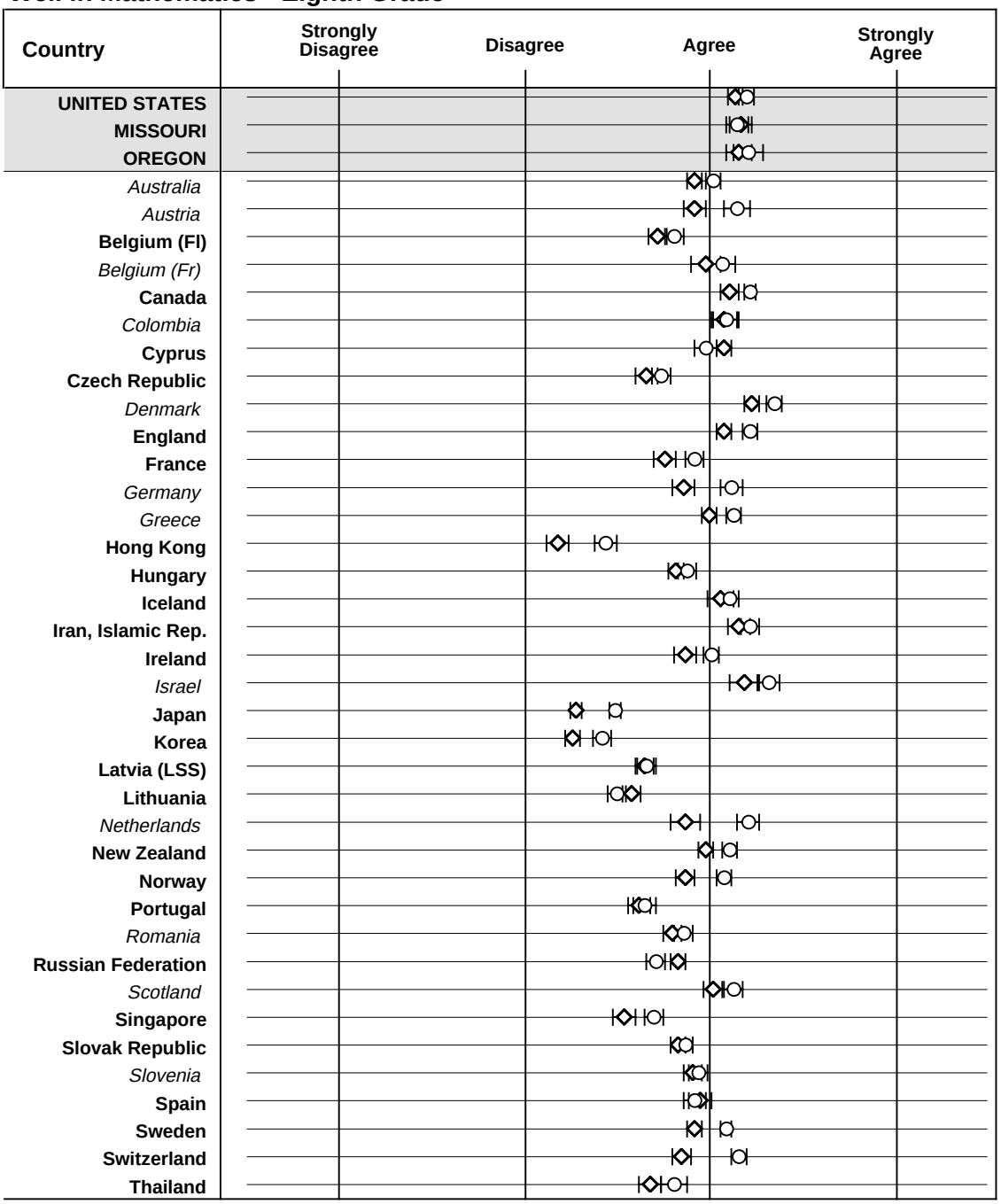
Background data for Bulgaria and South Africa not available.

A tilde (~) indicates insufficient data to report achievement.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

Figure 4.2

Gender Differences in Students' Self-Perceptions About Usually Doing Well in Mathematics - Eighth Grade*



SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).
Background data for Bulgaria and South Africa not available.

Table 4.13

Students' Reports on Things Necessary to Do Well in Mathematics - Eighth Grade*

Country	Percent of Students Responding Agree or Strongly Agree			
	Natural Talent/Ability	Good Luck	Lots of Hard Work Studying at Home	Memorize the Textbook or Notes
UNITED STATES	50 (1.0)	32 (1.2)	90 (0.6)	59 (1.1)
MISSOURI	51 (1.4)	30 (1.7)	87 (1.0)	55 (1.5)
OREGON	48 (1.5)	27 (1.5)	88 (1.0)	49 (1.6)
Australia	66 (0.8)	30 (0.8)	92 (0.5)	67 (0.8)
Austria	70 (1.4)	27 (1.2)	78 (1.2)	39 (1.2)
Belgium (Fl)	58 (1.7)	22 (2.0)	85 (1.1)	51 (1.8)
Belgium (Fr)	69 (1.3)	23 (1.3)	93 (0.8)	93 (0.5)
Canada	61 (1.0)	26 (0.9)	87 (0.7)	42 (0.9)
Colombia	91 (1.0)	62 (1.4)	97 (0.3)	74 (1.4)
Cyprus	51 (1.0)	34 (1.1)	92 (0.6)	71 (1.2)
Czech Republic	61 (1.0)	57 (1.2)	81 (1.0)	41 (1.8)
Denmark	90 (0.7)	28 (1.3)	87 (1.0)	61 (1.5)
England	45 (1.3)	23 (1.0)	93 (0.7)	49 (1.2)
France	40 (1.4)	21 (1.1)	90 (0.7)	95 (0.7)
Germany	59 (1.5)	25 (1.1)	76 (1.1)	47 (1.5)
Greece	54 (0.9)	26 (0.9)	95 (0.5)	84 (0.7)
Hong Kong	77 (1.0)	38 (1.0)	95 (0.6)	69 (1.5)
Hungary	95 (0.5)	56 (1.0)	79 (1.1)	47 (1.5)
Iceland	37 (1.8)	24 (1.5)	92 (0.8)	94 (1.0)
Iran, Islamic Rep.	95 (0.5)	51 (2.5)	96 (0.4)	89 (0.9)
Ireland	72 (1.0)	31 (1.2)	95 (0.5)	69 (1.1)
Israel	55 (2.1)	17 (1.6)	96 (0.6)	40 (2.1)
Japan	82 (0.6)	59 (1.0)	96 (0.3)	92 (0.6)
Korea	86 (0.7)	63 (1.0)	98 (0.2)	73 (0.7)
Kuwait	87 (1.1)	76 (1.7)	83 (0.9)	91 (0.7)
Latvia (LSS)	61 (1.1)	63 (1.4)	91 (0.7)	38 (1.3)
Lithuania	85 (1.0)	69 (1.1)	83 (0.9)	28 (1.5)
Netherlands	44 (1.5)	23 (1.5)	89 (0.9)	53 (1.7)
New Zealand	62 (1.1)	27 (1.2)	92 (0.5)	72 (1.2)
Norway	86 (0.6)	19 (0.8)	92 (0.6)	74 (1.1)
Portugal	72 (1.0)	39 (1.3)	97 (0.3)	56 (1.5)
Romania	66 (1.1)	59 (1.3)	88 (0.7)	73 (1.3)
Russian Federation	79 (1.0)	51 (1.4)	89 (0.8)	61 (1.9)
Scotland	– –	– –	– –	– –
Singapore	84 (0.7)	41 (1.0)	92 (0.7)	32 (1.6)
Slovak Republic	69 (1.1)	52 (1.1)	90 (0.6)	35 (1.1)
Slovenia	81 (1.0)	38 (1.3)	82 (1.0)	16 (1.0)
Spain	66 (1.2)	35 (1.0)	89 (0.8)	60 (1.4)
Sweden	48 (1.0)	24 (1.0)	83 (0.7)	33 (0.9)
Switzerland	60 (1.2)	22 (0.9)	71 (1.0)	36 (1.4)
Thailand	69 (1.2)	34 (1.1)	77 (0.9)	96 (0.4)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

A dash (–) indicates data are not available.

Internationally, there was a high degree of agreement among students that lots of hard work studying at home was necessary in order to do well in mathematics. Percentages of agreement were in the 80s and 90s for most countries, and in the 70s for Austria, Germany, Hungary, Switzerland, and Thailand. Eighty-eight percent in Oregon and 87% in Missouri so agreed, compared to 90% in the U.S. The variation was substantial from country to country regarding students' agreement with the necessity of memorizing the textbook or notes. In Belgium (French), France, Iceland, Japan, Kuwait, and Thailand, 90% or more of the eighth-grade students agreed or strongly agreed that memorization was important to doing well in mathematics. In contrast, fewer than 40% so agreed in Austria, Latvia (LSS), Lithuania, Singapore, the Slovak Republic, Slovenia, Sweden, and Switzerland. The U.S. eighth graders, as a whole, were in the middle with 59%, as were those in Missouri (55%) and Oregon (49%).

Students also were asked about why they need to do well in mathematics. Students could agree with any or all of the three areas of possible motivation presented in Table 4.14, including getting their desired job, to please their parents, and to get into their desired secondary school or university. There were substantial differences from country to country in students' responses. In Colombia, Cyprus, Iran, Kuwait, and Scotland, 50% or more of the eighth graders strongly agreed that they needed to do well in mathematics to get their desired job. The majority of students in nearly all countries either agreed or strongly agreed that getting their desired job was a motivating factor, except Korea, where 53% of the students disagreed or strongly disagreed. In the United States, 86% of the students reported getting their desired job was a motivating factor, and the results were similar in Missouri (84%) and Oregon (85%).

In Iran, Kuwait, and Thailand, 50% or more of the students strongly agreed that they needed to do well in mathematics to please their parents. Even though in most countries the majority of the eighth-grade students agreed at some level that pleasing their parents was important, 50% or more disagreed or strongly disagreed in Denmark, Iceland, Japan, the Netherlands, Slovenia, and Sweden. In the United States 80% agreed or strongly agreed, which was exactly the same as in Missouri, and nearly the same as in Oregon (82%). Internationally, the reason most frequently cited by students for needing to do well in mathematics was to get into students' desired secondary school or university. With the exception of Austria, Belgium (Flemish), Germany, the Netherlands, and Switzerland, three-fourths or more of the students strongly agreed or agreed that this was a motivating factor for doing well in mathematics. The United States was no exception, with 96% so agreeing. The corresponding figures were 94% for Missouri and 95% for Oregon.

Table 4.14

Students' Reports on Why They Need to Do Well in Mathematics - Eighth Grade*

Country	Percent of Students								
	To Get Desired Job			To Please Parents			To Get into Desired Secondary School or University		
	Strongly Agree	Agree	Disagree/ Strongly Disagree	Strongly Agree	Agree	Disagree/ Strongly Disagree	Strongly Agree	Agree	Disagree/ Strongly Disagree
UNITED STATES	47 (1.2)	39 (0.8)	15 (0.7)	35 (0.9)	45 (0.7)	20 (0.8)	64 (1.2)	32 (1.0)	4 (0.3)
MISSOURI	43 (1.7)	41 (1.5)	16 (0.8)	33 (1.1)	47 (1.0)	20 (1.1)	60 (1.3)	34 (1.2)	6 (0.5)
OREGON	43 (1.4)	42 (1.2)	15 (1.0)	33 (1.1)	49 (1.1)	18 (0.8)	59 (1.5)	36 (1.3)	5 (0.6)
Australia	36 (0.9)	43 (0.8)	21 (0.7)	22 (0.7)	50 (0.7)	28 (0.6)	36 (0.9)	42 (0.8)	22 (1.0)
Austria	33 (1.3)	31 (0.8)	36 (1.5)	17 (1.0)	37 (1.2)	46 (1.3)	36 (1.4)	27 (1.3)	37 (1.6)
Belgium (Fl)	17 (0.9)	40 (1.1)	43 (1.5)	16 (0.8)	53 (1.2)	32 (1.2)	27 (1.1)	47 (0.9)	26 (1.0)
Belgium (Fr)	35 (1.3)	36 (1.4)	29 (1.2)	28 (1.6)	49 (1.2)	23 (1.2)	36 (1.2)	41 (1.3)	23 (1.1)
Canada	44 (0.9)	41 (1.0)	15 (0.6)	23 (0.7)	44 (0.9)	32 (1.1)	55 (1.4)	37 (1.2)	8 (0.5)
Colombia	50 (1.7)	35 (1.3)	15 (0.9)	41 (2.2)	36 (1.2)	23 (1.5)	63 (1.2)	31 (1.1)	6 (0.5)
Cyprus	53 (1.1)	34 (1.0)	13 (0.8)	34 (0.9)	37 (1.1)	30 (1.0)	50 (1.0)	32 (0.9)	18 (0.9)
Czech Republic	32 (1.3)	50 (1.1)	17 (1.2)	23 (1.1)	61 (1.0)	16 (0.8)	45 (1.0)	40 (1.2)	15 (0.9)
Denmark	32 (1.2)	39 (1.3)	29 (1.1)	13 (1.3)	28 (1.2)	59 (1.7)	40 (1.5)	45 (1.4)	14 (1.0)
England	37 (1.1)	43 (1.1)	20 (0.9)	20 (1.1)	43 (1.3)	36 (1.5)	41 (1.2)	45 (1.1)	14 (1.0)
France	35 (1.1)	36 (1.0)	29 (1.2)	17 (1.0)	42 (1.4)	41 (1.4)	42 (1.1)	42 (1.0)	17 (0.9)
Germany	39 (1.3)	31 (1.1)	30 (1.0)	25 (1.2)	32 (0.9)	43 (1.2)	32 (1.1)	33 (1.1)	35 (1.2)
Greece	45 (0.9)	37 (1.0)	17 (0.6)	37 (1.2)	39 (0.9)	25 (0.8)	51 (0.9)	34 (0.9)	15 (0.6)
Hong Kong	24 (1.0)	52 (0.9)	24 (0.8)	16 (0.7)	43 (0.9)	41 (1.1)	32 (0.9)	51 (0.9)	17 (0.8)
Hungary	22 (1.0)	55 (1.0)	23 (1.1)	10 (0.7)	53 (1.0)	36 (1.2)	32 (1.0)	43 (1.0)	25 (1.2)
Iceland	32 (1.8)	47 (2.0)	21 (1.2)	13 (1.4)	30 (1.3)	57 (2.1)	49 (1.5)	44 (1.9)	7 (0.8)
Iran, Islamic Rep.	62 (1.2)	28 (1.0)	10 (0.9)	69 (1.3)	25 (1.3)	5 (0.6)	73 (1.3)	22 (1.0)	5 (0.7)
Ireland	40 (1.1)	40 (1.1)	20 (0.9)	19 (0.9)	43 (0.8)	38 (1.0)	42 (1.1)	40 (1.1)	18 (1.2)
Israel	45 (1.8)	34 (1.5)	21 (1.1)	21 (1.4)	36 (2.0)	44 (2.0)	68 (1.8)	28 (1.6)	4 (0.6)
Japan	12 (0.5)	43 (0.7)	45 (0.8)	6 (0.4)	28 (0.7)	66 (0.9)	35 (0.7)	56 (0.8)	9 (0.9)
Korea	13 (0.8)	34 (0.8)	53 (1.1)	11 (0.7)	44 (1.2)	44 (1.3)	35 (1.2)	51 (1.0)	14 (0.8)
Kuwait	50 (1.3)	34 (1.2)	15 (0.8)	64 (1.7)	29 (1.1)	8 (0.9)	63 (1.6)	25 (1.2)	12 (1.1)
Latvia (LSS)	39 (1.2)	46 (1.0)	15 (1.0)	29 (1.4)	50 (1.3)	20 (1.0)	45 (1.3)	44 (1.1)	11 (0.7)
Lithuania	43 (1.4)	44 (1.3)	13 (0.9)	16 (0.9)	37 (1.3)	47 (1.3)	41 (1.2)	42 (1.3)	17 (1.0)
Netherlands	16 (1.1)	37 (1.4)	47 (1.3)	8 (1.0)	35 (1.4)	57 (1.7)	19 (1.1)	47 (1.2)	33 (1.3)
New Zealand	41 (1.0)	42 (0.9)	17 (0.7)	22 (0.8)	44 (1.0)	34 (1.0)	37 (1.0)	44 (0.9)	20 (0.7)
Norway	24 (0.9)	49 (0.9)	28 (0.9)	14 (0.8)	38 (0.9)	48 (1.0)	37 (1.0)	52 (1.0)	11 (0.7)
Portugal	37 (0.8)	39 (0.9)	23 (0.8)	22 (1.0)	44 (1.0)	34 (1.1)	43 (1.1)	40 (1.0)	17 (0.8)
Romania	40 (1.2)	38 (1.0)	22 (1.1)	33 (1.0)	43 (1.1)	24 (1.0)	46 (1.2)	36 (1.0)	18 (1.0)
Russian Federation	42 (0.9)	40 (0.9)	18 (0.9)	26 (1.0)	45 (1.2)	29 (1.2)	44 (1.1)	39 (1.1)	17 (0.7)
Scotland	51 (1.2)	36 (1.1)	12 (0.6)	22 (0.9)	43 (1.0)	34 (1.0)	51 (1.2)	33 (1.1)	16 (1.0)
Singapore	37 (0.8)	48 (0.6)	15 (0.7)	20 (0.6)	46 (0.8)	34 (1.0)	51 (1.0)	44 (1.0)	5 (0.3)
Slovak Republic	31 (0.9)	48 (1.0)	20 (0.9)	15 (0.7)	56 (1.0)	29 (1.1)	42 (0.9)	51 (0.9)	7 (0.5)
Slovenia	27 (1.1)	51 (1.1)	22 (1.0)	8 (0.6)	35 (1.3)	56 (1.5)	39 (1.1)	49 (1.1)	12 (0.7)
Spain	31 (1.0)	39 (0.9)	29 (0.8)	36 (1.0)	45 (0.9)	18 (0.9)	47 (1.0)	41 (0.9)	12 (0.5)
Sweden	24 (0.9)	47 (0.9)	29 (0.8)	11 (0.7)	35 (0.9)	54 (1.1)	29 (0.9)	53 (0.9)	18 (0.6)
Switzerland	30 (1.0)	36 (0.9)	34 (1.0)	18 (1.0)	39 (0.9)	43 (0.9)	32 (0.9)	39 (1.1)	28 (0.9)
Thailand	47 (1.1)	48 (1.0)	4 (0.4)	54 (1.0)	44 (1.1)	2 (0.3)	61 (1.1)	37 (1.0)	2 (0.3)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

What Are Students' Attitudes Towards Mathematics?

To collect information on eighth-grade students' perceptions of mathematics, TIMSS asked them a series of questions about its utility, importance, and enjoyability. Students' perceptions about the value of learning mathematics may be considered as both an input and outcome variable, because their attitudes towards the subject can be related to educational achievement in ways that reinforce higher or lower performance. That is, students who do well in mathematics generally have more positive attitudes towards the subject, and those who have more positive attitudes tend to perform better.

Table 4.15 provides students' responses to the question about how much they like or dislike mathematics, together with their average mathematics achievement. As anticipated, within nearly every country, a clear positive relationship can be observed between a stronger liking of mathematics and higher achievement. Compared to 70% of the students in the United States, 67% of the students in Missouri reported liking mathematics to some extent as did 62% in Oregon. In both states, the results followed the international pattern of students with higher degrees of liking having higher mathematics achievement. Even though the majority of eighth-graders in nearly every country indicated they liked mathematics to some degree, clearly not all students feel positive about this subject area. In Austria, the Czech Republic, Germany, Hungary, Japan, Korea, Lithuania, and the Netherlands, more than 40% of the eighth-grade students reported disliking mathematics.

The data in Figure 4.3 reveal that, on average, eighth graders of both genders were relatively neutral about liking mathematics. The United States, Missouri, and Oregon were consistent in this regard. The results in the United States and Oregon also were consistent with most countries in terms of no significant gender differences in students' reports about liking mathematics. In contrast, the finding in Missouri where girls reported significantly more liking of mathematics than did boys was unique for TIMSS. In no country did girls report a significantly stronger liking of the subject area than did boys. However, boys reported liking mathematics better than girls did in several countries, including Austria, France, Germany, Hong Kong, Japan, Norway, and Switzerland.

To gain some understanding about eighth-graders' view about the utility of mathematics and their enjoyment of it as a school subject, TIMSS asked students to state their level of agreement with the following four statements: 1) I would like a job that involved using mathematics, 2) Mathematics is important to everyone's life, 3) Mathematics is boring, and 4) I enjoy learning mathematics. The results for these four questions were averaged with students' responses to the question about liking mathematics to form an index of their overall attitudes towards mathematics.

Table 4.15

Students' Reports on How Much They Like Mathematics - Eighth Grade*

Country	Dislike a Lot		Dislike		Like		Like a Lot	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
UNITED STATES	12 (0.7)	463 (5.2)	17 (0.7)	492 (5.2)	47 (0.8)	504 (4.8)	23 (1.0)	519 (6.1)
MISSOURI	15 (1.0)	466 (8.5)	19 (1.2)	502 (7.3)	47 (1.3)	508 (7.0)	20 (1.1)	532 (8.4)
OREGON	14 (0.9)	487 (9.2)	23 (1.6)	515 (8.8)	43 (1.5)	529 (8.1)	19 (1.8)	559 (10.5)
Australia	12 (0.6)	480 (5.2)	24 (0.7)	523 (4.8)	51 (0.7)	541 (4.1)	13 (0.7)	563 (5.0)
Austria	16 (1.0)	517 (6.2)	26 (1.1)	529 (4.7)	41 (1.1)	548 (3.6)	17 (1.2)	558 (6.3)
Belgium (Fl)	11 (0.8)	520 (7.3)	21 (1.0)	558 (4.9)	49 (1.1)	566 (6.7)	18 (1.1)	602 (6.2)
Belgium (Fr)	11 (1.2)	489 (8.2)	19 (1.0)	514 (5.7)	48 (1.1)	529 (3.9)	22 (1.2)	557 (7.1)
Canada	10 (0.5)	498 (4.7)	16 (0.7)	521 (3.6)	54 (1.1)	527 (2.9)	20 (0.9)	553 (3.4)
Colombia	8 (0.6)	367 (6.9)	14 (1.1)	378 (3.9)	55 (1.3)	388 (3.1)	23 (1.4)	392 (6.6)
Cyprus	14 (0.9)	423 (3.5)	13 (0.5)	449 (4.3)	46 (1.0)	473 (2.7)	28 (1.0)	515 (3.4)
Czech Republic	14 (0.8)	533 (6.0)	36 (1.2)	550 (5.4)	41 (1.4)	578 (6.0)	8 (0.6)	606 (8.0)
Denmark	5 (0.6)	480 (7.9)	17 (1.1)	477 (4.3)	46 (1.2)	503 (4.0)	32 (1.5)	522 (3.9)
England	5 (0.5)	473 (8.5)	15 (1.0)	499 (6.5)	56 (1.2)	507 (3.2)	24 (1.1)	518 (4.6)
France	12 (1.0)	506 (5.7)	20 (1.1)	524 (4.6)	51 (1.3)	544 (3.3)	17 (1.0)	566 (5.5)
Germany	23 (1.2)	481 (4.8)	22 (1.1)	508 (6.8)	31 (1.1)	525 (5.0)	24 (1.1)	522 (5.7)
Greece	11 (0.6)	453 (5.0)	15 (0.6)	468 (4.3)	49 (1.0)	480 (3.4)	25 (1.0)	517 (3.6)
Hong Kong	12 (0.8)	545 (10.1)	23 (0.9)	569 (7.0)	48 (1.0)	598 (6.1)	17 (0.9)	629 (6.5)
Hungary	12 (0.8)	496 (7.4)	30 (1.2)	522 (4.3)	47 (1.1)	549 (3.8)	11 (0.7)	589 (6.1)
Iceland	6 (0.9)	447 (15.0)	15 (1.1)	480 (5.9)	56 (1.7)	488 (4.7)	23 (1.5)	503 (5.5)
Iran, Islamic Rep.	7 (0.6)	407 (5.2)	8 (0.7)	412 (5.2)	47 (1.5)	421 (2.8)	38 (1.5)	446 (2.8)
Ireland	9 (0.7)	492 (7.1)	18 (1.0)	520 (5.4)	53 (1.2)	531 (5.1)	21 (1.1)	549 (8.0)
Israel	10 (1.3)	513 (9.8)	24 (1.4)	523 (8.2)	45 (1.7)	522 (5.5)	21 (1.3)	536 (8.5)
Japan	11 (0.7)	550 (4.1)	36 (1.0)	585 (2.6)	43 (1.0)	625 (2.3)	10 (0.5)	649 (4.1)
Korea	6 (0.3)	536 (8.0)	36 (1.2)	569 (3.6)	44 (1.2)	628 (3.3)	14 (0.8)	676 (5.0)
Kuwait	8 (1.4)	371 (5.6)	8 (0.8)	391 (4.8)	40 (1.6)	391 (3.1)	44 (2.1)	398 (3.1)
Latvia (LSS)	7 (0.7)	469 (6.2)	26 (1.2)	475 (4.2)	56 (1.3)	499 (3.6)	11 (0.8)	536 (5.8)
Lithuania	12 (0.8)	457 (6.1)	35 (1.3)	463 (4.1)	44 (1.4)	488 (4.1)	9 (0.7)	519 (8.7)
Netherlands	13 (1.8)	494 (17.1)	30 (1.3)	535 (7.5)	50 (1.8)	554 (6.2)	8 (0.8)	567 (9.2)
New Zealand	9 (0.6)	475 (6.0)	19 (0.8)	500 (4.9)	51 (0.9)	508 (5.0)	21 (0.9)	533 (6.1)
Norway	11 (0.7)	454 (3.9)	26 (0.9)	485 (3.3)	47 (1.0)	514 (2.9)	16 (0.7)	540 (4.2)
Portugal	10 (0.7)	421 (3.8)	19 (1.0)	439 (3.4)	53 (1.0)	456 (2.5)	18 (1.1)	485 (4.0)
Romania	11 (0.7)	458 (7.3)	18 (0.7)	460 (5.4)	52 (1.0)	483 (4.1)	19 (1.0)	516 (5.6)
Russian Federation	5 (0.5)	499 (8.9)	22 (1.0)	510 (7.2)	58 (1.2)	540 (5.4)	15 (0.8)	574 (5.1)
Scotland	7 (0.6)	458 (6.4)	19 (0.9)	493 (5.3)	57 (1.0)	498 (6.0)	17 (1.0)	529 (9.8)
Singapore	4 (0.4)	583 (8.8)	14 (0.7)	613 (6.4)	54 (0.9)	642 (4.8)	28 (1.1)	671 (5.5)
Slovak Republic	15 (0.6)	496 (4.4)	25 (1.0)	526 (4.2)	49 (1.1)	559 (3.7)	11 (0.7)	613 (4.5)
Slovenia	11 (1.0)	511 (6.7)	23 (1.1)	519 (4.5)	52 (1.5)	540 (3.5)	14 (0.8)	606 (4.7)
Spain	13 (0.8)	459 (3.6)	24 (0.8)	473 (3.0)	45 (0.9)	491 (2.5)	18 (0.8)	516 (3.6)
Sweden	11 (0.7)	479 (4.9)	29 (1.0)	510 (3.2)	48 (1.1)	526 (3.3)	13 (0.7)	547 (5.1)
Switzerland	10 (0.7)	508 (7.0)	22 (1.1)	543 (4.1)	48 (0.9)	549 (3.2)	20 (0.8)	563 (4.6)
Thailand	3 (0.4)	502 (11.7)	15 (1.1)	503 (5.8)	59 (1.3)	519 (5.5)	23 (1.5)	548 (7.9)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1977.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

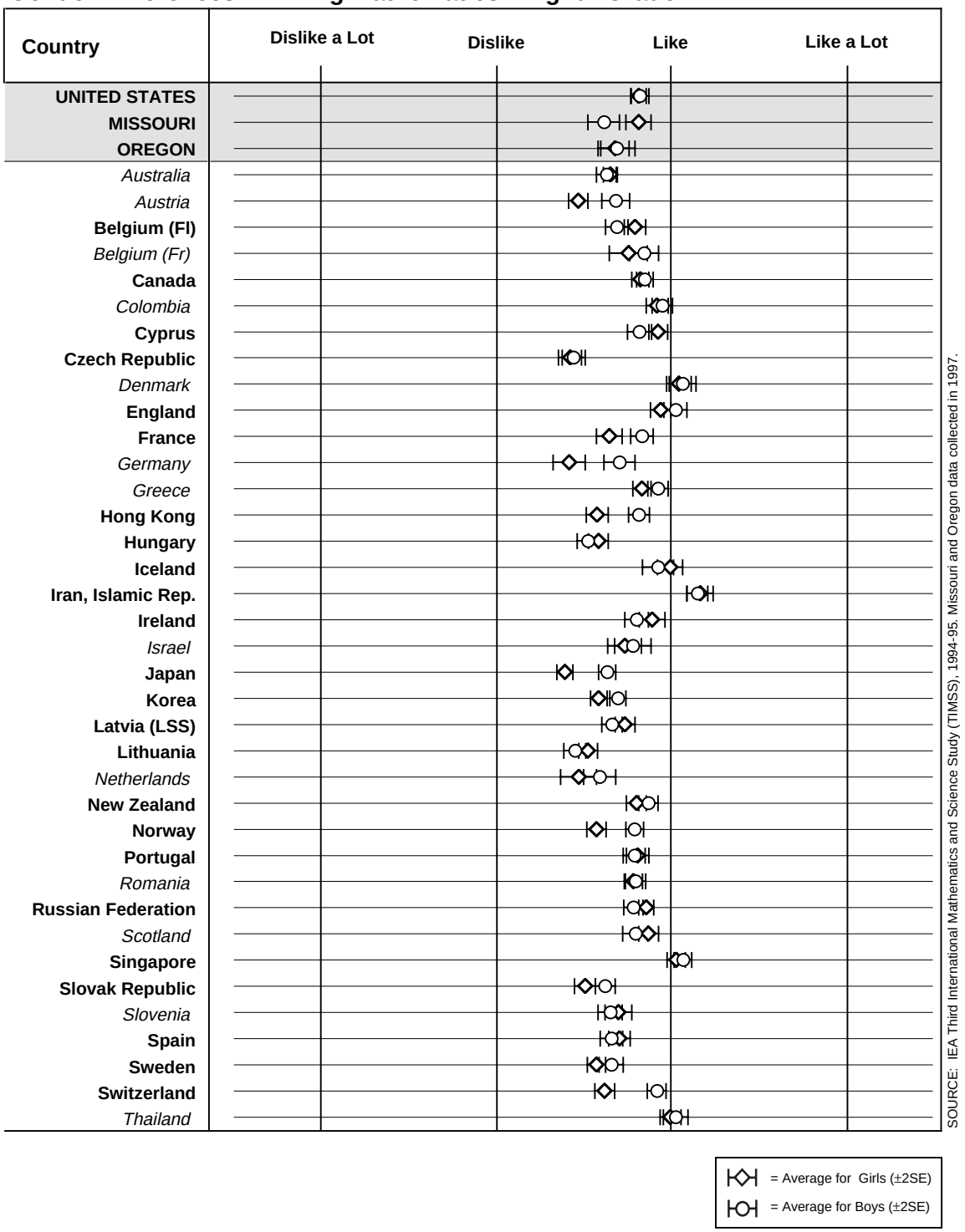
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

Figure 4.3

Gender Differences in Liking Mathematics - Eighth Grade*



SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).
Background data for Bulgaria and South Africa not available.

The data for the index in Table 4.16 reveal that eighth-grade students in Missouri and Oregon generally had positive attitudes towards mathematics, and that those students with more positive attitudes had higher average mathematics achievement. These findings are consistent with the results for the TIMSS countries. On average, across the five questions comprising the mathematics attitude index, the majority of students in each TIMSS country expressed positive or strongly positive attitudes about mathematics. Very few students (usually only 2% to 3%) consistently had strongly negative opinions about all aspects of the subject. Since these results seem slightly more supportive than students' liking of the subject alone, it may be that students understand the utility of mathematics to a greater extent than they actually like doing it.

Gender differences for the index of overall attitudes are portrayed in Figure 4.4. In many countries, girls and boys reported similar overall attitudes about mathematics, and this was true in the United States as it was in Oregon. Once again, even though girls in Missouri had significantly more positive attitudes towards mathematics than did boys, this was not a finding in any of the TIMSS countries. The countries where boys' attitudes were significantly more positive than those of girls included Austria, England, France, Germany, Greece, Hong Kong, Japan, the Netherlands, Norway, Sweden, and Switzerland. Interestingly, the index of overall attitudes towards mathematics showed gender differences in a somewhat different set of countries than the single question about liking mathematics. For the countries showing a gender difference on the attitudes index but not on the liking question, it is possible that boys more than girls perceive the relevance of mathematics.

Table 4.16

Students' Overall Attitudes[1] Towards Mathematics - Eighth Grade*

Country	Strongly Negative		Negative		Positive		Strongly Positive	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
UNITED STATES	4 (0.3)	481 (7.5)	26 (0.9)	483 (5.0)	55 (1.0)	503 (4.8)	15 (0.7)	526 (6.8)
MISSOURI	5 (0.7)	477 (11.5)	28 (1.4)	490 (7.6)	55 (1.3)	508 (7.1)	12 (1.1)	539 (10.1)
OREGON	4 (0.6)	488 (12.8)	31 (2.0)	507 (9.0)	51 (1.5)	529 (8.1)	13 (1.4)	570 (11.7)
Australia	4 (0.3)	492 (8.3)	32 (0.9)	514 (4.5)	55 (0.8)	540 (4.3)	9 (0.6)	561 (5.9)
Austria	4 (0.5)	527 (11.1)	38 (1.1)	532 (4.1)	47 (0.9)	542 (3.5)	12 (0.9)	560 (7.4)
Belgium (Fl)	4 (0.5)	535 (10.7)	33 (1.1)	547 (5.2)	52 (1.2)	572 (6.4)	11 (0.9)	604 (8.8)
Belgium (Fr)	3 (0.5)	507 (10.0)	28 (1.3)	514 (5.4)	53 (1.4)	526 (4.0)	15 (0.9)	558 (5.4)
Canada	3 (0.3)	510 (9.1)	23 (0.8)	512 (3.5)	58 (0.7)	528 (2.7)	16 (0.7)	554 (3.3)
Colombia	1 (0.5)	~ ~	11 (1.2)	387 (8.2)	61 (1.5)	385 (3.7)	26 (1.2)	387 (5.9)
Cyprus	2 (0.4)	~ ~	19 (1.1)	435 (3.3)	53 (0.9)	471 (2.6)	26 (1.0)	513 (3.8)
Czech Republic	3 (0.3)	543 (10.4)	39 (1.4)	544 (6.1)	52 (1.4)	574 (5.6)	6 (0.6)	613 (10.1)
Denmark	1 (0.2)	~ ~	16 (1.1)	479 (4.8)	57 (1.3)	502 (3.5)	26 (1.4)	523 (4.7)
England	1 (0.3)	~ ~	17 (1.0)	497 (5.9)	64 (1.1)	509 (3.0)	18 (1.0)	514 (6.0)
France	3 (0.5)	520 (7.7)	27 (1.5)	518 (4.5)	54 (1.1)	543 (3.2)	16 (1.0)	564 (5.7)
Germany	5 (0.5)	498 (8.0)	38 (1.4)	498 (5.2)	43 (1.1)	518 (5.3)	13 (0.8)	521 (6.3)
Greece	2 (0.3)	~ ~	21 (0.8)	467 (3.9)	57 (0.9)	482 (3.7)	20 (0.8)	512 (3.7)
Hong Kong	3 (0.4)	530 (16.4)	31 (1.0)	561 (7.8)	57 (1.1)	601 (6.1)	9 (0.6)	640 (6.6)
Hungary	2 (0.3)	~ ~	38 (1.2)	518 (4.1)	53 (1.3)	547 (3.7)	7 (0.6)	592 (7.2)
Iceland	2 (0.5)	~ ~	24 (1.6)	478 (5.5)	59 (1.5)	489 (4.9)	14 (1.2)	499 (6.5)
Iran, Islamic Rep.	2 (0.3)	~ ~	15 (1.2)	409 (3.1)	54 (1.6)	426 (2.7)	30 (1.3)	446 (2.9)
Ireland	2 (0.3)	~ ~	26 (1.1)	515 (5.3)	59 (1.2)	530 (5.3)	13 (0.9)	551 (8.1)
Israel	2 (0.5)	~ ~	25 (1.9)	523 (7.9)	56 (1.7)	524 (6.4)	17 (1.4)	527 (8.8)
Japan	4 (0.4)	558 (7.1)	44 (1.2)	592 (2.7)	48 (1.3)	619 (2.0)	3 (0.2)	649 (8.7)
Korea	2 (0.2)	~ ~	48 (1.1)	581 (3.0)	46 (1.1)	630 (3.4)	5 (0.4)	680 (9.9)
Kuwait	3 (0.6)	372 (6.9)	15 (1.6)	385 (4.4)	48 (1.7)	390 (3.3)	34 (1.9)	400 (2.6)
Latvia (LSS)	1 (0.2)	~ ~	28 (1.3)	478 (4.1)	62 (1.3)	496 (3.7)	8 (0.7)	526 (5.9)
Lithuania	2 (0.4)	~ ~	38 (1.3)	467 (3.9)	53 (1.4)	480 (4.1)	7 (0.6)	513 (9.3)
Netherlands	4 (0.5)	506 (14.7)	40 (1.9)	526 (9.1)	50 (1.8)	554 (6.2)	6 (0.8)	570 (10.6)
New Zealand	2 (0.3)	~ ~	23 (0.9)	491 (4.4)	60 (0.9)	511 (5.0)	15 (0.8)	530 (6.4)
Norway	3 (0.3)	456 (8.3)	30 (0.9)	481 (2.9)	55 (0.8)	511 (2.7)	12 (0.7)	538 (4.6)
Portugal	2 (0.3)	~ ~	24 (1.2)	436 (3.0)	58 (1.0)	456 (2.5)	16 (1.1)	480 (3.9)
Romania	1 (0.1)	~ ~	25 (1.0)	465 (5.7)	60 (1.0)	480 (4.2)	15 (0.9)	520 (6.2)
Russian Federation	1 (0.2)	~ ~	24 (1.1)	512 (5.4)	63 (1.2)	538 (6.1)	12 (0.8)	570 (5.5)
Scotland	7 (0.6)	458 (6.4)	19 (0.9)	493 (5.3)	57 (1.0)	498 (6.0)	17 (1.0)	529 (9.8)
Singapore	1 (0.2)	~ ~	16 (0.8)	609 (6.2)	62 (0.9)	646 (4.9)	20 (1.0)	666 (5.7)
Slovak Republic	1 (0.3)	~ ~	30 (1.0)	516 (3.7)	60 (1.0)	556 (3.7)	9 (0.6)	601 (5.4)
Slovenia	3 (0.4)	535 (11.2)	33 (1.3)	519 (3.7)	57 (1.4)	546 (3.5)	8 (0.7)	601 (6.8)
Spain	3 (0.4)	459 (5.9)	33 (1.0)	474 (2.8)	52 (1.0)	491 (2.2)	13 (0.8)	513 (4.3)
Sweden	2 (0.3)	~ ~	33 (1.1)	503 (3.3)	55 (0.9)	523 (3.2)	10 (0.7)	553 (5.0)
Switzerland	3 (0.3)	532 (9.2)	28 (1.1)	540 (4.1)	53 (1.2)	549 (3.0)	16 (0.6)	554 (5.5)
Thailand	0 (0.1)	~ ~	12 (1.1)	503 (7.3)	72 (1.0)	520 (5.3)	16 (1.2)	551 (9.1)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

[1]Index of overall attitudes towards mathematics is based on average of responses to the following statements: 1) I would like a job that involved using mathematics; 2) Mathematics is important to everyone's life; 3) Mathematics is boring (reversed scale); 4) I enjoy learning mathematics; 5) I like mathematics.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

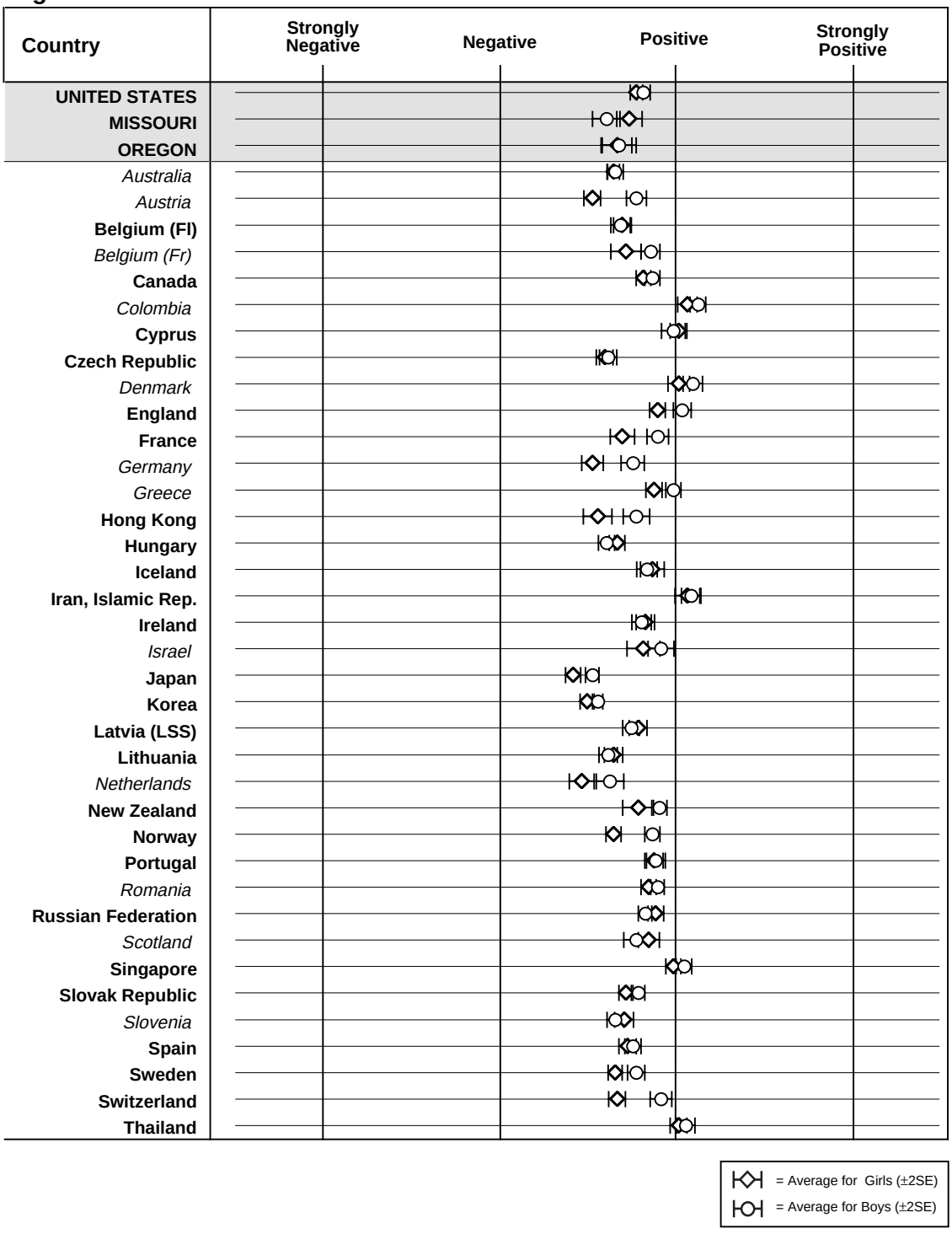
Background data for Bulgaria and South Africa not available.

A tilde (~) indicates insufficient data to report achievement.

Figure 4.4

Gender Differences in Students' Overall Attitudes[1] Towards Mathematics

Eighth Grade*



SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

[1]Index of overall attitudes towards mathematics is based on average of responses to the following statements: 1) I would like a job that involved using mathematics; 2) Mathematics is important to everyone's life; 3) Mathematics is boring (reversed scale); 4) I enjoy learning mathematics; 5) I like mathematics.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

Chapter 5

TEACHERS AND MATHEMATICS INSTRUCTION

Teachers and the instructional approaches they use are fundamental in building students' mathematical understanding. Primary among their many duties and responsibilities, teachers structure and guide the pace of individual, small-group, and whole-class work to present new material, engage students in mathematical tasks, and help deepen students' grasp of the mathematics being studied. Teachers may help students use technology and tools to investigate mathematical ideas, analyze students' work for misconceptions, and promote positive attitudes about mathematics. They also may assign homework and conduct informal as well as formal assessments to monitor progress in student learning, make ongoing instructional decisions, and evaluate achievement outcomes.

Effective teaching is a complex endeavor requiring knowledge about the subject matter of mathematics, understanding of the ways in which students learn, and the ability to use successful pedagogical approaches. It can be fostered through institutional support and adequate resources. Teachers also can support each other in planning instructional strategies, devising real-world applications of mathematical concepts, and developing sequences that move students from concrete tasks to the ability to think for themselves and explore mathematical theories.

TIMSS administered a background questionnaire to teachers to gather information about their backgrounds, training, and how they think about mathematics. The questionnaire also asked about how they spend their time related to their teaching tasks and the instructional approaches they use in their classrooms. Information was collected about the materials used in instruction, the activities students do in class, the use of calculators and computers in mathematics lessons, the role of homework, and the reliance on different types of assessment approaches.

This chapter presents the results of teachers' responses to some of these questions. Because the sampling for the teacher questionnaires was based on participating students, the responses to the mathematics teacher questionnaire do not necessarily represent all of the eighth-grade mathematics teachers for each of the TIMSS participants. Rather, they represent teachers of the representative samples of students assessed. It is important to note that in this report, the student is always the unit of analysis, even when information from the teachers' questionnaires is being reported. Using the student as the unit of analysis makes it possible to describe the instruction received by representative samples of students. Although this approach may provide a different perspective from that obtained by simply collecting information from teachers, it is consistent with the TIMSS goals of providing information about the educational contexts and performance of students.

The tables in this chapter contain special notations regarding the availability of teacher responses. For a country where teacher responses are available for 70% to 84% of the students, an "r" is included next to the data for that country. When teacher responses

are available for 50% to 69% of the students, an "s" is included next to the data for that country. When teacher responses are available for less than 50% of the students, an "x" replaces the data.

Who Delivers Mathematics Instruction?

This section provides information about the mathematics teaching force for each of the TIMSS participants, in terms of certification, degrees, age, gender, and years of teaching experience.

Table 5.1 contains teachers' reports on their age and gender. In many countries, the overwhelming majority of students were taught by teachers in their 30s and 40s and this pattern prevailed in Missouri (74% of the students). In the United States, 63% of the students were taught by teachers in their 30s and 40s, and 19% by teachers 50 years or older. As in a number of TIMSS countries, the teaching force in Oregon was comparatively older, with 71% of the students having mathematics teachers in their 40s or older. The TIMSS participants where 70% or more of the eighth-grade students had mathematics teachers in their 40s or older included the Czech Republic, Denmark, France, Germany, Norway, Romania, the Slovak Republic, and Spain. Very few countries seemed to have a comparatively younger teaching force.

In about one-fourth of the TIMSS countries, approximately equivalent percentages of eighth-grade students were taught mathematics by male teachers and female teachers (Table 5.1). However, in Missouri two-thirds of the students had female teachers, a finding which mirrors the results for the United States as well as a number of other TIMSS countries. At least 70% of the eighth-grade students had female mathematics teachers in the Czech Republic, Hungary, Israel, Latvia (LSS), Lithuania, the Russian Federation, the Slovak Republic, and Slovenia. In Oregon, more of the students (60%) had male mathematics teachers than female teachers. This pattern of at least 60% of students having male mathematics teachers was found in the Scandinavian countries as well as in Canada, Colombia, Germany, Greece, Hong Kong, Iceland, Iran, Japan, the Netherlands, Spain, and Switzerland.

As might be expected from the differences in teachers' ages from country to country, the TIMSS data indicate differences in teachers' experience across countries (see Table 5.2). Those countries with younger teaching forces tended to have more students taught by less experienced teachers. At least half the eighth-grade students had mathematics teachers with 10 years or less of experience in Hong Kong, Iran, Korea, Kuwait, Portugal, and Thailand. In contrast, at least half the students had mathematics teachers with more than 20 years of experience in Belgium (French), the Czech Republic, France, Romania, the Slovak Republic, and Spain. Both Missouri and Oregon fell between these two extremes as did the United States. However, consistent with the differences in teachers' ages, the teachers in Oregon were somewhat more experienced than those in the United States as a whole (68% compared to 61% of the students were taught mathematics by teachers with 11 or more years of experience). In Missouri, 58% of the students were taught by teachers with 11 or more years of experience.

Table 5.1

Teachers' Reports on Their Age and Gender - Mathematics - Eighth Grade*

Country	Percent of Students Taught by Teachers				Percent of Students Taught by Teachers	
	29 Years or Under	30 - 39 Years	40 - 49 Years	50 Years or Older	Female	Male
UNITED STATES	17 (3.0)	19 (3.2)	44 (4.4)	19 (2.9)	65 (4.0)	35 (4.0)
MISSOURI	14 (2.0)	28 (5.2)	46 (5.0)	11 (2.1)	67 (4.9)	33 (4.9)
OREGON	13 (1.3)	17 (2.6)	54 (4.1)	17 (3.3)	40 (3.8)	60 (3.8)
Australia	22 (2.6)	27 (3.2)	41 (3.3)	10 (1.9)	44 (3.3)	56 (3.3)
Austria	r 9 (2.6)	38 (3.8)	42 (4.6)	10 (2.7)	r 48 (4.4)	52 (4.4)
Belgium (Fl)	13 (3.1)	28 (4.2)	30 (4.2)	29 (4.9)	66 (4.3)	34 (4.3)
Belgium (Fr)	s 5 (2.3)	26 (5.0)	46 (6.0)	23 (5.1)	s 51 (5.5)	49 (5.5)
Canada	15 (2.4)	21 (3.1)	39 (3.9)	26 (3.2)	38 (4.3)	62 (4.3)
Colombia	23 (4.4)	25 (4.1)	40 (4.5)	12 (2.9)	34 (4.2)	66 (4.2)
Cyprus	0 (0.0)	38 (4.7)	47 (5.2)	15 (3.5)	r 61 (5.6)	39 (5.6)
Czech Republic	8 (2.4)	20 (3.6)	41 (4.7)	31 (4.8)	82 (3.2)	18 (3.2)
Denmark	2 (1.4)	22 (4.0)	52 (4.7)	24 (4.0)	35 (4.5)	65 (4.5)
England	s 17 (2.5)	23 (3.1)	43 (2.8)	17 (2.4)	s 45 (3.6)	55 (3.6)
France	11 (2.7)	17 (3.7)	48 (5.0)	24 (3.8)	43 (4.5)	57 (4.5)
Germany	s 0 (0.0)	13 (3.5)	36 (5.2)	51 (5.3)	s 33 (4.9)	67 (4.9)
Greece	0 (0.4)	33 (4.4)	54 (4.2)	12 (4.2)	30 (3.8)	70 (3.8)
Hong Kong	48 (6.1)	29 (5.1)	11 (3.7)	12 (3.8)	40 (5.2)	60 (5.2)
Hungary	10 (2.5)	31 (4.4)	42 (4.4)	18 (3.1)	87 (3.1)	13 (3.1)
Iceland	r 12 (4.9)	39 (7.0)	29 (6.0)	20 (6.9)	r 39 (5.6)	61 (5.6)
Iran, Islamic Rep.	44 (4.8)	36 (5.1)	17 (3.0)	2 (1.6)	37 (4.8)	63 (4.8)
Ireland	17 (3.6)	34 (4.3)	35 (4.1)	14 (3.1)	57 (4.0)	43 (4.0)
Israel	r 12 (4.8)	27 (7.3)	41 (7.8)	20 (6.3)	r 95 (2.4)	5 (2.4)
Japan	22 (3.2)	43 (3.7)	25 (3.5)	10 (2.5)	28 (3.8)	72 (3.8)
Korea	26 (3.7)	43 (4.4)	12 (3.2)	19 (3.0)	45 (3.9)	55 (3.9)
Kuwait	40 (4.1)	40 (4.0)	16 (3.5)	3 (2.8)	51 (1.9)	49 (1.9)
Latvia (LSS)	15 (3.5)	41 (5.1)	20 (3.8)	24 (4.2)	90 (2.8)	10 (2.8)
Lithuania	8 (2.3)	36 (4.1)	22 (3.5)	34 (4.4)	87 (2.6)	13 (2.6)
Netherlands	6 (2.5)	33 (5.2)	50 (5.2)	11 (2.9)	22 (4.1)	78 (4.1)
New Zealand	12 (2.5)	38 (4.2)	35 (3.8)	15 (3.3)	42 (4.1)	58 (4.1)
Norway	7 (2.1)	23 (3.8)	39 (4.1)	31 (3.5)	32 (3.9)	68 (3.9)
Portugal	45 (4.5)	35 (4.1)	14 (2.2)	6 (2.2)	68 (3.8)	32 (3.8)
Romania	11 (2.4)	18 (3.1)	41 (4.3)	30 (4.0)	64 (4.0)	36 (4.0)
Russian Federation	18 (3.6)	29 (3.3)	33 (3.1)	21 (3.2)	97 (1.2)	3 (1.2)
Scotland	14 (3.3)	28 (4.4)	40 (4.9)	18 (3.2)	45 (4.6)	55 (4.6)
Singapore	26 (4.1)	18 (3.2)	33 (4.6)	23 (3.8)	60 (4.5)	40 (4.5)
Slovak Republic	7 (2.0)	22 (3.6)	50 (4.7)	22 (3.7)	79 (3.9)	21 (3.9)
Slovenia	r 9 (3.0)	59 (4.9)	22 (4.4)	10 (2.5)	r 87 (3.6)	13 (3.6)
Spain	0 (0.4)	24 (3.6)	48 (4.3)	28 (3.7)	37 (4.1)	63 (4.1)
Sweden	10 (2.2)	22 (3.5)	27 (3.2)	41 (4.3)	33 (3.3)	67 (3.3)
Switzerland	10 (3.5)	27 (3.9)	37 (4.4)	25 (3.9)	13 (2.3)	87 (2.3)
Thailand	r 25 (5.0)	43 (6.2)	29 (6.2)	3 (2.3)	r 61 (6.2)	39 (6.2)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Table 5.2

Teachers' Reports on Their Years of Teaching Experience - Mathematics - Eighth Grade*

Country		0-5 Years		6-10 Years		11-20 Years		More than 20 Years	
		Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
UNITED STATES		25 (3.4)	484 (6.3)	14 (2.7)	488 (9.8)	25 (3.2)	501 (7.3)	36 (3.3)	513 (7.5)
MISSOURI		18 (3.2)	493 (10.1)	25 (5.3)	525 (9.9)	27 (4.1)	499 (8.1)	31 (3.9)	504 (3.8)
OREGON		17 (1.9)	520 (6.0)	15 (2.9)	476 (7.1)	36 (3.7)	535 (9.6)	32 (3.6)	539 (8.5)
Australia		18 (2.3)	517 (8.5)	19 (2.6)	528 (11.6)	35 (2.8)	540 (8.5)	28 (2.6)	533 (8.5)
Austria	r	7 (2.3)	516 (19.7)	13 (2.5)	546 (9.5)	51 (4.0)	554 (6.7)	28 (3.6)	549 (8.8)
Belgium (Fl)		10 (2.8)	556 (17.9)	9 (2.2)	590 (14.5)	32 (4.8)	554 (13.4)	49 (4.9)	575 (10.6)
Belgium (Fr)	s	8 (3.2)	536 (12.3)	8 (2.3)	528 (13.8)	31 (5.2)	558 (7.0)	54 (4.8)	543 (6.4)
Canada		17 (2.6)	527 (6.7)	15 (2.9)	527 (5.0)	22 (3.6)	526 (7.6)	46 (3.8)	528 (3.8)
Colombia		18 (3.0)	409 (7.7)	22 (5.0)	375 (11.7)	27 (4.3)	385 (6.0)	33 (4.2)	385 (5.0)
Cyprus	r	30 (4.6)	474 (4.6)	19 (4.3)	474 (7.6)	25 (5.0)	467 (6.4)	26 (4.7)	471 (5.5)
Czech Republic		12 (3.1)	566 (17.7)	9 (1.9)	538 (8.6)	17 (4.1)	584 (11.4)	62 (4.7)	562 (5.7)
Denmark		4 (1.9)	487 (2.6)	4 (2.0)	493 (14.4)	47 (4.9)	504 (3.3)	45 (4.8)	508 (4.4)
England	s	19 (2.5)	522 (10.8)	11 (2.1)	518 (13.5)	39 (3.5)	512 (8.1)	31 (3.0)	515 (11.3)
France		11 (2.5)	539 (8.1)	11 (3.1)	529 (10.2)	26 (4.6)	540 (8.8)	52 (4.3)	538 (5.4)
Germany	s	10 (2.2)	534 (14.5)	14 (4.3)	471 (12.1)	32 (5.1)	521 (10.6)	44 (5.5)	516 (9.3)
Greece		16 (3.1)	464 (7.2)	20 (3.4)	469 (5.3)	47 (4.3)	490 (3.5)	17 (4.4)	503 (12.0)
Hong Kong		53 (5.9)	585 (9.7)	14 (3.3)	606 (16.3)	18 (4.2)	574 (19.2)	15 (3.9)	596 (19.8)
Hungary		13 (2.9)	530 (12.7)	10 (2.8)	510 (7.4)	38 (4.1)	537 (5.6)	38 (4.1)	547 (5.2)
Iceland	r	19 (5.1)	478 (5.3)	14 (3.8)	480 (8.5)	33 (7.1)	492 (7.3)	35 (7.7)	496 (10.6)
Iran, Islamic Rep.		38 (4.5)	417 (3.7)	24 (4.8)	437 (3.8)	24 (4.3)	433 (3.2)	14 (3.0)	440 (4.8)
Ireland		13 (3.0)	513 (16.3)	17 (3.5)	507 (12.6)	42 (4.6)	535 (8.4)	28 (4.5)	523 (10.0)
Israel	r	16 (6.1)	490 (9.1)	12 (4.3)	555 (15.9)	45 (7.4)	510 (8.3)	27 (7.4)	548 (13.7)
Japan		19 (3.3)	606 (5.0)	25 (3.5)	607 (4.3)	36 (3.8)	598 (3.5)	19 (2.9)	614 (4.0)
Korea		28 (3.5)	610 (4.7)	29 (3.9)	622 (5.6)	23 (3.7)	597 (5.6)	20 (3.1)	606 (5.5)
Kuwait	r	30 (6.3)	397 (2.5)	33 (7.9)	388 (3.0)	31 (7.3)	388 (4.8)	6 (4.0)	418 (8.5)
Latvia (LSS)		12 (3.4)	496 (7.0)	16 (3.4)	482 (8.8)	38 (5.0)	496 (5.5)	34 (5.1)	490 (5.8)
Lithuania	r	5 (1.8)	455 (9.2)	15 (3.3)	465 (11.0)	33 (4.2)	482 (8.4)	47 (4.3)	481 (5.2)
Netherlands		13 (3.6)	530 (19.5)	21 (3.6)	525 (10.2)	42 (5.3)	548 (17.8)	24 (4.0)	556 (9.3)
New Zealand		17 (3.1)	497 (7.5)	28 (4.0)	515 (7.9)	34 (4.1)	517 (9.2)	20 (3.4)	487 (9.4)
Norway		12 (2.7)	499 (10.7)	10 (2.5)	500 (6.1)	35 (4.0)	508 (4.0)	43 (4.6)	503 (3.4)
Portugal		51 (4.7)	449 (3.0)	16 (3.1)	447 (5.4)	27 (3.9)	462 (4.3)	6 (2.3)	477 (8.6)
Romania		10 (2.3)	452 (14.2)	15 (3.1)	466 (9.9)	14 (3.1)	496 (12.8)	61 (4.2)	486 (5.7)
Russian Federation		16 (3.7)	541 (25.2)	14 (2.5)	532 (9.7)	29 (4.0)	526 (7.1)	41 (5.0)	538 (6.6)
Scotland		17 (3.4)	483 (9.2)	12 (3.2)	484 (14.3)	42 (4.4)	496 (8.5)	29 (4.3)	507 (12.3)
Singapore		30 (4.5)	617 (9.4)	11 (2.8)	658 (14.0)	11 (3.0)	664 (13.4)	48 (4.6)	652 (7.0)
Slovak Republic		6 (1.9)	556 (13.3)	15 (3.3)	531 (8.5)	21 (3.5)	539 (8.2)	58 (4.5)	553 (4.6)
Slovenia	r	4 (1.9)	537 (23.2)	19 (4.0)	533 (6.0)	55 (5.0)	542 (5.5)	22 (3.8)	550 (6.2)
Spain		3 (0.8)	472 (17.7)	8 (2.4)	486 (7.6)	39 (4.3)	488 (3.8)	50 (4.3)	488 (3.1)
Sweden		16 (2.4)	529 (7.1)	15 (2.8)	512 (9.5)	26 (3.1)	518 (6.2)	44 (4.1)	520 (4.4)
Switzerland		14 (3.3)	540 (10.1)	6 (1.8)	545 (19.0)	37 (4.6)	549 (8.4)	42 (4.9)	548 (7.4)
Thailand	s	48 (6.6)	517 (9.0)	11 (2.6)	499 (9.4)	35 (6.2)	540 (11.0)	5 (3.4)	615 (17.7)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

The relationship between years of teaching experience and mathematics achievement was not consistent across countries. In about one-fourth of the countries, including the United States, the eighth-grade students with the most experienced teachers (more than 20 years) had higher mathematics achievement than did those with less experienced teachers (5 years or fewer). This may reflect the practice of giving teachers with more seniority the more advanced classes. Although the higher achieving students had more experienced teachers in Oregon, the results for Missouri were more similar to countries showing no clear pattern of performance differences in relation to years of teaching experience. In Missouri, there was little difference in students' performance in relation to years of teaching experience.

What Are Teachers' Perceptions About Mathematics?

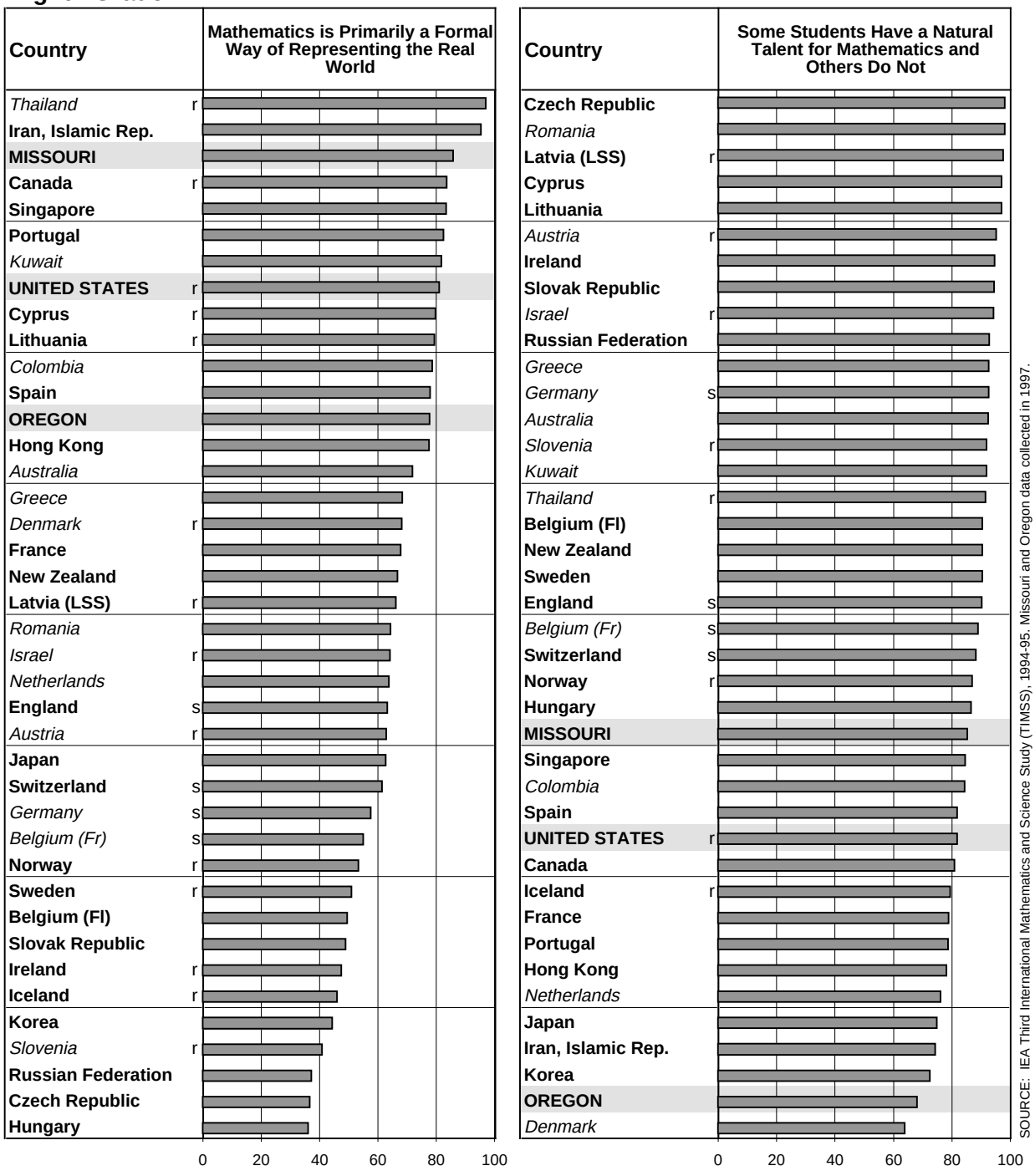
Figure 5.1 depicts the percentages of eighth-grade students whose mathematics teachers reported certain beliefs about mathematics and the way mathematics should be taught. Teachers in many countries indicated a fairly practical view of mathematics, seeing it essentially as a way of modeling the real world. However, there was variation across countries in the amount of agreement with this view of the nature of mathematics. In Thailand and Iran, nearly all students had teachers who agreed or strongly agreed that mathematics is primarily a formal way of representing the real world. In about a dozen countries including the United States, many students (about 80%) had teachers with this point of view, and the results in Missouri and Oregon were similar to those for the United States. However, several of the Central or Eastern European countries (Slovenia, the Russian Federation, the Czech Republic, and Hungary), were at the other end of the continuum with 40% or fewer of the students' having mathematics teachers that agreed with this view.

There appeared to be nearly uniform agreement by teachers across countries about the inherent nature of mathematical abilities. In most countries, 80% or more of the students had teachers who agreed that some students have a natural talent for mathematics and others do not. Even though the United States and Missouri fit this general pattern, fewer students in Oregon (68%) had teachers agreeing with this statement.

Regarding perceptions about how to teach mathematics, teachers' opinions varied across countries concerning whether or not more practice during class is an effective approach to help students having difficulty. As indicated in Figure 5.1, at least 80% of the eighth-grade students in the Czech Republic, Cyprus, Greece, Iran, the Slovak Republic, Thailand, Kuwait, Portugal, and Romania had teachers who agreed or strongly agreed with this approach. Conversely, fewer than 20% of the students in the Russian Federation and Norway had teachers who agreed with this approach. The results for Oregon were similar to those for the Russian Federation and Norway, and those for Missouri and the United States also were towards this end of the continuum of countries.

Figure 5.1

Percent of Students Whose Mathematics Teachers Agree or Strongly Agree with Statements About the Nature of Mathematics and Mathematics Teaching Eighth Grade*

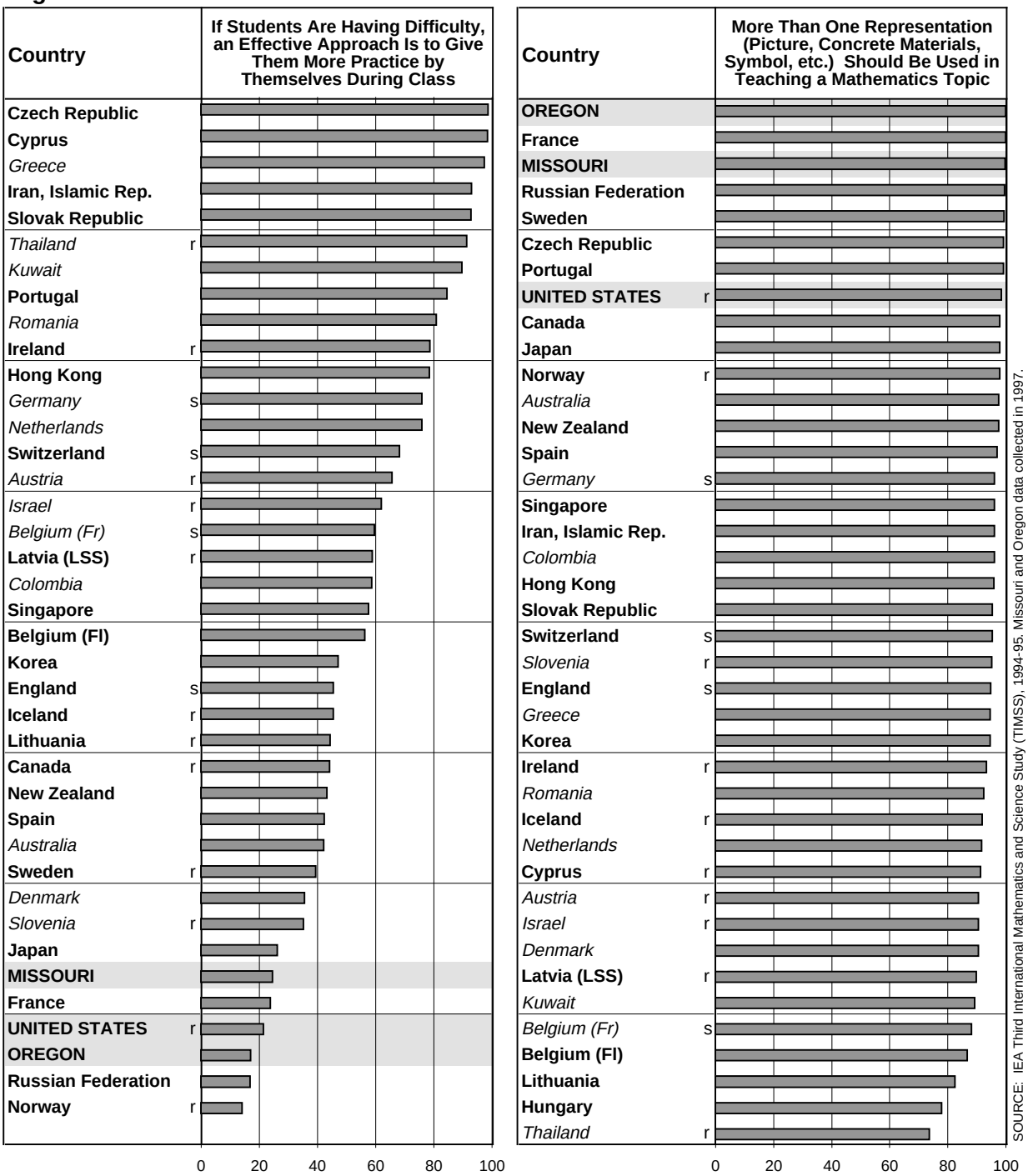


SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).
Background data for Bulgaria and South Africa not available.
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.
Scotland did not ask these questions.

Figure 5.1 (Continued)

Percent of Students Whose Mathematics Teachers Agree or Strongly Agree with Statements About the Nature of Mathematics and Mathematics Teaching Eighth Grade*



SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).
Background data for Bulgaria and South Africa not available.
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.
Scotland did not ask these questions. Hungary did not ask teachers their opinions about the effectiveness of more individual practice.

There was nearly complete agreement by teachers across countries, however, that more than one representation should be used in teaching a mathematics topic (Figure 5.1). Oregon and Missouri joined the countries topping the list. In only Hungary and Thailand did fewer than 80% of the eighth-grade students have teachers that agreed with this approach. This instructional approach is particularly useful in helping students with different learning styles understand key ideas. Also, using data in different formats reinforces the idea of mathematics as a network of interconnected concepts and procedures.

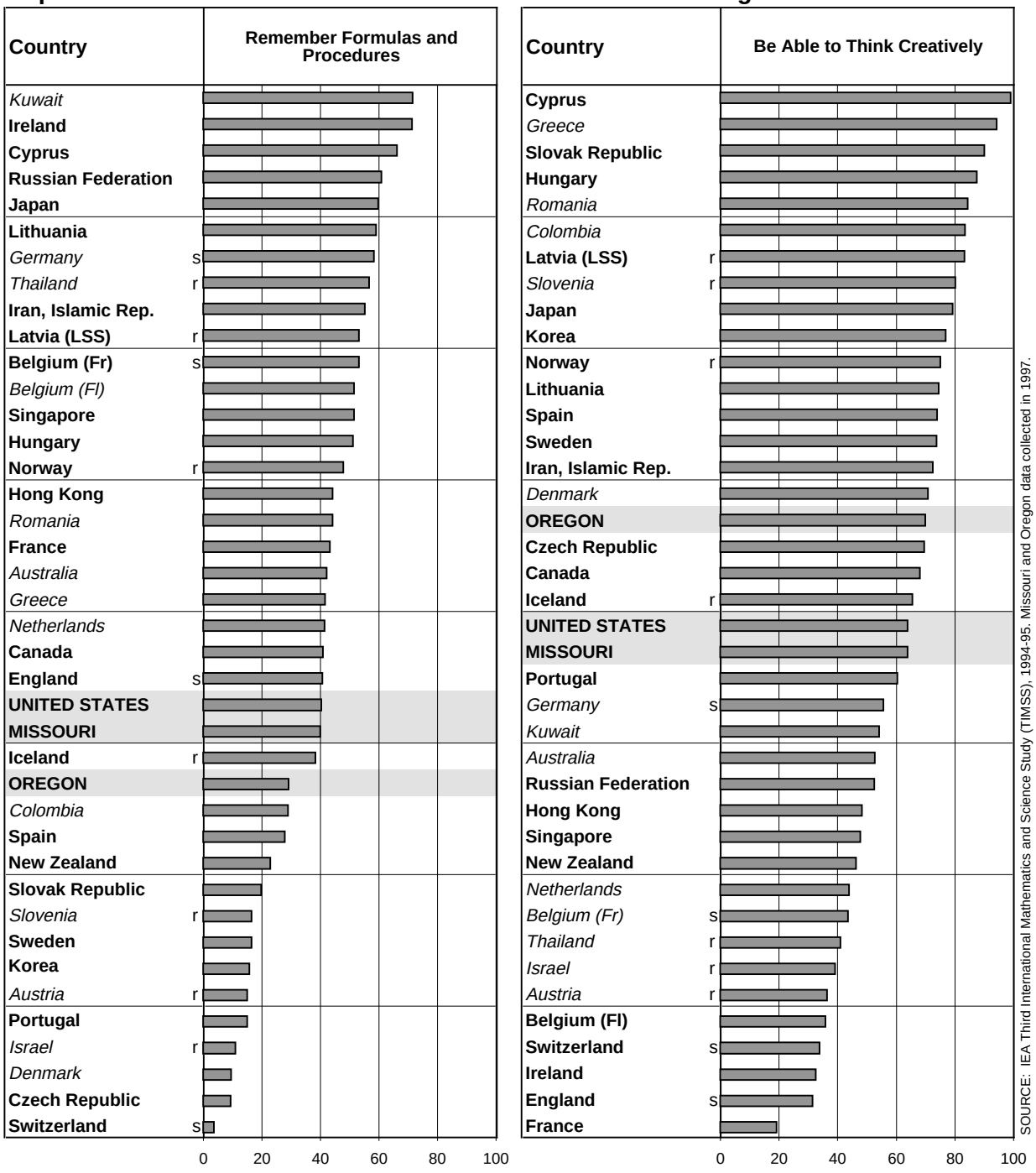
TIMSS also queried teachers about the cognitive demands of mathematics, asking them to rate the importance of various skills for success in the discipline. Figure 5.2 shows the percentages of students whose teachers rated each of four different skills as very important. Across the participating countries, fewer students had teachers who felt the ability to remember formulas and procedures was very important compared to the other cognitive demands of which they were asked. There was a range, however, with teachers of approximately 70% of the eighth-grade students in Kuwait and Ireland rating this ability as very important compared to those of fewer than 20% of the students in Slovenia, Sweden, Korea, Austria, Portugal, Israel, Denmark, the Czech Republic, and Switzerland. The results for the United States and Missouri fell in the middle (approximately 40%), while somewhat fewer students in Oregon had teachers agreeing that memorization was important.

Internationally, there was considerable variation in teachers' responses to the statement about the importance of thinking creatively, from nearly all of the students in Cyprus having teachers that agreed with this statement to only about 20% in France (Figure 5.2). Again, the United States and Missouri were mid range (about 60%), but here somewhat more students in Oregon had teachers agreeing with the statement. When teachers were asked about the importance of understanding how mathematics is used in the real world, Missouri topped the list of the TIMSS countries, and teachers in the United States as a whole were also in high agreement. About 80% of the students in the U.S. had mathematics teachers agreeing with this statement, and the corresponding figure for Oregon was near 70%. Interestingly, fewer than 40% of the eighth-grade students in Israel, Austria, Belgium (Flemish), Switzerland, Ireland, England, and France had teachers who felt it was very important to think creatively, and fewer than 40% in Latvia (LSS), Korea, Thailand, Belgium (Flemish), Hong Kong, France, Israel, the Netherlands, Switzerland, and Ireland had teachers who felt it was very important to understand how mathematics is used in the real world. With the current calls from business and industry for helping students improve their ability to apply mathematics and solve practical problems in job-related situations, it might be rather surprising that teachers in these countries do not place more importance on these latter two aspects of mathematics.

In all countries except the Czech Republic, Switzerland, the Netherlands, and Austria, the majority of students had teachers who felt it was very important to be able to provide reasons to support mathematical solutions. The results for Oregon and Missouri were similar to those in nine countries including the United States, where 80% or more of the students had teachers that so agreed.

Figure 5.2

Percent of Students Whose Mathematics Teachers Think Particular Abilities Are Very Important for Students' Success in Mathematics in School - Eighth Grade*



SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).
Background data for Bulgaria and South Africa not available.
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.
Scotland did not ask these questions.

Figure 5.2 (Continued)

Percent of Students Whose Mathematics Teachers Think Particular Abilities Are Very Important for Students' Success in Mathematics in School - Eighth Grade*

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).
Background data for Bulgaria and South Africa not available.
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.
Scotland did not ask these questions.

How Do Teachers Spend Their School-Related Time?

The data in Table 5.3 reveal that in a number of countries, eighth-grade mathematics teachers are specialists. In Belgium (Flemish), Belgium (French), Cyprus, England, France, Kuwait, Lithuania, the Netherlands, New Zealand, Portugal, the Russian Federation, Scotland, and Slovenia, the majority of eighth-grade students had teachers who spent at least 75% of their formally scheduled school time teaching mathematics. In the United States, Missouri, and Oregon slightly less than one-third of the students were taught by such teachers. In Oregon, the majority of the students (55%) take mathematics from teachers who devote less than half of their time to teaching mathematics.

For most participating countries, there was little difference in students' achievement according to whether they were taught by specialists, and this was the case for the United States and Missouri. However, in Oregon and some countries (e.g., Austria, England, France, Germany, Ireland, and Switzerland) those students with specialists for teachers had higher average mathematics achievement. In Switzerland, this is at least partially because specialists teach the students in the higher tracks and generalists the students in lower tracks. Generally, it is important to keep in mind the complexity of the relationships between instruction and achievement. In tracked systems, many characteristics of instruction can be related to the track.

As shown in Table 5.4, teachers in most countries reported that mathematics classes typically meet for at least 2 hours per week, but less than 3.5 hours. However, from 3.5 up to nearly 5 hours of weekly class time was reported for 50% or more of the students in a number of countries including the United States. As might be expected the amount of instructional time provided in Oregon and Missouri was commensurate with that provided in the United States. The data reveal no clear pattern between the number of in-class instructional hours and mathematics achievement either across or between countries.

In addition to their formally scheduled duties, teachers were asked about the number of hours per week spent on selected school-related activities outside the regular school day. Table 5.5 presents the results. For example, on average, eighth grade students in the United States had mathematics teachers who reported spending 2.7 hours per week preparing or grading tests, and another 2.7 hours per week reading and grading papers. Their teachers spent 2.4 hours per week on lesson planning and 2.7 hours combined on meetings with students and parents. They spent 0.9 hours on professional reading and development and 3.6 hours on record keeping and administrative tasks combined. Teachers' reports in Missouri closely paralleled those for the United States as a whole, as did those from the teachers in Oregon. However, the teachers in Oregon reported spending somewhat less time than their colleagues in preparing or grading tests and meeting with students outside classroom time. Even though differences were reported from country to country, teachers reported similar demands on their time. Across countries, teachers reported that grading tests, grading student work, and lesson planning were the most time consuming activities, averaging as much as 10 hours per week in Singapore. In general, teachers also reported several hours per week spent on keeping students' records and other administrative tasks.

Table 5.3

Teachers' Reports on the Proportion of Their Formally Scheduled School Time Spent Teaching Mathematics[1] - Eighth Grade*

Country		Less Than 50 Percent		50-74 Percent		75-100 Percent	
		Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
UNITED STATES		38 (3.7)	494 (5.4)	31 (4.0)	506 (8.9)	31 (3.7)	501 (6.8)
MISSOURI		41 (4.3)	499 (6.9)	28 (4.3)	508 (10.4)	31 (5.2)	512 (6.4)
OREGON		55 (4.5)	513 (4.7)	13 (2.6)	534 (8.3)	32 (4.2)	542 (11.7)
Australia		37 (3.1)	527 (5.4)	25 (3.2)	526 (8.2)	38 (3.6)	541 (8.8)
Austria	r	51 (3.3)	537 (6.3)	30 (3.1)	548 (7.8)	19 (3.2)	575 (13.8)
Belgium (Fl)		12 (3.0)	573 (16.9)	29 (4.4)	543 (14.0)	60 (4.4)	579 (9.2)
Belgium (Fr)	s	8 (3.0)	554 (9.6)	12 (4.0)	535 (14.1)	80 (4.9)	546 (4.5)
Canada		59 (3.3)	520 (3.2)	26 (3.2)	543 (7.7)	15 (2.2)	532 (7.2)
Colombia		34 (3.5)	381 (3.8)	36 (4.2)	402 (4.2)	30 (4.1)	384 (5.5)
Cyprus	r	3 (2.0)	472 (16.2)	6 (2.0)	472 (8.4)	91 (2.8)	471 (2.5)
Czech Republic		58 (4.7)	565 (7.0)	30 (4.5)	564 (9.7)	12 (3.3)	561 (7.8)
Denmark		65 (4.6)	505 (3.2)	27 (4.2)	499 (4.2)	8 (2.8)	519 (10.4)
England	s	10 (2.0)	495 (26.0)	21 (2.9)	499 (10.7)	69 (2.8)	524 (4.6)
France		6 (1.6)	496 (15.2)	9 (2.6)	529 (17.6)	85 (2.9)	542 (3.4)
Germany	s	49 (5.5)	499 (9.5)	35 (5.2)	518 (9.9)	17 (3.3)	552 (7.5)
Greece		– –	– –	– –	– –	– –	– –
Hong Kong		42 (6.1)	603 (10.0)	21 (5.1)	570 (15.1)	36 (4.8)	580 (11.7)
Hungary		– –	– –	– –	– –	– –	– –
Iceland	r	56 (6.6)	486 (4.9)	26 (8.2)	494 (8.7)	18 (6.5)	492 (18.8)
Iran, Islamic Rep.		23 (5.7)	430 (5.6)	32 (5.2)	431 (3.6)	45 (5.0)	430 (2.6)
Ireland		37 (4.3)	500 (9.5)	24 (3.6)	528 (10.7)	39 (4.8)	547 (8.9)
Israel	r	25 (6.7)	520 (15.9)	28 (7.8)	514 (14.0)	47 (8.4)	531 (9.8)
Japan		24 (3.3)	606 (6.0)	40 (4.0)	606 (4.5)	37 (3.5)	603 (4.3)
Korea		44 (4.5)	607 (4.1)	46 (4.5)	610 (4.1)	10 (2.6)	623 (8.3)
Kuwait	r	17 (5.8)	395 (5.5)	28 (6.9)	386 (3.9)	55 (8.0)	395 (4.3)
Latvia (LSS)	r	23 (4.2)	484 (6.5)	35 (4.5)	485 (6.4)	43 (4.9)	498 (4.5)
Lithuania		8 (1.9)	498 (7.3)	8 (2.1)	451 (9.4)	84 (2.9)	478 (4.4)
Netherlands		4 (2.0)	526 (44.0)	18 (4.5)	494 (25.9)	79 (4.9)	555 (6.8)
New Zealand		28 (3.5)	493 (8.2)	18 (3.4)	526 (12.6)	54 (4.0)	511 (6.1)
Norway		49 (4.4)	504 (3.5)	39 (4.5)	503 (3.6)	12 (2.5)	506 (3.9)
Portugal		5 (2.0)	452 (7.0)	15 (3.1)	447 (6.9)	80 (3.6)	456 (2.9)
Romania		73 (4.2)	485 (5.2)	20 (3.7)	480 (9.2)	6 (2.2)	437 (8.2)
Russian Federation		0 (0.2)	~ ~	2 (1.2)	~ ~	98 (1.2)	536 (5.4)
Scotland	r	2 (1.3)	~ ~	6 (2.4)	479 (36.5)	92 (2.7)	495 (6.4)
Singapore		22 (3.4)	626 (9.6)	53 (5.1)	658 (7.2)	25 (4.5)	630 (7.5)
Slovak Republic		61 (4.0)	547 (3.8)	26 (3.6)	544 (7.3)	13 (3.3)	553 (10.7)
Slovenia	r	14 (3.6)	550 (8.6)	22 (3.8)	531 (6.4)	63 (4.4)	543 (4.6)
Spain		69 (4.1)	487 (2.6)	26 (4.0)	486 (5.0)	5 (2.0)	499 (17.3)
Sweden		89 (2.3)	519 (3.2)	10 (2.1)	524 (10.2)	1 (0.8)	~ ~
Switzerland		52 (4.0)	532 (5.2)	30 (3.9)	552 (9.7)	18 (2.2)	579 (7.3)
Thailand	r	26 (5.6)	520 (14.7)	30 (5.0)	525 (11.8)	44 (5.9)	532 (9.7)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

[1]Formally scheduled school time included time scheduled for teaching all subjects, as well as student supervision, student counseling/appraisal, administrative duties, individual curriculum planning, cooperative curriculum planning, and other non-student contact time.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Table 5.4

Teachers' Reports on Average Number of Hours Mathematics Is Taught Weekly to Their Mathematics Classes - Eighth Grade*

Country		Less Than 2 Hours		2 Hours to < 3.5		3.5 Hours to < 5		5 Hours or More	
		Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
UNITED STATES	s	8 (1.4)	492 (26.2)	24 (3.4)	501 (9.9)	58 (4.4)	507 (5.4)	11 (2.8)	498 (10.0)
MISSOURI	r	14 (3.4)	506 (11.1)	22 (3.7)	510 (9.6)	46 (5.3)	504 (7.5)	19 (5.1)	490 (9.2)
OREGON	r	13 (3.2)	511 (17.1)	23 (4.6)	540 (14.3)	57 (3.8)	542 (6.6)	7 (1.6)	491 (12.5)
Australia	r	5 (1.7)	528 (19.5)	50 (3.7)	518 (6.2)	44 (3.7)	552 (7.6)	1 (0.7)	~ ~
Austria	r	0 (0.0)	~ ~	99 (0.1)	549 (4.1)	1 (0.1)	~ ~	0 (0.0)	~ ~
Belgium (Fl)	s	0 (0.0)	~ ~	50 (4.4)	572 (5.6)	50 (4.4)	603 (5.4)	0 (0.0)	~ ~
Belgium (Fr)	s	0 (0.0)	~ ~	3 (1.8)	486 (12.9)	83 (4.2)	544 (4.7)	14 (3.8)	564 (10.0)
Canada		3 (1.2)	528 (11.8)	31 (3.8)	521 (5.0)	50 (3.6)	537 (4.3)	17 (3.1)	520 (10.2)
Colombia	r	4 (2.0)	389 (8.2)	25 (5.5)	367 (8.8)	58 (5.4)	397 (3.9)	13 (3.3)	390 (8.2)
Cyprus		x x	x x	x x	x x	x x	x x	x x	x x
Czech Republic		1 (0.9)	~ ~	6 (2.0)	587 (17.2)	90 (2.7)	561 (5.1)	3 (1.6)	535 (10.2)
Denmark		– –	– –	– –	– –	– –	– –	– –	– –
England		– –	– –	– –	– –	– –	– –	– –	– –
France	r	2 (1.4)	~ ~	10 (3.2)	532 (13.4)	87 (3.3)	539 (3.9)	2 (1.3)	~ ~
Germany	s	2 (1.5)	~ ~	85 (3.1)	523 (5.3)	12 (2.9)	463 (13.3)	1 (0.9)	~ ~
Greece		4 (1.7)	459 (10.8)	88 (2.8)	486 (3.5)	3 (1.6)	459 (12.3)	4 (1.6)	480 (8.9)
Hong Kong		5 (2.4)	612 (47.4)	26 (5.2)	590 (19.5)	63 (5.8)	590 (7.6)	6 (2.9)	567 (30.1)
Hungary		0 (0.0)	~ ~	75 (3.6)	538 (3.9)	23 (3.6)	536 (7.0)	1 (1.0)	~ ~
Iceland	r	0 (0.0)	~ ~	90 (2.9)	492 (5.3)	8 (2.9)	467 (3.5)	1 (0.2)	~ ~
Iran, Islamic Rep.		– –	– –	– –	– –	– –	– –	– –	– –
Ireland	r	1 (0.7)	~ ~	86 (3.7)	524 (6.4)	12 (3.4)	555 (15.2)	1 (1.1)	~ ~
Israel	r	6 (4.1)	523 (13.7)	41 (8.0)	520 (12.7)	47 (8.1)	514 (9.2)	6 (3.7)	579 (22.6)
Japan		4 (1.8)	607 (24.3)	91 (2.3)	602 (2.7)	4 (1.4)	649 (18.5)	0 (0.5)	~ ~
Korea		1 (0.7)	~ ~	90 (3.0)	610 (2.8)	5 (1.8)	608 (13.8)	5 (2.3)	604 (19.5)
Kuwait		2 (1.5)	~ ~	21 (5.6)	396 (5.7)	76 (5.7)	391 (2.4)	1 (1.0)	~ ~
Latvia (LSS)		1 (0.5)	~ ~	30 (4.8)	491 (5.8)	62 (5.3)	492 (4.3)	8 (2.6)	489 (15.0)
Lithuania		1 (0.8)	~ ~	61 (4.1)	482 (5.0)	29 (3.9)	481 (7.5)	9 (2.3)	448 (13.8)
Netherlands		3 (1.9)	529 (54.2)	97 (1.9)	542 (8.1)	0 (0.0)	~ ~	0 (0.0)	~ ~
New Zealand		5 (1.8)	484 (11.6)	42 (4.3)	514 (7.1)	50 (4.3)	507 (6.4)	3 (1.5)	503 (27.3)
Norway	r	7 (2.6)	502 (5.0)	80 (3.9)	508 (3.1)	8 (2.8)	502 (7.7)	5 (2.1)	513 (7.7)
Portugal		1 (0.8)	~ ~	89 (2.9)	455 (2.7)	10 (2.8)	452 (7.8)	0 (0.0)	~ ~
Romania		8 (2.6)	497 (17.6)	80 (3.5)	481 (5.0)	9 (2.5)	482 (12.4)	2 (0.6)	~ ~
Russian Federation		0 (0.0)	~ ~	17 (3.6)	519 (8.6)	70 (5.6)	533 (5.1)	14 (4.8)	567 (18.0)
Scotland		5 (2.0)	473 (14.8)	35 (4.4)	500 (11.6)	60 (4.6)	494 (7.1)	0 (0.0)	~ ~
Singapore		0 (0.0)	~ ~	52 (4.7)	654 (6.9)	48 (4.7)	633 (7.6)	0 (0.0)	~ ~
Slovak Republic		0 (0.0)	~ ~	2 (1.3)	~ ~	86 (3.0)	544 (3.2)	11 (2.9)	561 (11.0)
Slovenia	r	0 (0.0)	~ ~	87 (3.4)	542 (4.0)	12 (3.3)	525 (9.5)	1 (0.8)	~ ~
Spain	r	2 (1.1)	~ ~	28 (4.0)	480 (5.5)	62 (4.7)	490 (3.6)	8 (2.6)	494 (9.2)
Sweden	r	3 (1.2)	506 (24.2)	97 (1.3)	520 (3.2)	0 (0.4)	~ ~	0 (0.3)	~ ~
Switzerland	s	2 (1.4)	~ ~	14 (3.4)	520 (17.8)	71 (3.5)	557 (6.5)	13 (3.0)	566 (12.4)
Thailand		x x	x x	x x	x x	x x	x x	x x	x x

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

An "x" indicates teacher response data available for <50% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

Table 5.5

Average Number of Hours[1] Students' Teachers Spend on Various School-Related Activities Outside the Formal School Day During the School Week - Mathematics - Eighth Grade*

Country	Preparing or Grading Tests	Reading and Grading Student Work	Planning Lessons by Self	Meeting with Students Outside Classroom Time	Meeting with Parents	Professional Reading and Development	Keeping Students' Records	Administrative Tasks
UNITED STATES	2.7 (0.1)	r 2.7 (0.2)	2.4 (0.1)	2.0 (0.1)	0.7 (0.0)	0.9 (0.1)	1.6 (0.1)	2.0 (0.1)
MISSOURI	2.7 (0.1)	2.7 (0.1)	2.3 (0.1)	2.0 (0.1)	0.6 (0.1)	1.1 (0.1)	1.8 (0.1)	1.9 (0.1)
OREGON	2.0 (0.1)	2.6 (0.1)	2.0 (0.1)	1.5 (0.1)	0.6 (0.0)	0.9 (0.1)	1.9 (0.1)	1.7 (0.1)
Australia	2.3 (0.1)	1.8 (0.1)	2.6 (0.1)	1.3 (0.1)	0.4 (0.0)	0.9 (0.1)	1.0 (0.1)	2.0 (0.1)
Austria	r 2.3 (0.1)	r 2.5 (0.1)	r 3.6 (0.1)	r 0.4 (0.1)	r 0.6 (0.0)	r 1.5 (0.1)	r 0.9 (0.1)	r 1.1 (0.1)
Belgium (Fl)	3.8 (0.1)	2.3 (0.1)	2.9 (0.2)	0.8 (0.1)	0.6 (0.1)	0.6 (0.1)	0.5 (0.0)	1.2 (0.1)
Belgium (Fr)	s 3.4 (0.2)	s 1.6 (0.1)	s 2.8 (0.2)	s 0.7 (0.1)	s 0.5 (0.1)	s 0.9 (0.1)	s 0.7 (0.1)	s 1.2 (0.1)
Canada	2.3 (0.1)	2.4 (0.1)	2.6 (0.1)	1.4 (0.1)	0.5 (0.0)	0.8 (0.1)	1.1 (0.0)	1.7 (0.1)
Colombia	2.8 (0.1)	r 1.8 (0.1)	3.1 (0.1)	1.2 (0.1)	0.8 (0.1)	1.9 (0.2)	r 0.8 (0.1)	1.1 (0.1)
Cyprus	3.4 (0.1)	r 1.3 (0.2)	r 3.2 (0.2)	r 0.3 (0.1)	r 1.1 (0.1)	r 0.9 (0.1)	r 0.5 (0.0)	r 1.0 (0.1)
Czech Republic	3.4 (0.1)	1.6 (0.1)	4.0 (0.1)	1.2 (0.1)	0.5 (0.0)	0.8 (0.1)	0.9 (0.1)	1.3 (0.1)
Denmark	– –	– –	– –	– –	– –	– –	– –	– –
England	s 2.1 (0.1)	s 3.7 (0.1)	s 2.6 (0.1)	s 1.4 (0.1)	s 0.6 (0.0)	s 0.9 (0.1)	s 0.7 (0.1)	s 2.2 (0.1)
France	4.0 (0.1)	r 1.1 (0.1)	3.4 (0.2)	0.7 (0.1)	0.6 (0.0)	r 1.2 (0.1)	0.7 (0.0)	1.0 (0.1)
Germany	s 3.1 (0.1)	s 2.2 (0.2)	s 4.2 (0.1)	s 0.8 (0.1)	s 0.8 (0.1)	s 1.8 (0.2)	s 1.1 (0.1)	s 1.7 (0.1)
Greece	2.4 (0.1)	1.0 (0.1)	2.0 (0.2)	0.4 (0.1)	0.9 (0.1)	2.1 (0.1)	r 0.5 (0.1)	1.2 (0.1)
Hong Kong	2.4 (0.2)	3.1 (0.2)	2.2 (0.2)	1.7 (0.2)	0.4 (0.1)	1.0 (0.2)	0.7 (0.1)	1.2 (0.1)
Hungary	3.0 (0.1)	2.5 (0.1)	4.0 (0.1)	1.9 (0.1)	0.8 (0.1)	1.8 (0.1)	0.8 (0.1)	2.3 (0.1)
Iceland	r 2.0 (0.2)	r 2.3 (0.3)	r 3.0 (0.2)	r 0.9 (0.1)	r 0.8 (0.1)	r 0.9 (0.1)	r 1.3 (0.2)	r 2.2 (0.2)
Iran, Islamic Rep.	2.6 (0.2)	1.9 (0.2)	2.1 (0.1)	1.0 (0.1)	0.8 (0.1)	0.5 (0.1)	2.0 (0.1)	1.1 (0.2)
Ireland	2.3 (0.1)	1.6 (0.1)	2.3 (0.1)	0.8 (0.1)	0.3 (0.0)	0.5 (0.1)	0.7 (0.1)	1.3 (0.1)
Israel	r 3.6 (0.2)	r 1.7 (0.2)	r 2.9 (0.3)	r 1.5 (0.2)	r 0.9 (0.1)	r 2.8 (0.3)	r 1.1 (0.2)	r 1.9 (0.2)
Japan	2.0 (0.1)	1.8 (0.1)	2.9 (0.1)	1.8 (0.1)	0.4 (0.0)	1.8 (0.1)	1.4 (0.1)	2.6 (0.2)
Korea	1.7 (0.1)	1.5 (0.1)	2.1 (0.1)	1.6 (0.1)	0.4 (0.0)	1.2 (0.1)	0.9 (0.1)	2.0 (0.1)
Kuwait	2.4 (0.2)	2.1 (0.2)	2.7 (0.2)	0.4 (0.1)	0.6 (0.1)	1.0 (0.2)	0.9 (0.2)	0.9 (0.2)
Latvia (LSS)	3.0 (0.2)	r 2.8 (0.2)	3.3 (0.1)	r 1.8 (0.1)	r 0.7 (0.1)	r 1.1 (0.1)	r 0.4 (0.1)	r 1.0 (0.1)
Lithuania	1.5 (0.1)	2.7 (0.2)	3.1 (0.1)	1.6 (0.1)	0.8 (0.1)	1.9 (0.1)	0.8 (0.1)	r 0.6 (0.1)
Netherlands	3.7 (0.2)	0.7 (0.1)	2.5 (0.2)	1.0 (0.1)	0.6 (0.0)	1.1 (0.1)	0.4 (0.0)	1.1 (0.1)
New Zealand	2.3 (0.1)	1.7 (0.1)	3.0 (0.1)	1.3 (0.1)	0.4 (0.0)	1.0 (0.1)	0.8 (0.0)	2.3 (0.1)
Norway	2.4 (0.1)	1.6 (0.1)	3.6 (0.1)	0.8 (0.1)	0.7 (0.0)	0.6 (0.1)	0.9 (0.1)	1.8 (0.1)
Portugal	2.8 (0.1)	1.9 (0.1)	3.3 (0.1)	0.9 (0.1)	0.5 (0.1)	1.0 (0.1)	0.9 (0.1)	1.2 (0.1)
Romania	2.8 (0.1)	2.4 (0.1)	3.6 (0.1)	2.0 (0.1)	1.0 (0.1)	1.3 (0.1)	1.6 (0.1)	2.2 (0.1)
Russian Federation	2.6 (0.1)	3.4 (0.1)	3.5 (0.2)	2.4 (0.1)	1.2 (0.1)	2.3 (0.1)	1.0 (0.1)	2.1 (0.1)
Scotland	1.5 (0.1)	r 2.0 (0.1)	1.8 (0.1)	1.0 (0.1)	0.5 (0.1)	0.8 (0.1)	1.0 (0.1)	1.5 (0.1)
Singapore	3.4 (0.1)	4.1 (0.1)	2.7 (0.1)	1.6 (0.1)	0.4 (0.0)	1.1 (0.1)	1.1 (0.1)	2.0 (0.1)
Slovak Republic	2.9 (0.1)	1.9 (0.1)	3.6 (0.1)	1.3 (0.1)	0.7 (0.0)	0.9 (0.1)	1.1 (0.1)	1.1 (0.1)
Slovenia	r 2.6 (0.1)	r 1.0 (0.1)	r 3.7 (0.1)	r 1.2 (0.1)	r 1.2 (0.1)	r 1.7 (0.1)	r 0.6 (0.0)	r 1.8 (0.1)
Spain	2.1 (0.1)	1.4 (0.1)	1.8 (0.1)	0.9 (0.1)	1.1 (0.0)	1.6 (0.1)	0.8 (0.0)	1.7 (0.1)
Sweden	2.2 (0.1)	1.6 (0.1)	4.0 (0.1)	0.7 (0.0)	0.8 (0.0)	1.3 (0.1)	0.9 (0.0)	2.3 (0.1)
Switzerland	3.0 (0.1)	r 2.0 (0.1)	r 3.9 (0.1)	r 0.9 (0.1)	r 0.8 (0.1)	r 1.8 (0.1)	r 0.7 (0.0)	r 2.2 (0.1)
Thailand	s 2.6 (0.2)	s 1.9 (0.2)	r 1.8 (0.2)	s 1.5 (0.2)	s 0.5 (0.1)	s 1.3 (0.2)	s 1.1 (0.1)	s 1.5 (0.2)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

[1]Average hours based on: No time=0, Less Than 1 Hour=.5, 1-2 Hours=1.5; 3-4 Hours=3.5; More Than 4 Hours=5.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Opportunities to meet with colleagues to plan curriculum or teaching approaches enable teachers to expand their views of mathematics, their resources for teaching, and their repertoire of teaching and learning skills. Table 5.6 contains teachers' reports on how often they meet with other teachers in their subject area to discuss and plan curriculum or teaching approaches. Teachers of the majority of the students reported weekly or even daily planning meetings in Belgium (French), Colombia, Cyprus, the Czech Republic, England, Hungary, Israel, Kuwait, Latvia (LSS), Lithuania, Norway, Scotland, the Slovak Republic, Slovenia, and Sweden. In the remaining countries, however, most students had mathematics teachers who reported only limited opportunities to plan curriculum or teaching approaches with other teachers (monthly or even yearly meetings). The United States was in this latter category, with teachers of nearly two-thirds of the students reporting meeting monthly or less frequently. In Oregon, teachers' reports resembled those for the United States, but in Missouri this figure rose to 82%. Teachers of 36% of the eighth graders in Missouri reported meeting only once or twice a year.

Table 5.6

Teachers' Reports on How Often They Meet with Other Teachers in Their Subject Area to Discuss and Plan Curriculum or Teaching Approaches - Mathematics - Eighth Grade*

Country		Percent of Students Taught by Teachers			
		Meeting Never or Once/Twice a Year	Meeting Monthly or Every Other Month	Meeting Once, Twice, or Three Times a Week	Meeting Almost Every Day
UNITED STATES		29 (3.7)	37 (3.9)	26 (3.7)	8 (2.4)
MISSOURI		36 (5.0)	46 (5.1)	14 (3.3)	4 (1.5)
OREGON		24 (3.8)	44 (4.5)	28 (3.2)	4 (1.6)
Australia		12 (2.2)	52 (3.3)	24 (2.8)	12 (2.4)
Austria	r	17 (2.9)	37 (4.0)	36 (3.7)	9 (3.0)
Belgium (Fl)		52 (4.8)	29 (4.1)	15 (3.3)	4 (1.7)
Belgium (Fr)	s	19 (4.0)	29 (4.9)	41 (5.4)	11 (3.6)
Canada		29 (3.0)	33 (3.2)	30 (3.7)	8 (2.5)
Colombia		17 (3.6)	32 (4.3)	48 (4.6)	4 (1.7)
Cyprus		3 (1.8)	4 (1.6)	77 (3.8)	17 (3.0)
Czech Republic		12 (2.7)	30 (4.8)	37 (5.3)	21 (3.9)
Denmark		– –	– –	– –	– –
England	s	7 (1.7)	33 (3.3)	52 (3.8)	9 (1.4)
France		35 (5.2)	32 (4.9)	30 (4.5)	3 (1.9)
Germany	s	42 (5.8)	33 (4.8)	15 (3.9)	10 (3.1)
Greece		41 (4.1)	28 (4.9)	22 (3.9)	9 (2.5)
Hong Kong		30 (5.2)	53 (5.8)	16 (4.1)	1 (1.2)
Hungary		2 (1.3)	10 (2.7)	41 (4.4)	46 (4.2)
Iceland	r	23 (4.3)	31 (6.0)	41 (7.2)	4 (3.7)
Iran, Islamic Rep.		21 (5.3)	38 (5.3)	35 (4.3)	6 (2.3)
Ireland		63 (4.4)	25 (4.0)	11 (3.0)	2 (1.2)
Israel	r	5 (3.5)	20 (6.8)	53 (8.0)	21 (5.0)
Japan		23 (3.6)	28 (3.8)	46 (4.3)	3 (1.3)
Korea		23 (3.6)	37 (4.1)	37 (4.4)	3 (1.8)
Kuwait		2 (1.6)	2 (2.2)	67 (6.6)	29 (5.9)
Latvia (LSS)	r	19 (3.7)	31 (3.8)	28 (4.1)	22 (3.8)
Lithuania		14 (2.6)	29 (4.3)	26 (3.5)	31 (3.8)
Netherlands		12 (3.6)	65 (5.6)	21 (4.2)	1 (1.4)
New Zealand		10 (2.5)	43 (4.0)	45 (4.0)	2 (1.0)
Norway		6 (2.1)	17 (3.4)	71 (3.8)	6 (2.0)
Portugal		7 (1.9)	72 (3.9)	18 (3.2)	3 (1.7)
Romania		7 (2.1)	45 (4.0)	24 (3.4)	24 (3.4)
Russian Federation		8 (3.0)	55 (4.3)	25 (3.8)	12 (3.3)
Scotland		5 (2.2)	20 (3.9)	69 (4.2)	6 (2.3)
Singapore		10 (3.1)	68 (4.5)	16 (3.4)	6 (2.4)
Slovak Republic		3 (1.4)	23 (3.6)	30 (4.1)	44 (4.3)
Slovenia	r	2 (1.4)	26 (4.5)	26 (4.2)	46 (4.4)
Spain		16 (3.0)	43 (4.4)	39 (4.6)	2 (1.2)
Sweden		9 (2.3)	17 (2.7)	49 (3.9)	24 (3.2)
Switzerland	r	38 (3.8)	33 (3.8)	26 (3.5)	3 (1.4)
Thailand	r	53 (6.2)	31 (5.7)	12 (4.1)	4 (2.6)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

How Are Mathematics Classes Organized?

Instructional organization can subsume many factors, including the diversity of the students placed into classrooms, the availability of instructional resources, the typical size of classes, and practices regarding in-class grouping. Often, how instruction is organized can influence the implemented curriculum and the opportunities of students.

Figure 5.3 presents teachers reports about several factors that might limit how they teach their mathematics classes. The results are presented visually via pie graphs. The percentage of students whose teachers reported that a particular factor limited how they taught mathematics either "quite a lot" or "a great deal" also is shown next to each graph. In most countries, a substantial number of teachers reported that the differing academic abilities of their students limited how they teach mathematics. However, fewer than half of the U.S. students (44%) and of those in Missouri (42%) and Oregon (36%) were in such classes. In general, fewer teachers reported that students with special needs limited instruction. Comparatively few students appear to be in such mathematics classes in the United States (i.e., United States 15%, Missouri 19%, and Oregon 13%). In many countries about half the students appear to be in classes adversely affected by disruptive students, and the U.S. teachers noted this as a limiting factor for 39% of the students. According to their teachers, more students than in the United States were in such classes in Missouri (47%) and fewer were in Oregon (28%).

Compared to many countries, U.S. classrooms appear to have adequate equipment for use in demonstrations and to be in adequate physical facilities (Figure 5.3). Still, teachers of 29% of the students in Missouri noted shortage of equipment as a limiting factor compared to 13% in Oregon and 20% for the United States as a whole. In a number of the TIMSS countries, teachers reported that high student/teacher ratios were a limiting instructional factor for the majority of the students. Again, this appeared to be somewhat less of a problem in the United States, with 29% of the students in such classes. However, teachers reported this as a limiting factor for 44% of the students in Missouri and 40% of the students in Oregon.

Table 5.7 presents teachers' reports about the size of eighth-grade mathematics classes for the TIMSS countries. The data reveal rather large variations from country to country. According to teachers, mathematics classes were relatively small in a number of countries. For example, 90% or more of the students were in mathematics classes of 30 or fewer students in Belgium (Flemish), Belgium (French), the Czech Republic, Denmark, France, Germany, Hungary, Iceland, Latvia (LSS), Lithuania, the Netherlands, Norway, Portugal, the Russian Federation, Scotland, Slovenia, Sweden, and Switzerland. At the other end of the spectrum, 93% of the students in Korea and 48% in Colombia were in mathematics classes with more than 40 students. Similar to the results for the United States, 73% of the eighth graders in Oregon were in mathematics classes with 30 or fewer students, and only 7% were in classes of 41 or more students. In Missouri, 71% of the students were in classes with 30 or fewer students, but 23% of the students were in classes of 41 or more students.

Extensive research about class size in relation to achievement indicates that the existence of such a relationship is dependent on the situation. Dramatic reductions in class size can be related to gains in achievement, but the chief effects of smaller classes often are in relation to teacher attitudes and instructional behaviors. The

TIMSS data illustrates the complexity of this issue. Across countries, the four highest-performing countries at the eighth grade – Singapore, Korea, Japan, and Hong Kong – are among those with the largest mathematics classes. Within countries, several show little or no relationship between achievement and class size, often because students are mostly all in classes of similar size. Within other countries, there appears to be a curvilinear relationship, or those students with higher achievement appear to be in larger classes. In some countries, larger classes may represent the more usual situation for mathematics teaching, with smaller classes used primarily for students needing remediation or for those students in the less-advanced tracks.

Teachers can adopt a variety of organizational and interactive approaches in mathematics class. Whole-class instruction can be very efficient, because it requires less time on management functions and provides more time for developing mathematics concepts. Teachers can make presentations, conduct discussions, or demonstrate procedures and applications to all students simultaneously. Both whole-class and independent work have been standard features of mathematics classrooms. Students also can benefit from the type of cooperative learning that occurs with effective use of small-group work. Because they can help each other, students in groups can often handle challenging situations beyond their individual capabilities. Further, the positive affective impact of working together mirrors the use of mathematics in the workplace.

Figure 5.3

Teachers' Reports on Factors Limiting How They Teach Class Mathematics - Eighth Grade*

Country	Percent of Students Whose Teachers Report Each Factor Limiting How They Teach Class "Quite a Lot" or "A Great Deal"					
	Students with Different Academic Abilities	Students with Special Needs	Disruptive Students	Shortage of Equipment for Use in Demonstrations and Other Exercises	Inadequate Physical Facilities	High Student / Teacher Ratio
UNITED STATES	r 44	r 15	r 39	r 20	r 13	r 29
MISSOURI	r 42	r 19	r 47	r 29	r 13	r 44
OREGON	r 36	r 13	r 28	r 13	r 14	r 40
Australia	r 50	r 26	r 51	r 24	r 19	r 41
Austria	r 34	r 5	r 13	r 12	r 10	r 19
Belgium (Fl)	34	7	30	10	13	27
Belgium (Fr)	s 49	s 1	s 28	s 12	s 17	s 28
Canada	r 57	r 24	39	r 22	r 12	32
Colombia	28	52	46	42	r 43	r 53
Cyprus	r 84	r 55	r 65	r 36	r 39	r 85
Czech Republic	72	12	30	23	15	38
Denmark	41	7	38	32	28	32
England	s 32	s 16	s 24	s 16	s 18	s 24
France	62	9	35	13	13	38
Germany	s 54	s 12	s 38	s 15	s 19	s 38
Greece	86	47	41	53	49	80
Hong Kong	71	19	52	19	18	80
Hungary	92	52	55	47	35	46
Iceland	r 92	r 40	r 64	r 33	r 36	r 65
Iran, Islamic Rep.	89	63	50	69	55	62

Percent for "Quite a Lot" or "A Great Deal" →

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).
Background data for Bulgaria and South Africa not available.
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Figure 5.3 (Continued)

Teachers' Reports on What Factors Limit How They Teach Class Mathematics - Eighth Grade*

Country	Percent of Students Whose Teachers Report Each Factor Limiting How They Teach Class "Quite a Lot" or "A Great Deal"					
	Students with Different Academic Abilities	Students with Special Needs	Disruptive Students	Shortage of Equipment for Use in Demonstrations and Other Exercises	Inadequate Physical Facilities	High Student/Teacher Ratio
Ireland	61	r 28	41	r 10	r 14	39
Israel	r 63	r 5	r 6	r 25	r 16	r 23
Japan	63	–	–	12	–	42
Korea	77	38	60	31	36	67
Kuwait	67	49	51	46	28	89
Latvia (LSS)	r 81	r 31	r 22	r 46	r 29	29
Lithuania	89	r 21	37	73	28	48
Netherlands	21	0	15	4	10	15
New Zealand	53	24	46	26	17	37
Norway	r 67	r 27	r 31	r 35	r 16	r 54
Portugal	70	54	54	38	37	57
Romania	72	45	51	68	69	65
Russian Federation	77	21	18	66	47	42
Scotland	57	11	35	14	20	54
Singapore	55	13	44	25	15	60
Slovak Republic	64	11	39	40	1	34
Slovenia	r 49	r 6	r 48	r 31	r 34	r 52
Spain	r 80	r 58	r 64	r 39	r 28	r 66
Sweden	r 50	r 22	r 32	r 14	r 14	r 47
Switzerland	s 62	s 10	s 26	s 8	s 5	s 30
Thailand	r 82	r 34	r 31	r 80	r 75	r 66

Percent for "Quite a Lot" or "A Great Deal" →

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).
Background data for Bulgaria and South Africa not available.
A dash (–) indicates data are not available.
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

Table 5.7

Teachers' Reports on Average Size of Mathematics Class - Eighth Grade*

Country	1 - 20 Students		21 - 30 Students		31 - 40 Students		41 or More Students	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
UNITED STATES	s 24 (3.0)	504 (9.6)	59 (3.9)	507 (5.7)	12 (2.2)	506 (17.0)	4 (1.8)	490 (22.3)
MISSOURI	r 15 (2.4)	504 (7.0)	56 (5.3)	510 (7.4)	7 (1.7)	531 (13.0)	23 (5.6)	491 (9.0)
OREGON	r 22 (2.6)	504 (7.4)	51 (4.2)	533 (8.9)	19 (4.0)	581 (12.5)	7 (2.4)	517 (19.4)
Australia	r 13 (2.4)	497 (14.6)	71 (3.3)	528 (5.4)	16 (2.6)	583 (9.7)	1 (0.5)	~ ~
Austria	x x	x x	x x	x x	x x	x x	x x	x x
Belgium (Fl)	49 (3.6)	552 (8.2)	51 (3.6)	596 (4.4)	0 (0.0)	~ ~	0 (0.0)	~ ~
Belgium (Fr)	s 43 (5.3)	535 (6.2)	57 (5.3)	551 (6.1)	0 (0.0)	~ ~	0 (0.0)	~ ~
Canada	r 11 (2.1)	524 (10.3)	65 (4.0)	527 (3.4)	23 (3.6)	534 (11.7)	1 (0.5)	~ ~
Colombia	r 16 (4.2)	400 (24.3)	6 (2.2)	361 (4.1)	29 (4.0)	394 (6.5)	48 (4.6)	384 (3.9)
Cyprus	r 1 (0.0)	~ ~	37 (3.9)	467 (4.3)	62 (3.9)	474 (3.2)	0 (0.0)	~ ~
Czech Republic	13 (3.3)	534 (6.2)	77 (5.3)	564 (6.2)	11 (4.5)	591 (13.7)	0 (0.0)	~ ~
Denmark	r 49 (4.8)	504 (3.8)	51 (4.8)	506 (3.7)	0 (0.0)	~ ~	0 (0.0)	~ ~
England	s 18 (3.1)	482 (12.2)	62 (3.7)	511 (5.9)	20 (3.4)	554 (7.9)	0 (0.0)	~ ~
France	11 (2.6)	512 (8.8)	86 (2.9)	543 (3.9)	3 (1.8)	519 (8.7)	0 (0.0)	~ ~
Germany	s 25 (4.4)	493 (15.6)	72 (4.5)	522 (5.6)	3 (1.8)	558 (40.8)	0 (0.0)	~ ~
Greece	9 (2.3)	462 (9.7)	64 (4.4)	489 (3.3)	27 (3.9)	481 (7.2)	0 (0.0)	~ ~
Hong Kong	3 (1.9)	501 (63.7)	4 (2.2)	605 (35.3)	56 (5.7)	584 (10.7)	37 (5.9)	606 (10.1)
Hungary	37 (4.0)	528 (5.2)	57 (4.1)	541 (4.9)	6 (2.2)	551 (17.8)	0 (0.0)	~ ~
Iceland	r 36 (5.9)	478 (4.8)	64 (5.9)	497 (7.1)	0 (0.0)	~ ~	0 (0.0)	~ ~
Iran, Islamic Rep.	r 1 (0.9)	~ ~	26 (4.5)	428 (6.3)	54 (5.3)	431 (2.3)	19 (4.4)	424 (7.7)
Ireland	r 12 (2.7)	454 (8.5)	68 (4.5)	526 (6.7)	20 (3.9)	575 (9.5)	0 (0.0)	~ ~
Israel	r 14 (5.1)	495 (13.2)	36 (7.4)	524 (10.2)	49 (9.1)	529 (13.8)	2 (1.6)	~ ~
Japan	0 (0.2)	~ ~	4 (1.4)	598 (8.5)	88 (2.0)	600 (2.2)	8 (1.5)	667 (10.1)
Korea	2 (1.2)	~ ~	1 (1.0)	~ ~	4 (1.5)	562 (6.6)	93 (2.0)	611 (2.6)
Kuwait	0 (0.0)	~ ~	49 (8.0)	395 (3.1)	49 (7.8)	390 (4.0)	2 (1.9)	~ ~
Latvia (LSS)	r 41 (4.0)	482 (5.1)	51 (3.8)	501 (4.3)	4 (2.1)	502 (23.4)	4 (2.0)	469 (11.4)
Lithuania	r 43 (3.8)	461 (4.8)	54 (3.7)	491 (5.7)	3 (1.6)	502 (21.1)	0 (0.0)	~ ~
Netherlands	16 (4.7)	467 (21.0)	77 (5.6)	549 (6.5)	7 (3.6)	631 (18.1)	0 (0.0)	~ ~
New Zealand	11 (2.2)	460 (6.8)	68 (3.8)	508 (5.8)	21 (3.1)	536 (9.0)	0 (0.0)	~ ~
Norway	r 20 (3.5)	499 (6.2)	79 (3.7)	510 (2.9)	1 (0.5)	~ ~	1 (0.8)	~ ~
Portugal	12 (2.8)	440 (4.4)	80 (3.7)	456 (3.1)	7 (2.6)	469 (12.1)	0 (0.0)	~ ~
Romania	23 (2.7)	462 (7.9)	51 (4.3)	470 (5.3)	24 (4.1)	516 (9.0)	2 (1.2)	~ ~
Russian Federation	15 (2.7)	514 (12.1)	75 (3.6)	539 (5.8)	9 (2.3)	544 (8.6)	0 (0.0)	~ ~
Scotland	r 12 (2.8)	455 (11.6)	80 (3.8)	496 (6.9)	8 (2.7)	543 (18.4)	0 (0.0)	~ ~
Singapore	1 (0.7)	~ ~	10 (2.5)	645 (13.2)	72 (4.3)	640 (6.2)	18 (4.0)	656 (8.8)
Slovak Republic	15 (2.8)	526 (8.5)	67 (4.2)	546 (4.1)	19 (3.6)	556 (8.5)	0 (0.0)	~ ~
Slovenia	r 15 (3.1)	513 (6.8)	80 (3.6)	545 (4.0)	5 (1.8)	554 (18.5)	0 (0.0)	~ ~
Spain	r 13 (2.8)	470 (5.9)	48 (4.0)	484 (4.5)	36 (4.2)	497 (4.6)	4 (1.7)	476 (10.9)
Sweden	r 36 (3.9)	492 (5.8)	61 (4.0)	534 (3.9)	2 (1.2)	~ ~	0 (0.0)	~ ~
Switzerland	s 56 (4.5)	543 (8.1)	44 (4.5)	565 (6.6)	0 (0.0)	~ ~	0 (0.0)	~ ~
Thailand	x x	x x	x x	x x	x x	x x	x x	x x

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

An "x" indicates teacher response data available for <50% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

Figure 5.4 provides a pictorial view of the emphasis on individual, small-group, and whole-class work as reported by the mathematics teachers in the TIMSS countries. Because learning may be enhanced with teacher guidance and monitoring individual and small-group activities, the frequency of lessons using each of these organizational approaches is shown both with and without assistance of the teacher. Internationally, teachers reported that students working together as a class with the teacher teaching the whole class is a frequently used instructional approach. In Oregon and Missouri, as well as in most countries approximately 50% or even more of the eighth-grade students were taught this way during most or every lesson. In contrast, students working together as a class and responding to each other appeared to be a much less common approach, generally used for a third or fewer of the students on a frequent basis (except in Israel).

Equally as popular as having students working together as a class with the teacher teaching the whole class, was having students work individually with assistance from the teacher. This approach was relatively frequent in the U.S. (50% of the students in most lessons), although it was reported more frequently in Missouri (63%) than in Oregon (42%). Compared to most of the TIMSS countries including the United States, teachers in Oregon reported a high degree of group work, both in terms of having it teacher assisted (48% of the students in most lessons) and unassisted (24%).

Figure 5.4

Teachers' Reports About Classroom Organization During Mathematics Lessons Eighth Grade*

Country	Percent of Students Whose Teachers Report Using Each Organizational Approach "Most or Every Lesson"					
	Work Together as a Class with Students Responding to One Another	Work Together as a Class with Teacher Teaching the Whole Class	Work Individually with Assistance from Teacher	Work Individually without Assistance from Teacher	Work in Pairs or Small Groups with Assistance from Teacher	Work in Pairs or Small Groups without Assistance from Teacher
UNITED STATES	r 22	r 49	r 50	r 19	r 26	r 12
MISSOURI	r 22	r 54	r 63	r 26	r 13	r 4
OREGON	r 29	r 56	r 42	r 25	r 48	r 24
Australia	r 14	r 46	r 64	r 27	r 25	r 9
Austria	r 6	r 52	r 51	r 23	r 19	r 7
Belgium (Fl)	10	59	57	36	5	5
Belgium (Fr)	s 7	s 38	s 55	s 29	s 11	s 5
Canada	r 12	37	57	r 25	r 28	r 14
Colombia	25	41	55	r 19	44	r 22
Cyprus	r 13	r 61	r 73	r 23	r 26	r 9
Czech Republic	5	47	72	42	13	8
Denmark	5	41	74	16	18	4
England	s 19	s 46	s 57	s 25	s 14	s 8
France	11	48	56	26	17	4
Germany	s 23	s 70	s 54	s 15	s 20	s 9
Greece	4	58	60	18	14	3
Hong Kong	11	37	62	17	9	4
Hungary	11	60	65	22	7	1
Iceland	r 2	r 39	r 82	r 38	r 32	r 17
Iran, Islamic Rep.	33	66	55	8	42	10

Percent for "Most or Every Lesson" →

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).
Background data for Bulgaria and South Africa not available.
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Figure 5.4 (Continued)

Teachers' Reports About Classroom Organization During Mathematics Lessons
Eighth Grade*

Country	Percent of Students Whose Teachers Report Using Each Organizational Approach "Most or Every Lesson"					
	Work Together as a Class with Students Responding to One Another	Work Together as a Class with Teacher Teaching the Whole Class	Work Individually with Assistance from Teacher	Work Individually without Assistance from Teacher	Work in Pairs or Small Groups with Assistance from Teacher	Work in Pairs or Small Groups without Assistance from Teacher
Ireland	r 7	67	47	37	r 9	r 6
Israel	r 70	r 65	r 35	r 68	r 51	r 62
Japan	22	78	27	15	7	1
Korea	39	89	41	30	12	11
Kuwait	3	34	48	14	7	5
Latvia (LSS)	24	86	90	r 55	28	r 11
Lithuania	10	55	72	25	32	10
Netherlands	7	56	65	38	49	34
New Zealand	19	52	63	28	25	14
Norway	r 17	r 57	r 71	s 4	r 36	s 6
Portugal	10	67	69	5	50	4
Romania	12	86	56	19	18	3
Russian Federation	6	66	65	37	22	13
Scotland	r 5	r 34	r 62	r 28	r 7	r 3
Singapore	15	61	48	27	20	6
Slovak Republic	35	47	50	31	8	7
Slovenia	r 11	r 60	r 87	r 34	r 40	r 11
Spain	r 15	r 68	r 58	r 24	r 15	r 10
Sweden	r 24	r 50	r 72	r 1	r 43	r 5
Switzerland	s 4	s 48	s 61	s 25	s 35	s 20
Thailand	r 19	s 58	r 41	r 18	r 22	r 5

Percent for "Most or Every Lesson" →

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).
Background data for Bulgaria and South Africa not available.
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

What Activities Do Students Do in Their Mathematics Lessons?

As shown in Table 5.8, mathematics teachers in the participating countries generally reported heavier reliance on curriculum guides than textbooks or examination specifications in deciding which topics to teach. In contrast, in almost all countries, the textbook was the major written source mathematics teachers used in deciding how to present a topic to their classes. The United States as well as Missouri and Oregon followed the international patterns. In both Missouri and Oregon about three-fourths of the students were in mathematics classrooms where teachers reported relying on curriculum guides in deciding what to teach and about one-fourth were in classrooms where teachers used the textbook for this purpose. In Missouri, the percentages essentially were reversed for deciding how to present a topic. Twenty percent of the students in classes where teachers used the curriculum guide and 80% in classes where teachers used the textbook. In Oregon, 96% of the students were in classes where teachers used textbooks as the major source of written information in deciding how to present a topic.

The types of activities teachers asked eighth-grade students to do in mathematics classes varied from country to country. Teachers were asked how often they asked students to practice computational skills, and the responses are shown in Table 5.9. It appears that in most countries, the majority of the students practice computation in most or every lesson. The results for the United States as well as for Missouri and Oregon were consistent with the international patterns.

The data in Table 5.10 reveal that the majority of students in most countries also were asked to do some type of mathematics reasoning tasks in most or every lesson. The activities TIMSS asked about included explaining the reasoning behind an idea, using tables, charts, or graphs to represent and analyze relationships, working on problems for which there is no immediately obvious solution, and/or writing equations to represent relationships. The results for the United States as well as Missouri and Oregon were consistent with those for most countries. Approximately three-fourths of the students were asked to do reasoning tasks in most or every lesson, however, in Cyprus, Romania, and the Russian Federation, 55% or more of the students were asked to do at least one of these types of reasoning tasks in every lesson.

Teachers were not asked about the emphasis placed on using things from everyday life in solving mathematics problems, but students were (see Table 5.11). According to eighth-grade students, internationally, only a moderate emphasis is placed on doing these types of problems in mathematics class. Only in Canada, Cyprus, England, Greece, Iran, Latvia(LSS), New Zealand, Spain, and the United States did more than 50% of the students report being asked to do such problems on a frequent basis (pretty often or almost always). The results for Missouri and Oregon were nearly identical to those for the United States, with just about half the students being asked to do such types of problems on a regular basis.

Table 5.8

Teachers' Reports on Their Main Sources of Written Information[1] When Deciding Which Topics to Teach and How to Present a Topic - Mathematics - Eighth Grade*

Country	Percent of Students Taught by Teachers					
	Deciding Which Topics to Teach			Deciding How to Present a Topic		
	Curriculum Guide	Textbook	Examination Specifications	Curriculum Guide	Textbook	Examination Specifications
UNITED STATES	s 64 (3.7)	30 (3.3)	6 (1.3)	s 9 (2.3)	88 (2.4)	3 (1.2)
MISSOURI	r 75 (4.4)	24 (4.4)	2 (0.2)	r 20 (5.2)	80 (5.2)	0 (0.0)
OREGON	r 72 (3.8)	25 (3.5)	3 (1.7)	r 4 (2.0)	96 (2.0)	0 (0.0)
Australia	r 91 (2.0)	9 (2.0)	– –	r 13 (2.4)	87 (2.4)	– –
Austria	r 75 (4.2)	25 (4.2)	0 (0.2)	r 28 (3.9)	72 (3.8)	0 (0.2)
Belgium (Fl)	92 (2.7)	8 (2.7)	– –	r 8 (2.3)	92 (2.3)	– –
Belgium (Fr)	s 87 (4.6)	13 (4.6)	– –	s 2 (1.4)	98 (1.4)	– –
Canada	– –	– –	– –	– –	– –	– –
Colombia	r 63 (5.2)	35 (5.1)	3 (1.3)	r 43 (5.9)	56 (5.8)	1 (0.7)
Cyprus	r 67 (5.7)	33 (5.7)	0 (0.0)	r 17 (4.3)	83 (4.3)	0 (0.0)
Czech Republic	79 (4.6)	21 (4.6)	– –	9 (3.4)	91 (3.4)	– –
Denmark	– –	– –	– –	– –	– –	– –
England	– –	– –	– –	– –	– –	– –
France	89 (2.6)	10 (2.4)	1 (0.9)	r 13 (2.9)	87 (2.9)	0 (0.0)
Germany	s 80 (4.1)	20 (4.1)	– –	s 25 (5.4)	75 (5.4)	– –
Greece	53 (4.1)	47 (4.1)	– –	5 (1.9)	95 (1.9)	– –
Hong Kong	61 (6.3)	30 (6.0)	9 (2.2)	15 (4.5)	85 (4.5)	0 (0.0)
Hungary	79 (3.1)	19 (3.1)	2 (1.3)	18 (3.2)	81 (3.1)	1 (0.8)
Iceland	s 63 (8.1)	36 (8.1)	1 (0.1)	s 12 (3.9)	87 (4.0)	1 (0.1)
Iran, Islamic Rep.	r 64 (4.9)	31 (4.7)	5 (2.1)	r 55 (5.9)	36 (5.6)	9 (2.7)
Ireland	r 65 (4.8)	35 (4.8)	– –	r 14 (3.6)	86 (3.6)	– –
Israel	r 91 (4.9)	5 (3.1)	5 (3.6)	r 28 (6.5)	69 (7.2)	3 (3.3)
Japan	24 (3.4)	74 (3.5)	1 (1.1)	11 (2.4)	87 (2.8)	2 (1.4)
Korea	22 (3.4)	76 (3.6)	2 (1.1)	22 (3.2)	74 (3.5)	4 (1.7)
Kuwait	– –	– –	– –	– –	– –	– –
Latvia (LSS)	r 81 (4.0)	16 (3.7)	3 (1.5)	r 17 (3.2)	80 (3.8)	4 (1.8)
Lithuania	r 88 (3.1)	10 (2.8)	2 (1.3)	r 6 (2.3)	93 (2.2)	1 (0.9)
Netherlands	2 (1.3)	87 (4.0)	12 (3.8)	1 (0.8)	94 (2.8)	5 (2.7)
New Zealand	91 (2.6)	5 (2.0)	4 (1.7)	47 (4.3)	53 (4.3)	0 (0.0)
Norway	r 53 (4.8)	47 (4.8)	– –	s 9 (2.9)	91 (2.9)	– –
Portugal	86 (3.1)	14 (3.1)	– –	64 (4.9)	36 (4.9)	– –
Romania	94 (2.2)	3 (1.5)	3 (1.6)	28 (3.7)	67 (3.8)	5 (2.1)
Russian Federation	76 (4.4)	13 (2.8)	11 (3.2)	7 (2.5)	86 (3.6)	6 (2.7)
Scotland	s 79 (4.3)	10 (3.5)	11 (3.6)	s 28 (4.7)	68 (5.1)	4 (2.9)
Singapore	82 (3.5)	18 (3.5)	0 (0.2)	10 (2.8)	89 (2.8)	1 (0.4)
Slovak Republic	83 (3.6)	17 (3.6)	0 (0.0)	16 (3.0)	83 (3.1)	1 (0.8)
Slovenia	r 87 (3.7)	9 (3.1)	4 (2.0)	r 27 (4.5)	71 (4.8)	2 (1.6)
Spain	– –	– –	– –	– –	– –	– –
Sweden	r 46 (3.8)	54 (3.8)	– –	r 6 (1.7)	94 (1.7)	– –
Switzerland	s 69 (4.6)	30 (4.6)	1 (0.6)	x x	x x	x x
Thailand	s 44 (6.3)	50 (6.4)	6 (3.3)	r 17 (4.5)	83 (4.5)	0 (0.0)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

[1]Curriculum Guides include national, regional, and school curriculum guides; Textbooks include teacher and student editions, as well as other resource books; and Examination Specifications include national and regional levels.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

An "x" indicates teacher response data available for <50% of students.

Table 5.9

Teachers' Reports on How Often They Ask Students to Practice Computational Skills

Mathematics - Eighth Grade*

Country		Never or Almost Never		Some Lessons		Most Lessons		Every Lesson	
		Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
UNITED STATES	r	11 (1.9)	536 (12.9)	31 (3.4)	510 (9.2)	38 (4.4)	485 (6.2)	21 (3.9)	499 (10.4)
MISSOURI	r	12 (4.8)	531 (16.6)	27 (5.0)	524 (8.9)	44 (5.1)	490 (6.2)	17 (4.0)	495 (11.7)
OREGON	r	9 (2.5)	575 (8.8)	32 (3.8)	534 (10.5)	42 (3.9)	535 (9.8)	17 (2.5)	507 (8.0)
Australia	r	10 (2.2)	527 (16.0)	40 (3.4)	544 (7.0)	38 (3.5)	529 (7.0)	13 (2.2)	507 (14.1)
Austria	r	3 (1.7)	607 (12.8)	27 (3.6)	568 (7.3)	49 (3.7)	546 (7.0)	21 (2.7)	517 (10.3)
Belgium (Fl)		0 (0.0)	~ ~	33 (3.8)	603 (6.6)	49 (4.7)	574 (7.9)	18 (3.8)	524 (17.4)
Belgium (Fr)	s	4 (4.0)	553 (0.0)	28 (5.2)	530 (8.4)	52 (6.0)	548 (6.6)	16 (4.4)	551 (15.3)
Canada		4 (1.7)	529 (5.1)	36 (4.0)	527 (6.2)	42 (4.1)	531 (5.6)	18 (2.8)	525 (11.2)
Colombia		2 (1.2)	~ ~	13 (2.9)	391 (8.7)	50 (5.0)	383 (3.9)	35 (5.0)	391 (9.1)
Cyprus	r	5 (1.3)	490 (24.7)	38 (5.3)	464 (4.8)	42 (5.3)	469 (3.8)	15 (4.1)	477 (11.2)
Czech Republic		0 (0.0)	~ ~	23 (4.8)	558 (7.6)	37 (4.6)	567 (8.3)	40 (5.2)	559 (8.2)
Denmark		2 (1.4)	~ ~	51 (4.1)	507 (4.1)	42 (4.3)	500 (3.6)	6 (2.1)	497 (14.9)
England	s	7 (1.6)	542 (20.8)	52 (2.6)	515 (6.0)	34 (2.8)	506 (8.0)	8 (1.9)	539 (17.3)
France		6 (2.1)	534 (10.2)	44 (4.8)	549 (4.5)	44 (4.2)	536 (5.4)	7 (2.1)	517 (15.7)
Germany	s	17 (3.3)	479 (12.1)	51 (5.0)	522 (8.4)	25 (4.4)	525 (11.2)	7 (2.8)	501 (26.4)
Greece		7 (2.0)	456 (9.6)	52 (4.3)	482 (4.8)	33 (3.8)	491 (4.5)	8 (2.1)	491 (11.8)
Hong Kong		21 (5.3)	591 (16.1)	23 (4.9)	598 (17.0)	35 (5.1)	575 (13.2)	21 (4.4)	595 (15.4)
Hungary		0 (0.0)	~ ~	13 (3.1)	543 (10.8)	51 (4.3)	536 (5.1)	35 (4.3)	537 (5.5)
Iceland	r	0 (0.0)	~ ~	12 (4.4)	489 (6.5)	40 (6.1)	479 (6.9)	49 (6.7)	498 (7.7)
Iran, Islamic Rep.		7 (2.8)	416 (14.3)	51 (5.6)	431 (2.3)	29 (5.3)	432 (3.8)	13 (3.3)	432 (6.9)
Ireland		19 (3.9)	524 (14.8)	29 (4.2)	527 (10.7)	37 (4.5)	527 (9.7)	15 (3.1)	531 (19.1)
Israel	r	18 (5.9)	518 (18.9)	36 (7.4)	520 (11.2)	41 (6.3)	522 (12.8)	4 (2.6)	545 (44.6)
Japan		– –	– –	– –	– –	– –	– –	– –	– –
Korea		19 (3.4)	610 (5.9)	53 (4.3)	609 (3.7)	24 (4.0)	612 (5.3)	4 (1.3)	603 (10.8)
Kuwait		1 (0.6)	~ ~	28 (6.0)	390 (2.4)	51 (7.4)	391 (3.1)	20 (5.9)	393 (5.5)
Latvia (LSS)		– –	– –	– –	– –	– –	– –	– –	– –
Lithuania		0 (0.0)	~ ~	2 (1.0)	~ ~	30 (3.7)	482 (7.5)	68 (3.9)	476 (4.7)
Netherlands		– –	– –	– –	– –	– –	– –	– –	– –
New Zealand		7 (2.3)	519 (17.9)	45 (3.8)	509 (6.2)	40 (3.6)	505 (6.4)	7 (2.2)	509 (21.2)
Norway	r	5 (2.0)	506 (7.9)	59 (4.4)	505 (3.4)	34 (4.4)	509 (4.5)	2 (1.2)	~ ~
Portugal		– –	– –	– –	– –	– –	– –	– –	– –
Romania		0 (0.0)	~ ~	12 (2.6)	476 (15.0)	35 (4.1)	482 (8.4)	53 (4.4)	483 (6.2)
Russian Federation		0 (0.4)	~ ~	13 (2.3)	517 (12.4)	43 (3.6)	545 (9.0)	44 (3.5)	530 (7.9)
Scotland		– –	– –	– –	– –	– –	– –	– –	– –
Singapore		20 (3.7)	645 (11.6)	30 (4.2)	644 (9.4)	36 (4.4)	639 (7.4)	13 (3.3)	652 (15.2)
Slovak Republic		3 (1.3)	533 (16.2)	35 (4.6)	545 (6.3)	36 (4.2)	550 (5.7)	27 (4.1)	541 (5.8)
Slovenia	r	0 (0.0)	~ ~	21 (4.3)	535 (8.2)	36 (5.5)	551 (6.0)	43 (5.4)	533 (4.8)
Spain	r	30 (4.1)	481 (4.8)	42 (4.8)	490 (4.3)	23 (4.3)	491 (7.3)	4 (2.4)	477 (7.0)
Sweden	r	2 (0.9)	~ ~	18 (2.6)	512 (6.8)	51 (3.7)	523 (4.5)	29 (3.6)	515 (6.6)
Switzerland	s	4 (1.9)	545 (30.8)	21 (4.0)	560 (18.4)	59 (5.0)	552 (5.9)	16 (3.7)	548 (12.4)
Thailand	r	0 (0.0)	~ ~	13 (4.6)	547 (20.5)	42 (5.9)	519 (10.1)	45 (6.5)	529 (9.6)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

Table 5.10

Teachers' Reports on How Often They Ask Students to Do Reasoning Tasks[1]

Mathematics - Eighth Grade*

Country	Never or Almost Never		Some Lessons		Most Lessons		Every Lesson	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
UNITED STATES	r 0 (0.0)	~ ~	24 (3.4)	495 (8.1)	50 (3.5)	498 (5.9)	26 (3.3)	514 (10.2)
MISSOURI	r 0 (0.0)	~ ~	28 (5.2)	485 (7.5)	53 (5.5)	506 (6.2)	19 (3.3)	531 (16.0)
OREGON	r 0 (0.0)	~ ~	22 (3.7)	504 (16.6)	60 (4.4)	542 (4.7)	18 (3.7)	541 (19.3)
Australia	r 1 (0.9)	~ ~	38 (3.0)	520 (8.6)	48 (3.2)	538 (6.0)	13 (2.4)	547 (8.5)
Austria	r 0 (0.0)	~ ~	25 (3.4)	539 (10.2)	57 (4.5)	548 (6.4)	18 (3.4)	561 (10.3)
Belgium (Fl)	0 (0.3)	~ ~	25 (4.3)	549 (13.7)	56 (4.7)	577 (8.4)	19 (3.4)	604 (9.2)
Belgium (Fr)	s 0 (0.0)	~ ~	21 (4.3)	531 (8.7)	48 (6.1)	542 (6.1)	31 (5.7)	556 (9.3)
Canada	0 (0.0)	~ ~	19 (3.0)	527 (8.1)	62 (3.8)	529 (4.0)	19 (3.6)	529 (8.7)
Colombia	0 (0.0)	~ ~	18 (3.5)	377 (4.4)	56 (5.1)	392 (3.4)	26 (5.0)	382 (11.7)
Cyprus	r 0 (0.0)	~ ~	4 (2.2)	468 (41.8)	39 (4.8)	469 (5.6)	58 (5.2)	471 (2.8)
Czech Republic	0 (0.0)	~ ~	9 (3.4)	570 (20.6)	56 (5.5)	558 (7.3)	36 (5.1)	566 (8.0)
Denmark	4 (2.6)	477 (8.1)	59 (4.8)	507 (3.4)	31 (4.5)	504 (4.3)	5 (2.3)	500 (16.6)
England	s 0 (0.0)	~ ~	25 (2.7)	506 (9.5)	60 (3.0)	518 (5.4)	14 (2.1)	524 (12.3)
France	0 (0.0)	~ ~	32 (4.3)	528 (5.2)	48 (4.7)	550 (5.5)	20 (3.8)	537 (9.9)
Germany	s 1 (1.0)	~ ~	24 (4.4)	515 (13.5)	58 (4.8)	518 (7.6)	17 (3.9)	510 (11.4)
Greece	1 (0.6)	~ ~	15 (2.9)	475 (6.7)	47 (4.1)	485 (4.8)	37 (3.9)	488 (6.4)
Hong Kong	1 (1.2)	~ ~	33 (5.5)	595 (12.6)	58 (5.6)	584 (9.8)	8 (3.2)	578 (28.7)
Hungary	0 (0.0)	~ ~	8 (2.4)	502 (6.6)	54 (4.6)	538 (5.2)	38 (4.5)	543 (5.8)
Iceland	r 1 (1.3)	~ ~	72 (6.4)	489 (5.1)	22 (5.9)	497 (15.0)	5 (2.3)	468 (19.5)
Iran, Islamic Rep.	0 (0.0)	~ ~	30 (6.3)	427 (5.6)	47 (6.0)	429 (3.0)	23 (4.5)	434 (4.0)
Ireland	1 (0.6)	~ ~	55 (4.8)	525 (8.1)	33 (4.3)	520 (8.8)	12 (3.3)	562 (18.0)
Israel	r 3 (2.7)	474 (0.0)	9 (4.3)	532 (12.5)	68 (8.1)	528 (9.9)	20 (5.9)	502 (15.7)
Japan	0 (0.0)	~ ~	7 (2.2)	594 (5.1)	55 (4.4)	604 (2.9)	37 (4.3)	608 (4.4)
Korea	1 (0.7)	~ ~	3 (1.5)	640 (9.6)	72 (3.7)	608 (3.0)	24 (3.4)	612 (6.8)
Kuwait	2 (2.4)	~ ~	49 (5.9)	392 (3.4)	41 (5.2)	392 (3.1)	8 (4.1)	386 (3.2)
Latvia (LSS)	r 0 (0.0)	~ ~	16 (3.6)	482 (8.6)	60 (4.8)	490 (4.2)	24 (4.4)	499 (7.1)
Lithuania	0 (0.0)	~ ~	15 (2.8)	467 (10.6)	59 (4.4)	475 (5.5)	26 (4.0)	490 (6.4)
Netherlands	– –	– –	– –	– –	– –	– –	– –	– –
New Zealand	0 (0.0)	~ ~	35 (3.4)	493 (6.9)	53 (3.9)	514 (6.6)	12 (2.7)	525 (12.7)
Norway	r 0 (0.0)	~ ~	47 (4.4)	506 (4.0)	48 (4.3)	508 (3.6)	5 (2.2)	509 (13.0)
Portugal	0 (0.0)	~ ~	16 (3.1)	454 (5.7)	66 (4.0)	454 (3.1)	18 (3.5)	456 (6.5)
Romania	0 (0.0)	~ ~	5 (1.7)	444 (21.5)	22 (3.2)	476 (9.4)	74 (3.4)	486 (4.9)
Russian Federation	0 (0.0)	~ ~	6 (1.9)	508 (13.3)	39 (4.0)	525 (6.1)	55 (4.8)	545 (7.0)
Scotland	– –	– –	– –	– –	– –	– –	– –	– –
Singapore	0 (0.0)	~ ~	34 (4.1)	637 (9.5)	57 (4.5)	648 (6.2)	8 (2.3)	642 (20.7)
Slovak Republic	0 (0.0)	~ ~	5 (2.0)	531 (7.2)	66 (4.0)	545 (4.0)	29 (3.9)	548 (5.7)
Slovenia	r 0 (0.0)	~ ~	13 (3.4)	537 (7.0)	77 (4.6)	541 (4.2)	10 (3.2)	539 (6.9)
Spain	r 0 (0.0)	~ ~	15 (3.3)	469 (5.2)	67 (4.2)	488 (3.5)	18 (3.3)	497 (6.2)
Sweden	r 1 (0.5)	~ ~	35 (3.8)	515 (6.6)	46 (3.7)	520 (4.0)	18 (2.8)	523 (7.5)
Switzerland	s 2 (1.6)	~ ~	31 (4.7)	538 (12.0)	52 (5.0)	556 (7.3)	15 (3.2)	583 (8.9)
Thailand	r 0 (0.0)	~ ~	49 (6.7)	525 (11.5)	34 (6.2)	521 (10.8)	17 (4.7)	544 (11.3)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

[1]Based on most frequent response for: explain reasoning behind an idea; represent and analyze relationships using tables, charts or graphs; work on problems for which there is no immediately obvious method of solution; and write equations to represent relationships.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Table 5.11

Students' Reports on Using Things from Everyday Life in Solving Mathematics Problems

Eighth Grade*

Country	Never		Once in a While		Pretty Often		Almost Always	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
UNITED STATES	14 (0.8)	491 (6.3)	34 (1.1)	515 (4.7)	31 (1.0)	504 (5.0)	21 (0.9)	481 (5.4)
MISSOURI	14 (1.1)	495 (9.6)	35 (1.3)	530 (6.8)	32 (1.3)	499 (6.8)	20 (0.9)	475 (8.1)
OREGON	10 (0.8)	524 (11.7)	37 (1.4)	537 (8.4)	34 (1.3)	524 (7.7)	20 (1.2)	510 (10.9)
Australia	14 (0.6)	512 (5.4)	39 (0.9)	543 (3.9)	34 (0.8)	536 (4.7)	13 (0.6)	513 (5.5)
Austria	21 (1.1)	536 (4.6)	44 (1.2)	546 (4.1)	23 (0.8)	545 (4.8)	12 (0.8)	519 (6.3)
Belgium (Fl)	34 (1.5)	563 (5.0)	41 (1.4)	576 (7.8)	20 (1.0)	567 (5.6)	5 (0.5)	512 (10.2)
Belgium (Fr)	39 (1.5)	525 (4.4)	39 (1.4)	543 (4.1)	15 (1.0)	514 (7.7)	8 (0.7)	510 (11.8)
Canada	13 (1.0)	528 (6.9)	36 (0.8)	534 (2.3)	34 (1.0)	530 (3.3)	17 (0.6)	517 (3.9)
Colombia	20 (1.6)	386 (4.9)	32 (1.5)	392 (4.5)	23 (1.0)	392 (4.5)	25 (1.2)	382 (5.5)
Cyprus	18 (1.0)	464 (3.6)	28 (0.9)	483 (3.4)	38 (1.0)	481 (3.5)	16 (0.9)	462 (4.4)
Czech Republic	16 (0.8)	553 (5.6)	41 (1.1)	565 (5.8)	34 (1.3)	573 (5.5)	9 (0.6)	552 (8.3)
Denmark	28 (1.3)	494 (4.7)	51 (1.5)	510 (3.5)	16 (1.3)	508 (5.2)	5 (0.5)	485 (11.0)
England	11 (0.9)	509 (7.4)	36 (1.2)	508 (4.3)	41 (1.3)	512 (2.7)	12 (0.8)	487 (6.9)
France	24 (1.5)	526 (3.7)	38 (1.0)	543 (3.2)	26 (1.3)	549 (4.5)	12 (0.8)	536 (5.8)
Germany	26 (1.4)	505 (4.8)	45 (1.5)	519 (5.1)	19 (1.1)	511 (6.7)	10 (0.8)	488 (6.6)
Greece	16 (0.8)	467 (5.3)	28 (0.9)	482 (3.9)	36 (1.1)	496 (3.8)	20 (0.7)	484 (4.3)
Hong Kong	26 (1.3)	578 (7.8)	45 (1.1)	599 (6.7)	20 (0.9)	593 (7.2)	8 (0.6)	570 (10.7)
Hungary	29 (1.2)	537 (4.5)	48 (1.2)	545 (4.0)	18 (0.8)	534 (6.3)	6 (0.5)	508 (9.7)
Iceland	35 (2.6)	491 (6.4)	36 (2.4)	497 (4.8)	21 (1.3)	482 (6.9)	8 (1.2)	451 (10.6)
Iran, Islamic Rep.	15 (0.9)	424 (5.6)	24 (1.0)	429 (4.1)	28 (1.2)	432 (2.5)	33 (1.0)	432 (3.4)
Ireland	39 (1.3)	529 (5.0)	33 (0.9)	543 (5.6)	18 (0.9)	524 (7.2)	9 (0.7)	495 (7.5)
Israel	19 (1.9)	527 (10.7)	41 (1.5)	533 (8.6)	23 (1.5)	516 (6.3)	16 (1.1)	511 (6.7)
Japan	25 (1.1)	594 (3.8)	57 (0.9)	608 (2.1)	16 (0.8)	612 (3.4)	2 (0.2)	~ ~
Korea	31 (1.1)	604 (3.4)	50 (1.0)	613 (3.3)	13 (0.7)	613 (6.7)	5 (0.5)	571 (10.8)
Kuwait	22 (1.4)	399 (3.9)	35 (1.7)	396 (3.2)	23 (1.7)	390 (3.7)	21 (1.5)	381 (3.8)
Latvia (LSS)	8 (0.9)	494 (7.2)	18 (0.9)	498 (5.3)	29 (1.0)	495 (4.0)	45 (1.4)	492 (3.9)
Lithuania	20 (1.0)	479 (5.1)	39 (1.0)	481 (4.1)	27 (1.1)	480 (4.8)	14 (0.8)	466 (6.4)
Netherlands	27 (1.5)	522 (10.0)	48 (1.5)	549 (6.1)	17 (1.1)	558 (7.1)	8 (0.7)	545 (11.1)
New Zealand	8 (0.6)	488 (7.1)	38 (1.0)	516 (5.1)	39 (1.1)	512 (4.7)	15 (0.7)	495 (5.9)
Norway	31 (1.2)	493 (3.1)	46 (1.1)	508 (2.5)	18 (0.9)	522 (4.5)	6 (0.5)	487 (8.2)
Portugal	20 (0.9)	457 (3.5)	36 (1.0)	459 (3.1)	24 (0.9)	452 (3.4)	20 (0.9)	448 (3.2)
Romania	15 (0.8)	483 (5.9)	41 (1.2)	492 (4.9)	23 (0.8)	479 (5.2)	21 (0.9)	469 (5.2)
Russian Federation	17 (1.1)	532 (5.0)	52 (1.2)	542 (5.0)	21 (1.6)	541 (9.4)	9 (0.8)	502 (8.5)
Scotland	17 (1.0)	492 (6.2)	35 (1.1)	511 (6.1)	33 (1.1)	502 (6.6)	15 (0.9)	479 (8.4)
Singapore	20 (0.9)	633 (6.3)	41 (1.0)	652 (5.2)	30 (0.9)	645 (5.7)	10 (0.5)	627 (5.9)
Slovak Republic	36 (1.6)	531 (3.7)	43 (1.2)	560 (4.4)	16 (0.9)	557 (5.3)	5 (0.5)	527 (11.2)
Slovenia	15 (0.9)	536 (4.1)	55 (1.2)	543 (3.8)	21 (0.9)	546 (5.0)	8 (0.8)	522 (7.0)
Spain	15 (1.0)	469 (3.6)	31 (1.1)	492 (2.7)	26 (1.0)	495 (2.8)	27 (1.1)	486 (3.1)
Sweden	29 (1.1)	509 (3.8)	41 (0.9)	525 (3.6)	23 (0.8)	525 (3.9)	7 (0.6)	517 (5.8)
Switzerland	17 (1.0)	543 (5.1)	51 (1.1)	552 (3.0)	25 (1.2)	549 (4.3)	7 (0.6)	523 (8.9)
Thailand	19 (0.8)	513 (5.4)	44 (0.9)	524 (5.3)	26 (0.9)	530 (8.1)	11 (0.7)	517 (7.5)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report achievement.

How Are Calculators and Computers Used?

As shown in Table 5.12, nearly all eighth-grade students reported having a calculator in the home, except in Iran (61%), Romania (62%), and Thailand (68%). In the United States, Missouri, and Oregon 98% to 99% reported a calculator in the home. Internationally, fewer students reported a computer in the home, even though more than three-fourths did so in Denmark, England, Iceland, Ireland, Israel, the Netherlands, and Scotland. Between 50% and 75% so reported in Australia, Austria, Belgium (Flemish), Belgium (French), Canada, Germany, Kuwait, New Zealand, Norway, Sweden, Switzerland, and the United States. Compared to 59% for the United States, 64% of the students in Missouri and 76% of the students in Oregon reported having a computer in the home. Fewer than 20% of the eighth-grade students reported home computers in Colombia, Iran, Latvia (LSS), Romania, and Thailand.

Table 5.13 provides teachers' reports about how often calculators are used in eighth-grade mathematics classes. Even though calculators appear to be widely available in most countries, teachers reported considerable variation from country to country in the frequency of calculator use in mathematics classrooms. Although using calculators can take the drudgery out of mathematics and free the learner to concentrate on higher-order problem-solving skills, another point of view is that permitting unrestricted use of calculators may damage students' mastery of basic skills in mathematics.

According to teachers in many of the TIMSS countries, three-fourths or more of the eighth-grade students use calculators almost every day in their mathematics classes. The figures were 84% to 85% for Missouri and Oregon, compared to 62% for the United States. The exceptions to at least weekly usage for the majority of the students were Belgium (Flemish), Greece, Iran, Ireland, Japan, Korea, Romania, and Thailand. Interestingly, Oregon joined England, Iceland, and the Netherlands in reporting that virtually all students used calculators in mathematics class to some extent. In Missouri, teachers reported that 6% of the students never or hardly ever used calculators, which compared to 8% for the U.S. as a whole. As revealed in Table 5.14, teachers reported that students use calculators for a variety of purposes. Across countries, no single use appears to predominate, although checking answers, routine computation, and solving complex problems are frequent purposes in many countries. Using calculators on tests and exams was often less frequent than other uses, ranging from 0% of the students in Japan and Thailand to 64% in Austria. The United States as well as Missouri and Oregon followed the international patterns.

Students' reports about the frequency of calculator usage in mathematics classes are presented in Table 5.15. Because different response categories were used for the student and teacher versions of the question, a direct comparison is difficult. Internationally, it does appear that fewer students than teachers indicated nearly always using calculators. However, combining the two most frequent categories for students (pretty often and almost always) and comparing those percentages of responses to the two most frequent response categories for teachers (almost every day and once or twice a week) yields a fair degree of agreement between teachers' and students' reports. For Missouri and Oregon, students reports of pretty often and almost always corresponded to teachers reports of almost every day.

Table 5.12

Students' Reports on Having a Calculator and Computer in the Home

Mathematics - Eighth Grade*

Country	Calculator				Computer			
	Yes		No		Yes		No	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
UNITED STATES	98 (0.3)	502 (4.5)	2 (0.3)	~ ~	59 (1.7)	518 (4.8)	41 (1.7)	474 (4.1)
MISSOURI	99 (0.2)	505 (6.5)	1 (0.2)	~ ~	64 (1.9)	520 (7.1)	36 (1.9)	479 (6.1)
OREGON	99 (0.4)	526 (7.9)	1 (0.4)	~ ~	76 (1.8)	537 (7.8)	24 (1.8)	488 (6.9)
Australia	97 (0.3)	533 (4.0)	3 (0.3)	450 (11.1)	73 (1.2)	539 (4.3)	27 (1.2)	510 (4.4)
Austria	100 (0.1)	540 (3.2)	0 (0.1)	~ ~	59 (1.5)	546 (3.5)	41 (1.5)	532 (4.0)
Belgium (Fl)	97 (0.8)	569 (5.2)	3 (0.8)	465 (20.2)	67 (1.3)	573 (5.8)	33 (1.3)	551 (6.3)
Belgium (Fr)	98 (0.3)	528 (3.4)	2 (0.3)	~ ~	60 (1.4)	538 (3.2)	40 (1.4)	511 (4.7)
Canada	98 (0.2)	529 (2.3)	2 (0.2)	~ ~	61 (1.3)	537 (2.4)	39 (1.3)	512 (3.2)
Colombia	88 (1.5)	389 (3.0)	12 (1.5)	356 (8.6)	11 (1.2)	405 (8.7)	89 (1.2)	382 (3.4)
Cyprus	96 (0.4)	477 (2.0)	4 (0.4)	418 (7.3)	39 (0.9)	484 (2.9)	61 (0.9)	469 (2.4)
Czech Republic	99 (0.2)	564 (4.9)	1 (0.2)	~ ~	36 (1.2)	579 (5.3)	64 (1.2)	555 (5.1)
Denmark	99 (0.3)	504 (2.9)	1 (0.3)	~ ~	76 (1.2)	508 (2.9)	24 (1.2)	490 (4.9)
England	99 (0.2)	508 (2.7)	1 (0.2)	~ ~	89 (0.8)	506 (3.1)	11 (0.8)	512 (8.2)
France	99 (0.2)	540 (3.1)	1 (0.2)	~ ~	50 (1.3)	547 (3.6)	50 (1.3)	531 (3.6)
Germany	99 (0.2)	510 (4.4)	1 (0.2)	~ ~	71 (1.0)	512 (4.3)	29 (1.0)	504 (5.6)
Greece	87 (0.6)	491 (3.0)	13 (0.6)	437 (4.6)	29 (1.0)	500 (5.3)	71 (1.0)	478 (2.8)
Hong Kong	99 (0.1)	590 (6.4)	1 (0.1)	~ ~	39 (1.9)	606 (7.2)	61 (1.9)	580 (6.5)
Hungary	97 (0.4)	541 (3.1)	3 (0.4)	457 (12.9)	37 (1.2)	569 (3.7)	63 (1.2)	521 (3.4)
Iceland	100 (0.1)	488 (4.5)	0 (0.1)	~ ~	77 (1.4)	488 (4.7)	23 (1.4)	483 (5.7)
Iran, Islamic Rep.	61 (1.8)	437 (2.2)	39 (1.8)	417 (2.9)	4 (0.4)	440 (6.9)	96 (0.4)	429 (2.1)
Ireland	97 (0.3)	529 (5.0)	3 (0.3)	497 (13.3)	78 (1.1)	531 (5.3)	22 (1.1)	521 (6.4)
Israel	99 (0.3)	524 (6.1)	1 (0.3)	~ ~	76 (2.1)	534 (5.8)	24 (2.1)	496 (9.1)
Japan	– –	– –	– –	– –	– –	– –	– –	– –
Korea	91 (0.5)	610 (2.5)	9 (0.5)	578 (8.1)	39 (1.2)	632 (3.6)	61 (1.2)	592 (2.8)
Kuwait	84 (1.2)	395 (2.6)	16 (1.2)	380 (3.3)	53 (2.0)	394 (2.9)	47 (2.0)	390 (2.8)
Latvia (LSS)	94 (0.5)	495 (3.1)	6 (0.5)	473 (8.1)	13 (0.9)	492 (5.6)	87 (0.9)	495 (3.1)
Lithuania	90 (1.0)	482 (3.6)	10 (1.0)	443 (6.3)	42 (1.4)	478 (3.9)	58 (1.4)	477 (4.2)
Netherlands	100 (0.1)	542 (7.0)	0 (0.1)	~ ~	85 (1.2)	545 (8.1)	15 (1.2)	524 (7.7)
New Zealand	99 (0.2)	509 (4.5)	1 (0.2)	~ ~	60 (1.3)	520 (5.0)	40 (1.3)	491 (4.6)
Norway	99 (0.2)	504 (2.2)	1 (0.2)	~ ~	64 (1.1)	512 (2.7)	36 (1.1)	489 (3.1)
Portugal	99 (0.2)	455 (2.5)	1 (0.2)	~ ~	39 (1.8)	469 (3.4)	61 (1.8)	446 (2.2)
Romania	62 (1.5)	491 (4.7)	38 (1.5)	467 (5.1)	19 (1.2)	496 (7.3)	81 (1.2)	479 (4.0)
Russian Federation	92 (0.8)	539 (5.0)	8 (0.8)	498 (10.8)	35 (1.5)	537 (5.6)	65 (1.5)	535 (6.2)
Scotland	98 (0.4)	500 (5.7)	2 (0.4)	~ ~	90 (0.6)	499 (5.8)	10 (0.6)	504 (7.4)
Singapore	100 (0.0)	644 (4.9)	0 (0.0)	~ ~	49 (1.5)	657 (5.1)	51 (1.5)	630 (5.1)
Slovak Republic	99 (0.2)	548 (3.3)	1 (0.2)	~ ~	31 (1.2)	563 (4.4)	69 (1.2)	540 (3.6)
Slovenia	98 (0.3)	542 (3.0)	2 (0.3)	~ ~	47 (1.3)	560 (3.7)	53 (1.3)	524 (3.4)
Spain	99 (0.2)	488 (2.0)	1 (0.2)	~ ~	42 (1.2)	499 (2.9)	58 (1.2)	479 (2.1)
Sweden	99 (0.1)	519 (2.9)	1 (0.1)	~ ~	60 (1.3)	531 (2.8)	40 (1.3)	500 (3.6)
Switzerland	99 (0.2)	547 (2.8)	1 (0.2)	~ ~	66 (1.2)	554 (3.1)	34 (1.2)	531 (3.8)
Thailand	68 (2.2)	530 (7.2)	32 (2.2)	508 (4.1)	4 (0.9)	573 (14.2)	96 (0.9)	521 (5.4)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

Table 5.13

Teachers' Reports on Frequency of Students' Use of Calculators in Mathematics Class[1]

Eighth Grade*

Country	Never or Hardly Ever		Once or Twice a Month		Once or Twice a Week		Almost Every Day	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
UNITED STATES	r 8 (2.3)	489 (17.7)	10 (2.0)	460 (8.4)	20 (3.4)	492 (7.6)	62 (4.2)	513 (5.8)
MISSOURI	r 6 (2.1)	496 (20.0)	0 (0.0)	~ ~	9 (1.6)	450 (0.8)	84 (2.5)	512 (5.3)
OREGON	r 0 (0.0)	~ ~	3 (1.7)	474 (6.6)	12 (1.7)	474 (5.6)	85 (2.2)	544 (6.0)
Australia	r 6 (2.0)	512 (26.3)	1 (0.7)	~ ~	10 (1.7)	511 (14.7)	83 (2.6)	537 (5.0)
Austria	r 2 (1.3)	~ ~	3 (1.7)	470 (14.6)	7 (2.1)	559 (17.4)	87 (3.1)	550 (4.2)
Belgium (Fl)	39 (4.9)	577 (12.1)	23 (3.9)	572 (16.4)	14 (3.8)	584 (15.6)	24 (3.5)	571 (6.4)
Belgium (Fr)	s 18 (5.1)	553 (11.0)	25 (5.0)	551 (9.9)	27 (4.9)	537 (8.7)	30 (5.5)	543 (9.2)
Canada	5 (1.4)	489 (17.5)	3 (0.9)	515 (13.1)	12 (2.5)	518 (9.9)	80 (2.8)	533 (3.8)
Colombia	33 (4.6)	383 (4.0)	11 (2.7)	397 (8.9)	22 (4.7)	401 (17.5)	34 (4.7)	377 (3.5)
Cyprus	r 27 (4.6)	471 (6.4)	8 (2.5)	464 (4.3)	21 (4.1)	463 (6.9)	44 (5.2)	475 (4.3)
Czech Republic	3 (1.9)	523 (19.8)	6 (2.3)	552 (17.5)	17 (4.4)	566 (9.2)	74 (4.9)	563 (5.7)
Denmark	28 (4.9)	502 (5.6)	15 (3.6)	503 (7.6)	18 (3.7)	507 (6.2)	39 (4.9)	507 (4.1)
England	s 0 (0.0)	~ ~	2 (0.7)	~ ~	15 (2.2)	479 (9.8)	83 (2.2)	523 (4.5)
France	4 (2.0)	537 (21.7)	3 (1.6)	565 (23.3)	19 (3.4)	538 (6.0)	74 (4.2)	537 (4.1)
Germany	s 19 (3.8)	511 (9.8)	5 (2.4)	579 (25.4)	15 (3.2)	526 (19.4)	62 (4.5)	508 (7.0)
Greece	46 (4.1)	486 (3.8)	23 (4.1)	475 (7.3)	12 (2.4)	483 (9.1)	19 (3.6)	490 (6.0)
Hong Kong	8 (3.0)	558 (38.8)	7 (2.9)	581 (21.4)	18 (3.7)	555 (18.4)	67 (4.9)	601 (8.0)
Hungary	29 (3.8)	533 (7.5)	5 (1.9)	512 (18.3)	6 (1.9)	534 (16.8)	60 (4.2)	540 (4.9)
Iceland	r 0 (0.0)	~ ~	0 (0.0)	~ ~	4 (1.8)	476 (15.8)	96 (1.8)	490 (5.2)
Iran, Islamic Rep.	54 (5.9)	422 (3.4)	32 (5.9)	437 (2.3)	9 (2.6)	432 (8.7)	5 (2.0)	442 (5.8)
Ireland	68 (4.6)	535 (8.0)	7 (2.3)	490 (15.9)	13 (3.5)	515 (16.2)	11 (3.2)	521 (16.6)
Israel	r 11 (5.7)	501 (9.0)	5 (3.7)	588 (34.8)	11 (4.6)	517 (34.6)	73 (6.9)	518 (7.6)
Japan	79 (3.7)	603 (2.9)	16 (3.4)	609 (9.1)	4 (1.7)	620 (22.6)	2 (1.2)	~ ~
Korea	76 (4.1)	613 (2.9)	16 (3.5)	608 (7.3)	8 (2.7)	585 (6.8)	1 (0.6)	~ ~
Kuwait	23 (5.8)	400 (4.6)	11 (3.5)	396 (5.6)	23 (5.6)	390 (4.6)	43 (7.1)	388 (3.2)
Latvia (LSS)	r 13 (3.0)	499 (7.8)	13 (3.6)	479 (8.6)	27 (4.4)	492 (7.1)	46 (4.9)	492 (5.2)
Lithuania	r 12 (2.9)	453 (10.8)	6 (2.2)	496 (22.0)	20 (3.7)	461 (9.0)	62 (4.4)	485 (4.9)
Netherlands	0 (0.0)	~ ~	2 (1.5)	~ ~	17 (4.3)	535 (20.4)	81 (4.5)	545 (9.2)
New Zealand	7 (2.1)	536 (18.4)	5 (1.6)	507 (12.6)	21 (3.4)	510 (9.3)	66 (4.0)	505 (6.0)
Norway	r 2 (1.3)	~ ~	1 (1.0)	~ ~	15 (3.8)	504 (6.2)	82 (3.8)	507 (2.8)
Portugal	1 (0.9)	~ ~	4 (1.3)	452 (10.4)	21 (3.4)	454 (5.9)	74 (3.8)	455 (2.8)
Romania	63 (4.2)	470 (5.1)	7 (2.3)	494 (12.2)	10 (2.5)	521 (10.0)	19 (3.1)	490 (10.5)
Russian Federation	9 (2.1)	512 (11.0)	6 (2.1)	556 (21.4)	18 (3.0)	533 (7.9)	67 (3.9)	536 (7.4)
Scotland	– –	– –	– –	– –	– –	– –	– –	– –
Singapore	1 (0.8)	~ ~	5 (1.9)	617 (23.0)	12 (2.7)	636 (14.1)	82 (3.2)	647 (5.4)
Slovak Republic	2 (1.1)	~ ~	6 (2.0)	547 (11.6)	10 (2.5)	547 (12.2)	82 (3.1)	546 (3.6)
Slovenia	r 35 (4.7)	539 (5.2)	13 (3.3)	542 (10.3)	17 (4.0)	534 (8.9)	35 (4.7)	543 (6.1)
Spain	r 40 (4.4)	487 (4.7)	4 (1.9)	490 (12.2)	11 (2.6)	479 (7.0)	45 (4.7)	489 (4.3)
Sweden	7 (2.2)	495 (17.2)	21 (3.0)	523 (6.5)	37 (4.0)	520 (5.0)	35 (3.9)	521 (5.6)
Switzerland	s 36 (4.6)	545 (10.7)	8 (2.6)	547 (13.1)	24 (4.0)	545 (13.4)	32 (3.5)	567 (7.9)
Thailand	r 72 (5.8)	532 (9.3)	15 (4.8)	525 (11.8)	9 (3.6)	501 (4.7)	4 (1.8)	523 (13.2)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

[1]Based on most frequent response for: checking answers, test and exams, routine computations, solving complex problems, and exploring number concepts.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Table 5.14

Teachers' Reports on Ways in Which Calculators Are Used at Least Once or Twice a Week - Mathematics - Eighth Grade*

Country	Percent of Students by Type of Use					
	Never or Hardly Ever Use Calculators	Checking Answers	Tests and Exams	Routine Computations	Solving Complex Problems	Exploring Number Concepts
UNITED STATES	r 8 (2.3)	r 71 (3.8)	r 47 (4.2)	r 68 (3.6)	r 76 (3.4)	r 58 (3.9)
MISSOURI	r 6 (2.1)	r 82 (4.7)	r 61 (5.5)	r 86 (2.6)	r 81 (4.8)	r 74 (4.7)
OREGON	r 0 (0.0)	r 95 (1.7)	r 50 (4.5)	r 86 (2.3)	r 85 (2.5)	r 77 (3.5)
Australia	r 6 (2.0)	r 84 (3.0)	r 47 (3.5)	r 92 (2.1)	r 76 (3.1)	r 48 (3.9)
Austria	r 2 (1.3)	r 91 (2.9)	r 64 (4.2)	r 91 (2.2)	r 70 (4.6)	s 28 (3.7)
Belgium (Fl)	39 (4.9)	24 (3.4)	10 (2.5)	28 (4.3)	15 (3.2)	10 (2.3)
Belgium (Fr)	s 18 (5.1)	s 53 (6.3)	s 16 (4.3)	s 41 (5.8)	s 39 (5.7)	s 24 (5.5)
Canada	5 (1.4)	85 (2.4)	r 52 (4.4)	82 (2.5)	86 (2.7)	r 63 (4.2)
Colombia	33 (4.6)	33 (4.4)	18 (3.8)	34 (4.7)	32 (4.4)	30 (4.9)
Cyprus	r 27 (4.6)	r 57 (5.3)	r 4 (2.3)	r 51 (5.8)	r 35 (4.3)	r 21 (4.6)
Czech Republic	3 (1.9)	80 (4.2)	22 (5.1)	67 (5.2)	80 (4.0)	16 (5.2)
Denmark	28 (4.9)	52 (4.9)	r 5 (2.0)	48 (5.1)	33 (4.4)	25 (4.2)
England	s 0 (0.0)	s 86 (2.4)	s 42 (3.4)	s 96 (1.0)	s 73 (2.6)	s 55 (3.4)
France	4 (2.0)	r 91 (2.8)	r 57 (4.8)	82 (3.5)	50 (5.0)	r 39 (5.3)
Germany	s 19 (3.8)	s 67 (4.8)	s 39 (4.9)	s 72 (4.4)	s 64 (5.4)	s 27 (5.5)
Greece	46 (4.1)	24 (3.5)	2 (1.0)	21 (3.5)	21 (3.4)	8 (2.4)
Hong Kong	8 (3.0)	74 (5.0)	53 (6.1)	79 (5.1)	62 (5.8)	29 (5.4)
Hungary	29 (3.8)	r 56 (5.1)	r 14 (2.9)	r 43 (4.4)	r 53 (4.7)	r 53 (4.4)
Iceland	r 0 (0.0)	r 91 (3.8)	r 51 (8.4)	r 97 (2.1)	r 99 (0.1)	r 69 (6.2)
Iran, Islamic Rep.	54 (5.9)	4 (1.6)	2 (1.7)	8 (2.4)	8 (2.8)	6 (1.6)
Ireland	68 (4.6)	18 (4.0)	4 (2.0)	r 17 (3.9)	r 7 (2.5)	r 4 (1.8)
Israel	r 11 (5.7)	r 75 (6.4)	r 57 (7.9)	r 72 (6.3)	r 56 (7.4)	r 43 (8.5)
Japan	79 (3.7)	1 (0.6)	0 (0.0)	3 (1.5)	2 (0.7)	3 (1.4)
Korea	76 (4.1)	1 (0.9)	1 (0.6)	6 (2.5)	4 (1.6)	1 (0.8)
Kuwait	23 (5.8)	51 (7.4)	25 (6.5)	52 (6.9)	48 (6.8)	22 (6.6)
Latvia (LSS)	r 13 (3.0)	r 50 (4.9)	r 8 (2.8)	r 59 (4.2)	r 49 (5.2)	r 17 (3.9)
Lithuania	r 12 (2.9)	r 72 (4.1)	r 9 (2.9)	r 66 (4.1)	r 58 (4.5)	r 18 (3.7)
Netherlands	0 (0.0)	83 (4.5)	50 (6.1)	97 (1.8)	67 (4.9)	46 (5.3)
New Zealand	7 (2.1)	41 (4.3)	20 (3.1)	85 (3.0)	70 (4.0)	54 (4.5)
Norway	r 2 (1.3)	r 93 (2.4)	r 24 (4.0)	r 91 (2.8)	r 72 (4.7)	r 35 (4.8)
Portugal	1 (0.9)	86 (2.6)	31 (3.5)	76 (3.4)	67 (3.7)	55 (4.2)
Romania	63 (4.2)	20 (3.4)	1 (1.1)	25 (3.3)	11 (2.7)	9 (2.3)
Russian Federation	9 (2.1)	73 (4.5)	15 (2.8)	76 (3.9)	45 (5.2)	6 (1.7)
Scotland	– –	– –	– –	– –	– –	– –
Singapore	1 (0.8)	89 (2.7)	47 (4.7)	83 (3.4)	82 (3.7)	57 (4.4)
Slovak Republic	2 (1.1)	79 (3.7)	31 (4.1)	72 (4.6)	77 (3.8)	60 (4.3)
Slovenia	r 35 (4.7)	r 39 (5.2)	r 4 (2.1)	r 38 (5.3)	r 28 (4.6)	r 6 (2.5)
Spain	r 40 (4.4)	r 46 (4.6)	r 16 (3.4)	r 35 (4.4)	r 39 (4.8)	r 29 (4.2)
Sweden	7 (2.2)	r 42 (4.1)	r 13 (2.8)	r 57 (4.1)	r 60 (3.6)	r 25 (3.5)
Switzerland	s 36 (4.6)	s 47 (4.9)	s 16 (2.7)	s 48 (4.3)	s 35 (3.9)	s 17 (2.8)
Thailand	r 72 (5.8)	r 7 (3.0)	r 0 (0.0)	r 5 (2.4)	r 9 (3.2)	s 10 (3.6)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

Table 5.15

Students' Reports on Frequency of Using Calculators in Mathematics Class - Eighth Grade*

Country	Never		Once in a While		Pretty Often		Almost Always	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
UNITED STATES	10 (1.6)	464 (9.4)	20 (1.6)	498 (5.8)	26 (1.2)	501 (5.3)	44 (2.7)	511 (5.6)
MISSOURI	4 (1.4)	483 (39.4)	11 (1.5)	489 (12.4)	24 (1.7)	512 (8.3)	61 (3.0)	506 (7.8)
OREGON	2 (0.4)	~ ~	8 (1.3)	499 (11.0)	30 (1.2)	516 (8.1)	60 (2.1)	537 (8.5)
Australia	4 (1.1)	495 (28.4)	10 (0.9)	509 (7.5)	31 (1.1)	533 (4.4)	55 (1.9)	539 (4.6)
Austria	2 (0.7)	~ ~	7 (0.8)	515 (9.9)	17 (1.2)	542 (7.2)	74 (2.1)	542 (3.3)
Belgium (Fl)	34 (4.1)	571 (12.4)	36 (2.4)	577 (6.1)	20 (2.5)	556 (10.5)	10 (1.6)	530 (11.7)
Belgium (Fr)	37 (2.7)	526 (4.6)	41 (1.9)	543 (3.9)	14 (1.6)	516 (8.4)	9 (1.1)	491 (8.6)
Canada	6 (1.2)	493 (8.7)	22 (1.6)	523 (3.6)	33 (1.2)	532 (3.0)	38 (2.2)	534 (4.4)
Colombia	54 (2.5)	394 (3.2)	26 (1.3)	382 (4.4)	9 (0.9)	393 (6.9)	11 (1.1)	371 (4.1)
Cyprus	30 (2.0)	480 (3.5)	39 (1.4)	477 (3.1)	21 (1.0)	475 (4.2)	10 (0.9)	452 (4.5)
Czech Republic	5 (1.2)	552 (12.0)	33 (2.5)	553 (6.1)	37 (2.1)	578 (6.8)	24 (1.9)	560 (5.5)
Denmark	32 (3.7)	506 (4.0)	37 (2.6)	499 (4.2)	19 (1.7)	514 (6.3)	12 (1.7)	498 (5.0)
England	0 (0.1)	~ ~	9 (0.9)	467 (6.6)	46 (1.6)	507 (4.3)	45 (1.8)	517 (3.3)
France	2 (0.9)	~ ~	27 (1.5)	539 (4.0)	40 (1.3)	548 (3.4)	30 (1.4)	530 (5.1)
Germany	25 (2.8)	502 (7.1)	19 (1.7)	527 (9.1)	20 (1.5)	517 (7.6)	35 (2.0)	504 (6.2)
Greece	51 (2.6)	482 (3.9)	26 (1.3)	494 (4.0)	14 (1.1)	489 (5.6)	9 (1.0)	473 (6.0)
Hong Kong	8 (2.3)	572 (27.9)	9 (1.2)	567 (15.8)	33 (1.9)	593 (6.4)	49 (2.5)	595 (7.0)
Hungary	20 (2.2)	521 (6.2)	39 (1.9)	539 (4.0)	24 (1.3)	547 (5.9)	17 (1.3)	547 (5.7)
Iceland	1 (0.3)	~ ~	6 (0.9)	474 (10.9)	32 (2.0)	491 (5.5)	61 (2.3)	487 (4.8)
Iran, Islamic Rep.	79 (1.4)	432 (2.4)	13 (1.0)	435 (4.7)	4 (0.5)	415 (4.4)	4 (0.5)	400 (6.5)
Ireland	79 (1.7)	535 (5.3)	14 (1.0)	517 (7.0)	4 (0.6)	493 (9.4)	3 (0.5)	484 (11.7)
Israel	7 (1.8)	517 (12.5)	21 (2.2)	536 (7.6)	27 (1.6)	532 (8.6)	45 (3.4)	515 (6.2)
Japan	75 (2.3)	607 (2.1)	21 (1.9)	603 (3.4)	3 (0.7)	575 (7.0)	0 (0.1)	~ ~
Korea	93 (0.5)	613 (2.5)	5 (0.4)	570 (9.7)	1 (0.3)	~ ~	1 (0.2)	~ ~
Kuwait	27 (2.9)	394 (3.3)	35 (1.9)	395 (3.6)	23 (1.5)	391 (3.9)	14 (1.9)	387 (3.7)
Latvia (LSS)	14 (1.4)	502 (5.7)	27 (1.4)	499 (4.1)	35 (1.3)	492 (4.1)	24 (2.0)	487 (5.2)
Lithuania	17 (1.7)	476 (6.5)	34 (1.5)	472 (3.9)	24 (1.2)	484 (4.5)	25 (1.7)	482 (5.8)
Netherlands	1 (0.2)	~ ~	9 (1.3)	514 (16.9)	36 (1.7)	547 (7.2)	54 (2.1)	544 (7.4)
New Zealand	6 (1.1)	519 (13.3)	20 (1.7)	503 (6.9)	37 (1.3)	511 (5.3)	36 (2.0)	510 (6.1)
Norway	4 (1.0)	465 (9.6)	25 (1.7)	497 (3.3)	39 (1.2)	509 (3.1)	33 (1.9)	508 (3.1)
Portugal	3 (0.6)	455 (7.3)	27 (1.6)	457 (3.1)	34 (1.2)	454 (3.5)	35 (1.5)	454 (2.8)
Romania	57 (1.7)	484 (4.7)	25 (1.2)	490 (5.4)	9 (0.6)	475 (6.8)	9 (0.8)	465 (7.3)
Russian Federation	9 (1.4)	538 (11.3)	37 (2.3)	537 (7.2)	25 (1.6)	537 (5.3)	29 (1.6)	534 (5.7)
Scotland	2 (0.7)	~ ~	16 (1.5)	498 (7.0)	48 (1.5)	501 (5.3)	34 (2.0)	498 (8.8)
Singapore	1 (0.4)	~ ~	16 (1.5)	613 (6.0)	54 (1.2)	648 (5.0)	29 (1.7)	655 (5.6)
Slovak Republic	4 (0.7)	550 (13.7)	24 (1.7)	543 (4.9)	37 (1.3)	554 (4.3)	35 (1.7)	544 (4.5)
Slovenia	44 (3.0)	544 (4.1)	38 (2.2)	540 (4.2)	10 (1.0)	534 (7.9)	8 (0.8)	535 (8.5)
Spain	49 (3.3)	493 (2.9)	23 (1.9)	492 (3.4)	12 (1.1)	479 (5.3)	17 (2.0)	471 (4.3)
Sweden	4 (0.9)	482 (13.1)	42 (2.2)	520 (3.2)	36 (1.7)	527 (3.9)	18 (2.2)	511 (5.2)
Switzerland	45 (2.9)	538 (4.6)	22 (1.6)	552 (5.1)	16 (1.2)	553 (5.5)	16 (1.3)	561 (6.3)
Thailand	59 (2.2)	514 (4.7)	34 (1.7)	535 (8.0)	5 (0.8)	543 (16.3)	2 (0.3)	~ ~

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report achievement.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

Table 5.16 contains teachers' reports about how often computers are used in mathematics class to solve exercises or problems, and Table 5.17 contains students' responses to a similar question. Internationally, substantial percentages of teachers and students agreed that the computer is almost never used in most students' mathematics lessons. Teachers and students agreed on moderate use of computers (more than 20% of the students in some lessons) in Austria, Denmark, England, Sweden, and the United States. For both teachers and students, the reports about computer use in Oregon and Missouri were nearly identical to those for the United States as a whole. That is, teachers reported that approximately 20% of the students use computers in at least some lessons. According to students, 10% use computers almost always or pretty often, while 21% use them once in a while.

Table 5.16

Teachers' Reports on Frequency of Using Computers in Mathematics Class to Solve Exercises or Problems - Eighth Grade*

Country	Never or Almost Never		Some Lessons		Most or Every Lesson	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
UNITED STATES	r 76 (3.1)	502 (5.9)	21 (3.2)	497 (9.1)	3 (1.7)	506 (22.2)
MISSOURI	r 79 (4.8)	503 (5.3)	20 (4.8)	510 (16.2)	1 (0.1)	~ ~
OREGON	r 81 (3.3)	529 (6.6)	19 (3.3)	551 (10.9)	0 (0.0)	~ ~
Australia	r 78 (3.2)	531 (5.3)	21 (3.2)	535 (9.6)	0 (0.2)	~ ~
Austria	r 69 (4.5)	551 (5.6)	29 (4.4)	542 (7.3)	1 (0.5)	~ ~
Belgium (Fl)	99 (0.7)	574 (4.6)	1 (0.7)	~ ~	0 (0.0)	~ ~
Belgium (Fr)	s 95 (2.4)	543 (4.4)	4 (2.2)	555 (25.7)	1 (1.0)	~ ~
Canada	82 (3.5)	533 (2.9)	18 (3.5)	511 (10.3)	1 (0.5)	~ ~
Colombia	94 (2.2)	387 (3.8)	5 (2.0)	391 (12.9)	1 (0.9)	~ ~
Cyprus	r 89 (3.3)	468 (2.9)	11 (3.3)	476 (11.4)	0 (0.0)	~ ~
Czech Republic	74 (5.4)	560 (6.4)	23 (5.1)	568 (8.8)	4 (2.8)	549 (0.7)
Denmark	38 (4.5)	500 (4.5)	62 (4.5)	507 (2.9)	0 (0.0)	~ ~
England	s 52 (3.9)	517 (5.9)	45 (3.7)	514 (6.9)	2 (1.0)	~ ~
France	86 (3.2)	541 (3.3)	14 (3.2)	536 (11.5)	0 (0.0)	~ ~
Germany	s 87 (3.1)	510 (5.8)	13 (3.1)	550 (12.3)	0 (0.0)	~ ~
Greece	85 (2.9)	481 (3.3)	12 (2.5)	500 (7.7)	2 (1.4)	~ ~
Hong Kong	90 (3.5)	590 (7.3)	9 (3.7)	576 (29.4)	1 (1.2)	~ ~
Hungary	– –	– –	– –	– –	– –	– –
Iceland	– –	– –	– –	– –	– –	– –
Iran, Islamic Rep.	93 (5.5)	429 (2.3)	6 (5.5)	435 (18.2)	1 (1.0)	~ ~
Ireland	99 (0.9)	528 (6.0)	1 (0.9)	~ ~	0 (0.0)	~ ~
Israel	– –	– –	– –	– –	– –	– –
Japan	90 (2.7)	604 (2.5)	9 (2.6)	612 (10.1)	1 (0.5)	~ ~
Korea	96 (1.6)	610 (2.5)	3 (1.3)	618 (21.6)	1 (1.0)	~ ~
Kuwait	73 (7.1)	393 (2.9)	21 (6.5)	387 (3.4)	6 (3.5)	389 (10.6)
Latvia (LSS)	r 97 (1.6)	490 (3.3)	3 (1.6)	494 (14.9)	0 (0.0)	~ ~
Lithuania	94 (1.8)	480 (4.1)	6 (1.8)	450 (12.3)	0 (0.0)	~ ~
Netherlands	– –	– –	– –	– –	– –	– –
New Zealand	86 (3.1)	506 (4.4)	14 (3.1)	526 (15.7)	0 (0.0)	~ ~
Norway	r 90 (2.6)	507 (2.7)	10 (2.6)	509 (5.1)	0 (0.0)	~ ~
Portugal	97 (1.5)	454 (2.6)	3 (1.5)	482 (23.2)	0 (0.0)	~ ~
Romania	96 (1.7)	481 (4.4)	4 (1.7)	512 (20.6)	0 (0.0)	~ ~
Russian Federation	78 (2.6)	533 (6.8)	15 (2.2)	537 (6.9)	6 (2.4)	566 (14.6)
Scotland	– –	– –	– –	– –	– –	– –
Singapore	92 (2.7)	643 (5.3)	8 (2.7)	652 (15.3)	0 (0.0)	~ ~
Slovak Republic	95 (1.5)	543 (3.3)	4 (1.3)	592 (13.5)	1 (0.8)	~ ~
Slovenia	r 69 (4.5)	539 (4.5)	27 (4.5)	545 (7.2)	4 (2.1)	527 (21.9)
Spain	r 89 (3.1)	488 (2.6)	11 (3.1)	472 (9.1)	0 (0.0)	~ ~
Sweden	r 74 (2.9)	519 (4.1)	25 (2.9)	515 (7.3)	0 (0.3)	~ ~
Switzerland	s 87 (3.2)	549 (5.6)	13 (3.3)	577 (13.0)	1 (0.8)	~ ~
Thailand	r 97 (2.0)	527 (7.5)	1 (1.5)	~ ~	2 (1.3)	~ ~

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Table 5.17

Students' Reports on Frequency of Using Computers in Mathematics Class

Eighth Grade*

Country	Never		Once in a While		Almost Always or Pretty Often	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
UNITED STATES	69 (2.5)	504 (4.6)	21 (1.8)	514 (6.8)	10 (1.5)	458 (7.5)
MISSOURI	69 (4.9)	509 (7.1)	21 (3.5)	518 (9.2)	10 (2.1)	448 (8.7)
OREGON	70 (3.3)	530 (8.4)	21 (2.1)	530 (8.2)	10 (1.5)	485 (12.7)
Australia	77 (2.1)	536 (4.4)	18 (1.7)	536 (7.6)	5 (0.9)	477 (11.4)
Austria	62 (2.6)	545 (3.8)	32 (2.2)	540 (5.4)	6 (0.8)	487 (7.9)
Belgium (Fl)	94 (1.1)	568 (5.7)	4 (0.9)	544 (15.7)	2 (0.6)	~ ~
Belgium (Fr)	94 (1.4)	532 (3.3)	3 (0.7)	531 (22.2)	4 (0.9)	437 (20.4)
Canada	82 (1.4)	532 (2.4)	13 (1.3)	528 (8.4)	5 (0.4)	476 (6.7)
Colombia	95 (0.5)	389 (2.9)	3 (0.4)	390 (6.9)	3 (0.3)	370 (5.9)
Cyprus	73 (0.9)	485 (1.8)	16 (0.9)	459 (4.9)	11 (0.8)	432 (4.3)
Czech Republic	88 (2.9)	564 (5.1)	8 (1.9)	560 (12.5)	4 (1.8)	570 (18.0)
Denmark	40 (3.6)	505 (4.0)	51 (3.0)	507 (3.6)	9 (1.3)	486 (8.4)
England	45 (2.6)	512 (4.9)	46 (2.3)	514 (4.3)	9 (1.2)	457 (6.8)
France	88 (2.4)	542 (3.3)	8 (2.0)	531 (10.8)	4 (0.8)	492 (9.6)
Germany	84 (2.1)	511 (4.6)	11 (1.9)	533 (9.3)	5 (0.7)	455 (7.7)
Greece	83 (1.0)	490 (2.9)	10 (0.7)	471 (6.4)	7 (0.6)	443 (6.2)
Hong Kong	91 (0.7)	592 (6.2)	6 (0.5)	580 (11.4)	3 (0.4)	559 (16.7)
Hungary	92 (0.8)	539 (3.2)	5 (0.8)	548 (12.3)	2 (0.4)	~ ~
Iceland	81 (2.4)	494 (4.4)	11 (1.3)	479 (5.1)	8 (1.6)	442 (9.8)
Iran, Islamic Rep.	92 (0.8)	432 (2.3)	3 (0.4)	416 (5.2)	4 (0.5)	399 (5.6)
Ireland	96 (1.1)	531 (5.0)	3 (0.9)	498 (30.4)	1 (0.3)	~ ~
Israel	76 (4.5)	530 (6.9)	12 (2.6)	523 (11.5)	11 (3.0)	489 (15.7)
Japan	77 (3.3)	604 (2.9)	19 (2.6)	611 (4.6)	4 (1.2)	604 (14.5)
Korea	93 (0.7)	611 (2.4)	5 (0.5)	587 (9.4)	2 (0.3)	~ ~
Kuwait	78 (1.8)	398 (2.8)	8 (1.0)	380 (6.6)	14 (1.4)	371 (3.1)
Latvia (LSS)	91 (1.1)	497 (3.1)	6 (0.9)	484 (8.5)	3 (0.4)	458 (12.9)
Lithuania	92 (1.0)	481 (3.4)	5 (0.8)	456 (8.8)	3 (0.5)	456 (13.2)
Netherlands	81 (3.4)	536 (7.8)	18 (3.3)	575 (13.8)	2 (0.4)	~ ~
New Zealand	79 (2.5)	512 (4.5)	17 (2.1)	514 (8.7)	4 (0.6)	442 (9.1)
Norway	88 (1.5)	508 (2.4)	10 (1.5)	487 (6.1)	2 (0.3)	~ ~
Portugal	97 (0.6)	455 (2.5)	2 (0.6)	~ ~	1 (0.2)	~ ~
Romania	78 (1.2)	487 (4.5)	8 (0.7)	471 (8.7)	14 (0.9)	468 (8.8)
Russian Federation	94 (0.8)	538 (5.7)	4 (0.6)	528 (6.8)	2 (0.3)	~ ~
Scotland	54 (3.1)	504 (6.9)	37 (2.5)	503 (6.1)	9 (1.3)	459 (4.7)
Singapore	90 (1.5)	644 (5.2)	8 (1.4)	653 (8.2)	2 (0.4)	~ ~
Slovak Republic	94 (1.0)	549 (3.5)	5 (1.0)	539 (9.6)	1 (0.2)	~ ~
Slovenia	89 (0.7)	547 (3.1)	7 (0.6)	494 (7.0)	3 (0.4)	492 (10.1)
Spain	93 (1.3)	490 (2.0)	4 (0.8)	466 (7.5)	3 (0.7)	452 (12.4)
Sweden	61 (3.2)	527 (3.5)	30 (2.7)	521 (3.8)	9 (1.1)	467 (5.6)
Switzerland	82 (2.1)	549 (3.2)	14 (1.8)	546 (6.0)	4 (0.6)	512 (16.9)
Thailand	91 (1.0)	522 (5.8)	6 (0.6)	535 (10.3)	3 (0.5)	509 (9.2)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report achievement.

How Much Homework Are Students Assigned?

Although teachers often give students time to begin or review homework assignments in class, homework is generally considered a method of extending the time spent on regular classroom lessons. Table 5.18 presents teachers' reports about how often they assigned homework and the typical lengths of such assignments. Internationally, most eighth-grade students were assigned mathematics homework at least three times a week. Most typically, for the majority of students the assignments were 30 minutes or less in length. Homework assignments were more than 30 minutes for the majority of students in Cyprus, Greece, Romania, the Russian Federation, Singapore, and Thailand. For students in Missouri, teachers reported that 89% were assigned homework at least three times a week, with 67% receiving assignments of 30 minutes or less and 22% receiving longer assignments. In Oregon, 82% were assigned homework this frequently, with 56% receiving shorter assignments and 26% receiving longer ones.

Homework generally has its biggest impact when it is commented on and graded by teachers. Table 5.19 presents teachers' reports about their use of students' written mathematics homework. In Missouri and Oregon, as well as in most countries including the United States, for at least 70% of the students, teachers reported at least sometimes, if not always, correcting homework assignments and returning those assignments to students. The exceptions were France, Germany, Hungary, Iceland, Japan, the Netherlands, Portugal, the Slovak Republic, and Slovenia.

Many teachers do not count mathematics homework directly in determining grades, but use it more as a method to monitor students' understanding and to correct misconceptions. In general, for the TIMSS countries, teachers reported that mathematics homework assignments contributed only sometimes to students' grades or marks (Table 5.19). In some countries, however, it had even less impact on grades. According to their teachers, homework never or only rarely contributed to the grades for the majority of the students in Austria, Belgium (Flemish), the Czech Republic, Denmark, France, Germany, Hungary, Ireland, Japan, Korea, Latvia (LSS), Lithuania, the Netherlands, Norway, Singapore, the Slovak Republic, Slovenia, Sweden, and Switzerland. In contrast, teachers reported that homework always contributed to the grades for the majority of the students in Cyprus, England, Portugal, the Russian Federation, and the United States. Teachers in the United States indicated that homework always contributed towards grades for 68% of the students, which was the most reported by any country. The results for Missouri at 66% paralleled those for the U.S. In comparison, teachers in Oregon reported that homework always counted towards grades for 79% of the students.

Table 5.18

Teachers' Reports About the Amount of Mathematics Homework Assigned - Eighth Grade*

Country		Percent of Students Taught by Teachers					
	Never Assigning Homework	Assigning Homework Less Than Once a Week		Assigning Homework Once or Twice a Week		Assigning Homework Three Times a Week or More Often	
		30 Minutes or Less	More Than 30 Minutes	30 Minutes or Less	More Than 30 Minutes	30 Minutes or Less	More Than 30 Minutes
UNITED STATES	r 0 (0.1)	3 (1.3)	0 (0.0)	7 (1.8)	3 (0.9)	64 (2.9)	23 (3.1)
MISSOURI	r 0 (0.2)	1 (0.1)	0 (0.0)	10 (1.5)	0 (0.0)	67 (4.3)	22 (4.1)
OREGON	r 0 (0.0)	4 (1.7)	0 (0.0)	14 (3.9)	1 (0.8)	56 (4.6)	26 (3.3)
Australia	r 1 (0.8)	6 (1.6)	0 (0.2)	21 (2.6)	4 (1.9)	62 (3.4)	5 (1.7)
Austria	r 0 (0.0)	1 (0.5)	0 (0.0)	24 (4.4)	3 (1.4)	63 (5.0)	10 (2.1)
Belgium (Fl)	0 (0.0)	17 (3.5)	2 (1.1)	52 (4.8)	10 (2.6)	15 (2.9)	5 (2.1)
Belgium (Fr)	1 (1.2)	2 (1.4)	0 (0.0)	30 (5.1)	5 (2.2)	55 (5.5)	7 (2.8)
Canada	r 2 (1.1)	2 (0.9)	1 (0.7)	22 (3.4)	2 (0.9)	59 (3.7)	13 (2.7)
Colombia	0 (0.0)	1 (0.9)	1 (0.8)	17 (4.7)	13 (2.9)	29 (4.2)	39 (4.2)
Cyprus	r 0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	50 (5.3)	50 (5.3)
Czech Republic	0 (0.4)	14 (4.5)	0 (0.0)	62 (5.2)	0 (0.3)	23 (3.5)	1 (0.6)
Denmark	0 (0.0)	4 (1.8)	0 (0.0)	42 (4.7)	3 (1.6)	49 (5.2)	2 (1.0)
England	0 (0.0)	3 (1.0)	1 (0.6)	44 (3.8)	47 (3.7)	3 (1.4)	2 (1.1)
France	0 (0.0)	0 (0.0)	2 (0.9)	7 (2.5)	4 (1.2)	77 (3.9)	10 (2.8)
Germany	1 (1.4)	1 (1.4)	0 (0.0)	22 (4.4)	0 (0.0)	73 (5.0)	3 (1.8)
Greece	0 (0.0)	1 (0.9)	0 (0.0)	0 (0.0)	0 (0.2)	31 (3.4)	67 (3.5)
Hong Kong	1 (1.4)	4 (2.2)	3 (1.8)	25 (4.7)	15 (4.1)	38 (6.0)	14 (4.1)
Hungary	0 (0.0)	1 (0.7)	0 (0.0)	2 (1.3)	0 (0.0)	82 (3.0)	15 (3.1)
Iceland	0 (0.0)	0 (0.0)	0 (0.0)	5 (2.0)	1 (1.0)	75 (5.5)	19 (5.5)
Iran, Islamic Rep.	0 (0.0)	1 (0.5)	3 (1.4)	10 (3.0)	59 (4.4)	2 (1.1)	26 (4.3)
Ireland	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.9)	0 (0.0)	94 (2.2)	5 (2.0)
Israel	r 0 (0.0)	1 (1.2)	0 (0.0)	3 (2.2)	0 (0.0)	48 (7.1)	48 (6.8)
Japan	0 (0.0)	27 (4.0)	4 (1.7)	37 (3.7)	10 (2.3)	16 (2.9)	6 (1.5)
Korea	0 (0.0)	5 (1.6)	8 (2.2)	27 (3.7)	21 (3.3)	21 (3.2)	18 (3.4)
Kuwait	0 (0.0)	0 (0.0)	0 (0.0)	19 (6.0)	2 (2.0)	60 (7.8)	18 (6.0)
Latvia (LSS)	0 (0.0)	0 (0.0)	0 (0.0)	8 (2.8)	1 (0.9)	83 (3.9)	9 (2.4)
Lithuania	0 (0.0)	0 (0.0)	0 (0.0)	2 (1.3)	0 (0.0)	76 (3.9)	22 (3.9)
Netherlands	1 (1.2)	1 (0.9)	0 (0.0)	12 (3.5)	2 (1.4)	81 (4.2)	4 (2.2)
New Zealand	0 (0.0)	5 (1.9)	2 (0.1)	34 (4.3)	4 (1.5)	54 (4.2)	2 (1.2)
Norway	r 0 (0.0)	0 (0.0)	0 (0.0)	7 (2.7)	8 (2.7)	67 (4.3)	18 (4.0)
Portugal	0 (0.0)	1 (0.9)	1 (0.5)	30 (4.0)	2 (1.1)	57 (4.1)	9 (2.4)
Romania	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.8)	1 (0.6)	11 (2.8)	87 (2.8)
Russian Federation	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.9)	1 (0.8)	42 (3.5)	55 (3.4)
Scotland	r 0 (0.4)	20 (4.3)	4 (2.0)	46 (5.1)	6 (2.3)	24 (4.1)	0 (0.0)
Singapore	0 (0.0)	1 (0.9)	0 (0.0)	3 (1.5)	11 (3.1)	26 (4.1)	58 (4.5)
Slovak Republic	0 (0.0)	1 (0.9)	0 (0.0)	12 (2.8)	1 (0.7)	83 (3.4)	4 (1.7)
Slovenia	r 0 (0.0)	0 (0.0)	0 (0.0)	2 (1.4)	0 (0.0)	74 (4.4)	24 (4.2)
Spain	r 0 (0.0)	4 (1.6)	0 (0.0)	18 (3.3)	9 (2.7)	47 (4.4)	22 (3.7)
Sweden	r 0 (0.4)	19 (3.0)	7 (1.9)	45 (4.0)	26 (3.3)	2 (1.2)	1 (1.2)
Switzerland	0 (0.0)	1 (0.4)	1 (0.3)	26 (4.2)	4 (1.5)	61 (4.4)	6 (2.3)
Thailand	r 0 (0.0)	0 (0.0)	0 (0.0)	7 (3.5)	20 (4.8)	16 (4.6)	58 (6.6)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students.

Table 5.19

Teachers' Reports on Their Use of Students' Written Mathematics Homework[1]

Eighth Grade*

Country	Percent of Students Taught by Teachers							
	Collecting, Correcting, and then Returning Assignments to Students				Using Homework to Contribute Towards Students' Grades or Marks			
	Never	Rarely	Sometimes	Always	Never	Rarely	Sometimes	Always
UNITED STATES	r 5 (1.4)	15 (2.3)	42 (4.2)	38 (4.4)	r 1 (0.4)	4 (1.6)	27 (4.3)	68 (4.3)
MISSOURI	r 3 (1.6)	11 (2.6)	60 (3.7)	25 (3.5)	r 0 (0.0)	2 (1.6)	32 (4.5)	66 (4.9)
OREGON	r 8 (3.3)	17 (2.9)	34 (4.3)	40 (4.5)	r 3 (1.2)	2 (1.5)	17 (3.8)	79 (3.9)
Australia	r 7 (1.9)	14 (2.5)	41 (3.7)	38 (3.6)	r 23 (3.1)	17 (2.6)	41 (3.4)	20 (2.8)
Austria	r 1 (0.5)	25 (3.4)	22 (3.2)	53 (3.8)	r 22 (3.8)	34 (4.0)	27 (3.4)	17 (3.6)
Belgium (Fl)	5 (1.6)	5 (2.9)	9 (2.3)	80 (3.7)	34 (4.9)	16 (3.0)	21 (3.9)	29 (3.9)
Belgium (Fr)	s 7 (3.2)	7 (2.9)	28 (5.2)	58 (6.0)	s 21 (4.6)	20 (4.0)	25 (4.9)	33 (5.7)
Canada	r 4 (1.6)	21 (2.9)	50 (4.2)	25 (3.3)	r 12 (2.7)	10 (2.7)	49 (4.3)	29 (3.4)
Colombia	0 (0.0)	9 (2.2)	11 (2.9)	80 (3.7)	1 (1.0)	10 (2.2)	49 (5.1)	40 (4.8)
Cyprus	r 8 (2.9)	18 (3.4)	56 (5.0)	17 (4.4)	r 0 (0.0)	2 (0.6)	37 (4.7)	62 (4.7)
Czech Republic	4 (2.8)	2 (1.3)	24 (3.9)	70 (4.7)	42 (4.9)	35 (5.2)	19 (4.5)	3 (1.5)
Denmark	10 (3.8)	17 (3.7)	45 (5.0)	27 (4.8)	44 (5.0)	29 (4.4)	17 (3.7)	10 (2.9)
England	s 2 (1.1)	3 (1.0)	42 (3.6)	53 (3.9)	s 4 (1.5)	7 (1.5)	39 (3.2)	50 (3.4)
France	11 (2.8)	43 (4.6)	26 (4.0)	19 (3.7)	44 (4.4)	33 (4.5)	14 (2.7)	9 (2.9)
Germany	s 13 (4.0)	34 (5.1)	47 (6.0)	7 (2.0)	s 32 (5.1)	33 (5.0)	28 (4.4)	6 (2.9)
Greece	9 (2.4)	20 (3.2)	49 (3.9)	22 (3.6)	3 (1.4)	7 (1.8)	43 (3.6)	46 (3.9)
Hong Kong	0 (0.0)	1 (1.2)	12 (3.5)	87 (3.6)	23 (4.4)	25 (4.9)	19 (4.3)	33 (5.3)
Hungary	9 (2.5)	35 (4.2)	49 (4.5)	7 (2.3)	20 (3.7)	40 (4.2)	28 (3.7)	11 (2.8)
Iceland	r 8 (3.7)	25 (7.1)	62 (7.5)	6 (1.8)	r 9 (3.9)	16 (4.3)	40 (6.4)	35 (7.6)
Iran, Islamic Rep.	10 (2.9)	14 (3.1)	40 (4.7)	37 (4.8)	11 (2.3)	27 (5.9)	41 (5.2)	21 (4.4)
Ireland	6 (2.4)	16 (3.8)	57 (5.1)	20 (4.2)	35 (5.2)	20 (4.1)	37 (4.5)	7 (2.4)
Israel	r 0 (0.0)	17 (5.2)	59 (8.1)	24 (8.3)	r 0 (0.0)	11 (5.3)	59 (8.4)	30 (8.5)
Japan	21 (3.4)	34 (4.3)	25 (3.9)	21 (3.6)	32 (3.6)	37 (4.5)	18 (4.0)	13 (3.1)
Korea	1 (1.0)	10 (2.4)	61 (3.9)	28 (3.7)	26 (3.2)	34 (4.0)	35 (4.0)	6 (1.7)
Kuwait	1 (0.8)	3 (2.6)	28 (7.2)	68 (7.7)	9 (2.7)	11 (3.4)	38 (7.0)	42 (6.4)
Latvia (LSS)	r 2 (1.6)	11 (3.0)	30 (4.1)	57 (4.7)	r 32 (4.0)	23 (3.4)	25 (3.4)	20 (3.6)
Lithuania	5 (1.7)	9 (2.6)	52 (4.4)	35 (4.5)	r 48 (5.0)	9 (2.7)	28 (4.2)	15 (3.2)
Netherlands	49 (5.2)	29 (5.0)	22 (3.9)	1 (0.8)	67 (5.2)	17 (4.6)	12 (3.8)	4 (1.9)
New Zealand	3 (1.7)	20 (3.1)	48 (4.2)	28 (3.7)	15 (2.9)	28 (3.8)	41 (4.3)	16 (3.2)
Norway	r 7 (2.4)	17 (3.6)	64 (4.6)	13 (3.5)	r 16 (3.5)	48 (5.0)	29 (4.6)	7 (2.6)
Portugal	9 (2.5)	23 (4.0)	43 (4.0)	26 (4.0)	2 (1.2)	13 (3.1)	34 (4.3)	51 (4.4)
Romania	4 (1.9)	11 (2.5)	49 (4.0)	37 (4.2)	8 (2.4)	16 (2.9)	44 (4.3)	32 (3.5)
Russian Federation	0 (0.1)	2 (1.1)	23 (3.7)	75 (4.0)	2 (0.9)	3 (1.3)	38 (5.5)	57 (5.1)
Scotland	– –	– –	– –	– –	– –	– –	– –	– –
Singapore	0 (0.0)	0 (0.0)	6 (2.2)	94 (2.2)	33 (4.6)	26 (4.2)	32 (4.0)	9 (2.5)
Slovak Republic	6 (2.6)	30 (3.8)	57 (4.7)	7 (2.2)	51 (4.7)	30 (4.3)	18 (3.0)	1 (0.6)
Slovenia	r 4 (2.0)	28 (4.9)	60 (5.1)	8 (2.8)	r 39 (4.1)	40 (5.0)	19 (4.2)	2 (1.6)
Spain	r 9 (2.9)	4 (1.8)	26 (4.6)	61 (4.8)	r 3 (1.6)	7 (2.5)	41 (4.8)	49 (4.8)
Sweden	r 6 (2.0)	8 (2.0)	24 (3.1)	62 (3.9)	r 27 (3.7)	23 (3.2)	32 (3.5)	18 (2.8)
Switzerland	s 5 (1.8)	23 (3.8)	56 (4.6)	16 (2.9)	s 42 (4.5)	42 (4.7)	15 (3.4)	0 (0.2)
Thailand	s 0 (0.0)	1 (0.6)	19 (4.9)	80 (4.9)	s 16 (4.9)	11 (3.1)	57 (5.8)	16 (4.7)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

[1]Based on those teachers who assign homework.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

What Assessment and Evaluation Procedures Do Teachers Use?

Teachers in participating countries were asked about the importance they place on different types of assessment and how they use assessment information. Their responses to these two questions are presented in Tables 5.20 and 5.21, respectively. The weight given to each type of assessment varied greatly from country to country. Internationally, the least weight reportedly was given to external standardized tests and teacher-made objective tests. In most participating countries, fewer than 50% of the eighth-grade students had mathematics teachers who reported giving quite a lot or a great deal of weight to either of these types of assessments. The Hungarian teachers reported the heaviest emphasis on projects or practical exercises. They reported relying on this type of assessment for 90% of the students, with the next highest countries being Colombia with 77%, Denmark with 74%, and Israel with 70%. However, the most heavily weighted types of assessment were teacher-made tests requiring explanations, observations of students, and students' responses in class. One or more of these assessment types was weighted heavily for 80% or more of the eighth-grade students in many European and Eastern European countries. Teachers were in less agreement about assessment approaches within Australia, Canada, England, Hong Kong, Israel, Japan, Korea, New Zealand, Singapore, Slovenia, Switzerland, Thailand, and the United States, where no type of assessment was weighted heavily for as many as 80% of the students. In contrast to teachers reports internationally, teachers in Missouri and Oregon agreed that they placed the heaviest emphasis on homework as a method of assessment, using it for more than 70% of their students. Teacher-made tests requiring explanations and projects or practical exercises were the next most emphasized, each being used for about 40% of the students in both states.

As might be anticipated, mathematics teachers in most countries reported using assessment information to provide grades or marks, to provide student feedback, to diagnose learning problems, and to plan future lessons. Teachers in fewer countries reported considerable use of assessment information to report to parents or for the purpose of tracking or making program assignments. In Missouri and Oregon, teachers reported using assessment information for about 90% of their students in three major ways: to provide grades, to provide student feedback, and to plan for future lessons. Compared to many TIMSS countries, they reported less use of assessment information to diagnose learning problems (for about 70% of the students) and more use of assessment information to report to parents (for about 80% of the students). Like the teachers in most countries they used assessment information least often to assign students to programs or tracks. However, teachers in Oregon used assessment information for this purpose more frequently (for 46% of the students) than did teachers in Missouri (for 35% of the students).

Table 5.20

Teachers' Reports on the Types of Assessment Given "Quite A Lot" or "A Great Deal" of Weight in Assessing Students' Work in Mathematics Class - Eighth Grade*

Country	Percent of Students Taught by Teachers Relying on Different Types of Assessment						
	External Standardized Tests	Teacher-Made Tests Requiring Explanations	Teacher-Made Objective Tests	Homework Assignments	Projects or Practical Exercises	Observations of Students	Students' Responses in Class
UNITED STATES	r 20 (2.2)	r 51 (3.7)	r 26 (3.7)	r 57 (3.9)	r 35 (3.3)	r 44 (3.3)	r 45 (3.3)
MISSOURI	r 34 (5.6)	r 37 (5.7)	r 24 (3.6)	r 78 (3.7)	r 41 (5.4)	r 33 (4.0)	r 32 (4.1)
OREGON	r 20 (3.3)	r 43 (4.1)	r 20 (3.5)	r 73 (3.7)	r 41 (4.0)	r 30 (3.7)	r 28 (3.7)
Australia	r 8 (1.8)	r 42 (2.9)	r 24 (2.9)	r 26 (2.9)	r 29 (2.9)	r 37 (3.4)	r 34 (3.3)
Austria	r 4 (1.1)	r 29 (3.1)	r 1 (0.5)	r 47 (3.7)	s 23 (3.8)	r 97 (1.6)	r 81 (4.0)
Belgium (Fl)	10 (2.6)	94 (1.9)	11 (3.1)	15 (2.7)	16 (2.6)	50 (4.0)	55 (4.0)
Belgium (Fr)	s 6 (2.5)	s 85 (4.8)	s 16 (4.4)	s 35 (6.0)	s 6 (3.6)	s 47 (6.3)	s 58 (5.5)
Canada	r 16 (3.3)	r 49 (4.0)	r 18 (3.0)	r 44 (4.5)	r 32 (3.6)	r 43 (4.5)	r 41 (3.9)
Colombia	16 (3.7)	81 (4.0)	55 (4.7)	90 (2.5)	77 (3.9)	88 (3.2)	94 (2.0)
Cyprus	r 40 (3.7)	r 71 (4.9)	r 56 (4.7)	r 96 (2.0)	r 67 (4.7)	r 88 (3.1)	r 100 (0.0)
Czech Republic	r 43 (5.4)	100 (0.3)	r 19 (5.1)	14 (3.1)	r 29 (4.9)	74 (4.4)	96 (2.6)
Denmark	54 (5.2)	75 (4.8)	21 (4.0)	66 (5.2)	74 (4.2)	97 (1.8)	91 (2.9)
England	s 36 (3.2)	s 32 (3.0)	s 7 (1.8)	s 68 (3.3)	s 48 (3.5)	s 71 (2.9)	s 66 (3.4)
France	23 (3.7)	83 (3.7)	25 (3.9)	28 (4.8)	r 16 (3.6)	49 (4.6)	54 (4.9)
Germany	s 0 (0.0)	s 55 (5.1)	s 7 (2.9)	s 18 (4.6)	s 40 (4.7)	s 74 (5.2)	s 81 (4.3)
Greece	32 (4.9)	92 (2.2)	44 (4.3)	58 (4.7)	r 45 (4.3)	87 (3.0)	99 (0.6)
Hong Kong	32 (5.4)	40 (5.4)	40 (5.8)	74 (5.4)	12 (3.7)	68 (5.2)	74 (4.8)
Hungary	34 (4.1)	71 (3.5)	24 (3.6)	43 (4.6)	90 (2.7)	69 (4.2)	87 (2.9)
Iceland	r 45 (8.3)	s 42 (9.0)	s 9 (3.5)	r 92 (3.0)	r 53 (7.0)	r 73 (7.3)	r 68 (6.1)
Iran, Islamic Rep.	22 (3.6)	88 (5.2)	24 (4.0)	60 (5.2)	r 14 (3.3)	r 45 (5.3)	86 (3.8)
Ireland	r 35 (4.7)	r 26 (4.2)	25 (4.3)	75 (4.1)	r 37 (4.9)	r 76 (4.0)	86 (3.6)
Israel	r 77 (6.0)	r 29 (7.4)	r 64 (7.0)	r 61 (7.6)	r 70 (7.7)	r 54 (7.1)	r 46 (6.1)
Japan	16 (2.5)	54 (3.8)	20 (3.2)	44 (3.8)	34 (3.7)	68 (3.7)	71 (3.6)
Korea	36 (3.9)	54 (4.3)	32 (3.8)	24 (3.9)	20 (3.6)	31 (3.8)	62 (3.9)
Kuwait	30 (6.6)	78 (6.5)	77 (6.4)	62 (7.5)	32 (6.3)	61 (6.5)	88 (5.2)
Latvia (LSS)	r 52 (4.7)	r 61 (5.2)	r 33 (4.4)	r 79 (4.3)	r 62 (4.9)	r 83 (3.6)	r 100 (0.0)
Lithuania	r 10 (3.0)	r 31 (4.0)	s 11 (3.1)	r 34 (4.8)	s 16 (3.3)	s 24 (4.5)	r 83 (3.3)
Netherlands	29 (5.8)	99 (1.1)	31 (6.2)	30 (5.4)	14 (4.1)	36 (5.1)	42 (5.6)
New Zealand	14 (2.9)	52 (4.5)	20 (3.3)	34 (4.0)	36 (4.5)	52 (4.3)	46 (4.3)
Norway	r 27 (4.0)	r 100 (0.0)	r 3 (1.6)	r 25 (3.9)	r 15 (3.6)	r 55 (4.6)	r 59 (4.8)
Portugal	14 (2.8)	69 (3.9)	16 (3.4)	79 (3.2)	61 (4.4)	89 (3.1)	97 (1.5)
Romania	48 (4.0)	90 (2.7)	51 (4.2)	81 (3.6)	37 (4.1)	78 (3.7)	97 (1.6)
Russian Federation	– –	100 (0.4)	54 (4.6)	64 (3.9)	52 (5.3)	97 (1.5)	– –
Scotland	– –	– –	– –	– –	– –	– –	– –
Singapore	– –	30 (3.8)	6 (2.2)	72 (4.9)	37 (4.7)	61 (5.2)	70 (4.7)
Slovak Republic	75 (3.8)	97 (1.3)	24 (4.4)	35 (4.7)	36 (4.3)	89 (2.8)	99 (0.9)
Slovenia	r 56 (5.2)	r 76 (4.2)	r 22 (4.4)	r 59 (5.2)	r 44 (5.0)	r 70 (4.0)	r 73 (3.9)
Spain	r 5 (2.1)	r 92 (2.5)	r 23 (3.8)	r 75 (4.3)	r 42 (4.6)	r 90 (2.1)	r 95 (1.7)
Sweden	r 59 (3.2)	r 90 (2.4)	r 19 (2.9)	r 50 (4.3)	r 53 (4.3)	r 87 (2.8)	r 79 (3.2)
Switzerland	s 28 (3.5)	s 77 (4.2)	s 6 (2.1)	s 13 (2.8)	s 14 (2.8)	s 47 (5.1)	s 54 (5.0)
Thailand	s 22 (5.1)	r 52 (6.2)	s 71 (5.0)	s 75 (5.4)	s 21 (4.5)	s 51 (7.0)	s 66 (6.7)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

Table 5.21

Teachers' Reports on Ways Assessment Information Is Used "Quite A Lot" or "A Great Deal" - Mathematics - Eighth Grade*

Country	Percent of Students Taught by Teachers Using Assessment Information					
	To Provide Grades or Marks	To Provide Student Feedback	To Diagnose Learning Problems	To Report to Parents	To Assign Students to Programs or Tracks	To Plan for Future Lessons
UNITED STATES	r 96 (1.0)	r 91 (2.4)	r 80 (2.8)	r 82 (2.6)	r 30 (3.1)	r 86 (2.4)
MISSOURI	r 88 (3.5)	r 93 (2.1)	r 76 (4.7)	r 82 (3.5)	r 35 (5.0)	r 93 (3.1)
OREGON	r 95 (2.2)	r 95 (1.5)	r 67 (4.2)	r 85 (2.8)	r 46 (4.3)	r 87 (3.5)
Australia	r 86 (2.8)	r 89 (2.3)	r 75 (3.5)	r 76 (3.1)	r 55 (3.9)	r 73 (3.0)
Austria	– –	r 72 (3.8)	r 75 (3.7)	r 39 (4.3)	r 17 (3.5)	r 53 (3.9)
Belgium (Fl)	r 70 (4.1)	r 78 (3.7)	r 88 (2.7)	r 80 (3.8)	r 84 (3.3)	r 54 (4.8)
Belgium (Fr)	s 92 (3.1)	s 81 (4.3)	s 92 (2.9)	s 61 (5.6)	– –	s 89 (3.0)
Canada	87 (2.6)	92 (1.8)	84 (3.1)	79 (3.0)	52 (3.6)	79 (3.2)
Colombia	68 (4.3)	90 (2.5)	92 (2.5)	53 (5.2)	37 (5.3)	94 (2.2)
Cyprus	r 100 (0.0)	r 93 (3.2)	r 96 (2.5)	r 96 (2.3)	r 60 (6.0)	r 91 (3.2)
Czech Republic	94 (3.2)	93 (2.7)	100 (0.5)	67 (4.5)	38 (5.2)	98 (1.3)
Denmark	26 (4.3)	85 (3.6)	r 85 (3.6)	54 (5.2)	68 (4.7)	85 (3.6)
England	s 91 (1.8)	s 91 (1.8)	s 84 (2.3)	s 81 (2.7)	s 78 (2.6)	s 85 (2.1)
France	89 (2.9)	93 (2.4)	90 (3.0)	61 (4.3)	36 (4.4)	91 (2.6)
Germany	s 84 (4.3)	s 86 (3.6)	s 89 (3.6)	s 48 (5.5)	s 28 (4.8)	s 86 (3.8)
Greece	97 (1.4)	88 (2.8)	90 (2.0)	89 (3.7)	41 (4.2)	77 (3.4)
Hong Kong	72 (5.1)	82 (4.7)	81 (4.9)	13 (4.1)	13 (4.1)	74 (4.4)
Hungary	58 (4.2)	71 (3.9)	95 (2.0)	81 (3.5)	83 (3.5)	79 (3.7)
Iceland	r 84 (6.2)	r 71 (7.7)	r 82 (6.8)	r 78 (7.3)	r 10 (4.5)	r 91 (4.5)
Iran, Islamic Rep.	83 (3.6)	r 71 (4.1)	81 (3.8)	63 (4.5)	62 (4.2)	79 (3.4)
Ireland	r 72 (4.3)	83 (3.5)	r 84 (3.5)	76 (3.8)	r 54 (4.6)	85 (3.5)
Israel	r 14 (5.9)	r 14 (4.2)	r 20 (5.8)	r 27 (7.3)	r 36 (6.2)	r 7 (3.8)
Japan	73 (3.6)	60 (3.9)	66 (3.6)	9 (2.1)	29 (3.3)	58 (3.9)
Korea	39 (3.7)	42 (4.3)	65 (3.8)	10 (2.7)	3 (1.4)	56 (4.3)
Kuwait	70 (7.1)	75 (5.0)	r 81 (6.2)	r 53 (6.3)	r 66 (7.2)	r 83 (5.8)
Latvia (LSS)	r 97 (1.6)	r 69 (4.3)	r 96 (2.1)	r 39 (4.7)	r 42 (4.9)	r 95 (2.2)
Lithuania	r 78 (4.1)	52 (4.4)	r 54 (4.5)	54 (4.8)	45 (4.6)	r 78 (4.1)
Netherlands	86 (3.6)	68 (5.6)	65 (5.3)	57 (5.7)	68 (5.4)	50 (5.7)
New Zealand	87 (2.9)	87 (2.7)	81 (3.0)	86 (3.1)	45 (4.2)	76 (3.4)
Norway	r 69 (4.6)	r 77 (4.4)	r 47 (5.2)	r 31 (4.1)	r 57 (5.0)	r 82 (3.9)
Portugal	92 (2.3)	80 (3.7)	95 (2.0)	64 (4.5)	43 (4.1)	90 (2.7)
Romania	94 (1.8)	90 (2.5)	94 (1.9)	75 (3.6)	78 (3.1)	95 (1.8)
Russian Federation	90 (2.8)	97 (1.2)	98 (1.2)	25 (4.2)	90 (2.7)	98 (1.0)
Scotland	– –	– –	– –	– –	– –	– –
Singapore	71 (3.7)	87 (3.3)	88 (3.2)	39 (4.4)	31 (4.4)	76 (4.3)
Slovak Republic	74 (4.0)	79 (3.4)	90 (2.7)	68 (4.3)	12 (2.8)	78 (4.2)
Slovenia	r 73 (4.1)	r 97 (2.0)	r 95 (2.4)	r 76 (4.7)	r 40 (5.2)	r 92 (2.9)
Spain	r 95 (2.1)	r 93 (2.3)	r 90 (2.8)	r 86 (3.5)	r 72 (4.1)	r 92 (2.6)
Sweden	r 73 (3.6)	r 91 (2.4)	r 85 (2.9)	r 53 (4.2)	r 32 (3.7)	r 93 (1.9)
Switzerland	s 85 (3.5)	s 92 (2.7)	s 88 (2.9)	s 47 (4.3)	s 23 (3.3)	s 80 (4.2)
Thailand	r 65 (6.2)	r 77 (5.4)	s 84 (4.7)	s 41 (6.4)	s 72 (5.1)	s 87 (4.2)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in1997.

As reported in Table 5.22, eighth-grade students around the world reported substantial variation in the frequency of testing in mathematics classes. The majority of the students reported having quizzes and tests only once in a while or never in Austria, the Czech Republic, Denmark, England, Germany, Hungary, Iceland, Ireland, Japan, Korea, Latvia (LSS), Norway, Scotland, and the Slovak Republic. In contrast, one-third or more of the students reported almost always having quizzes or tests in Colombia, Hong Kong, Kuwait, Romania, Spain, and the United States. The United States was one of the countries where the most students (38%) reported being tested almost always, and another 47% reported being tested pretty often. The results for Missouri and Oregon were consistent with those for the United States. Thirty-six percent of the eighth graders in Missouri reported being tested almost always and 46% pretty often. In Oregon, 32% reported being tested almost always and 49% being tested pretty often.

In a number of countries, the students tested only infrequently (once in a while or never) and those tested pretty often had similar achievement, while students who reported being tested almost always had lower achievement. In the United States, Missouri, and Oregon both the students tested infrequently and those tested almost always had lower achievement than the students tested pretty often. Some teachers may be testing the lower-achieving students less often because these students can least afford time diverted from their ongoing instructional program or maybe it takes these students longer to complete a unit of material. On the other hand, some teachers may be providing shorter lessons and follow-up quizzes for lower-achieving students to more closely monitor their grasp of the subject matter.

Table 5.22

Students' Reports on Frequency of Having a Quiz or Test in Their Mathematics Lessons - Eighth Grade*

Country	Once in a While or Never		Pretty Often		Almost Always	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
UNITED STATES	15 (0.9)	497 (6.7)	47 (1.1)	517 (4.5)	38 (1.1)	483 (4.8)
MISSOURI	19 (1.5)	501 (7.3)	46 (1.5)	522 (7.5)	36 (1.7)	484 (7.4)
OREGON	19 (1.5)	512 (8.5)	49 (1.7)	543 (8.2)	32 (1.8)	508 (9.0)
Australia	46 (1.2)	540 (5.1)	38 (0.9)	537 (4.1)	16 (0.9)	501 (6.0)
Austria	77 (1.6)	548 (3.5)	15 (1.2)	525 (5.9)	9 (0.8)	488 (5.6)
Belgium (Fl)	7 (0.8)	558 (12.7)	71 (1.7)	575 (5.8)	22 (2.0)	541 (8.3)
Belgium (Fr)	27 (1.7)	528 (4.9)	49 (1.7)	531 (3.8)	24 (1.2)	521 (5.0)
Canada	27 (1.3)	533 (4.2)	52 (1.2)	535 (2.4)	20 (1.3)	505 (4.0)
Colombia	22 (1.2)	385 (2.8)	35 (0.8)	389 (4.6)	43 (1.4)	388 (3.4)
Cyprus	22 (1.2)	466 (3.8)	63 (1.1)	482 (2.3)	15 (0.8)	455 (4.3)
Czech Republic	72 (1.3)	563 (5.1)	24 (1.2)	572 (6.8)	5 (0.4)	531 (7.5)
Denmark	69 (1.8)	508 (3.3)	21 (1.5)	500 (4.7)	10 (0.9)	489 (6.5)
England	50 (1.4)	511 (3.9)	40 (1.2)	511 (3.5)	10 (0.8)	479 (6.1)
France	30 (1.4)	540 (3.9)	51 (1.4)	543 (3.7)	20 (0.9)	528 (4.4)
Germany	66 (2.0)	521 (4.9)	22 (1.4)	499 (6.2)	12 (1.1)	474 (7.3)
Greece	44 (1.6)	488 (4.0)	40 (1.2)	491 (3.8)	16 (0.8)	458 (3.6)
Hong Kong	21 (2.2)	576 (12.1)	43 (1.3)	604 (5.7)	36 (2.4)	581 (8.3)
Hungary	80 (1.2)	542 (3.3)	15 (0.9)	540 (5.8)	5 (0.6)	486 (8.1)
Iceland	70 (1.7)	490 (4.0)	24 (1.8)	493 (6.1)	6 (1.2)	445 (18.8)
Iran, Islamic Rep.	45 (1.8)	434 (2.9)	28 (1.2)	428 (3.4)	27 (1.2)	425 (3.8)
Ireland	51 (2.1)	536 (6.1)	36 (1.6)	534 (5.6)	14 (1.0)	493 (7.5)
Israel	43 (3.3)	544 (5.8)	39 (2.4)	519 (7.3)	18 (2.0)	488 (8.0)
Japan	59 (2.3)	605 (2.6)	30 (1.6)	608 (4.1)	11 (1.5)	595 (4.7)
Korea	74 (1.5)	610 (2.6)	19 (1.3)	616 (5.3)	7 (0.6)	571 (7.5)
Kuwait	29 (1.7)	389 (3.6)	29 (1.5)	396 (5.0)	42 (1.8)	392 (2.7)
Latvia (LSS)	80 (1.4)	496 (3.0)	17 (1.2)	490 (5.7)	3 (0.4)	465 (11.2)
Lithuania	30 (1.6)	465 (4.3)	59 (1.4)	487 (4.0)	11 (0.8)	462 (7.5)
Netherlands	45 (1.6)	555 (9.5)	43 (1.3)	536 (7.1)	12 (0.9)	515 (7.4)
New Zealand	45 (1.7)	518 (5.3)	35 (1.1)	509 (4.9)	20 (1.2)	489 (5.4)
Norway	66 (1.3)	512 (2.5)	31 (1.3)	494 (3.4)	3 (0.4)	441 (7.5)
Portugal	49 (1.6)	461 (2.7)	28 (1.2)	451 (3.3)	23 (1.0)	446 (2.8)
Romania	30 (1.1)	478 (5.6)	36 (1.1)	490 (4.7)	34 (1.1)	479 (4.6)
Russian Federation	23 (1.5)	524 (5.8)	53 (2.0)	544 (5.9)	24 (1.4)	529 (5.7)
Scotland	63 (1.8)	505 (6.4)	28 (1.4)	498 (6.1)	9 (0.9)	468 (8.7)
Singapore	27 (1.2)	644 (5.6)	55 (1.0)	646 (5.2)	18 (0.9)	635 (6.2)
Slovak Republic	51 (1.6)	554 (4.0)	42 (1.4)	545 (4.2)	7 (0.5)	510 (6.8)
Slovenia	36 (1.6)	550 (4.2)	44 (1.4)	543 (3.4)	20 (1.0)	518 (4.6)
Spain	25 (1.4)	488 (2.8)	37 (1.2)	498 (2.8)	39 (1.3)	478 (2.7)
Sweden	43 (1.6)	522 (3.6)	49 (1.4)	523 (3.2)	7 (0.5)	473 (5.5)
Switzerland	41 (1.2)	550 (4.0)	45 (1.2)	553 (3.2)	14 (0.7)	519 (5.4)
Thailand	41 (1.7)	525 (6.2)	28 (0.9)	527 (6.7)	31 (1.2)	517 (6.0)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

Background data for Bulgaria and South Africa not available.

Appendix A

Overview of TIMSS Procedures

History

TIMSS represents the continuation of a long series of studies conducted by the International Association for the Evaluation of Educational Achievement (IEA). Since its inception in 1959, the IEA has conducted more than 15 studies of cross-national achievement in curricular areas such as mathematics, science, language, civics, and reading. IEA conducted its First International Science Study (FISS) in 1970-71, and the Second International Science Study (SISS) in 1983-84. The First and Second International Mathematics Studies (FIMS and SIMS) were conducted in 1964 and 1980-82, respectively. Since the subjects of mathematics and science are related in many respects, the third studies were conducted together as an integrated effort.[1] The TIMSS data collection took place towards the end of 1994 for countries in the Southern Hemisphere, and in the first half of 1995 for countries in the Northern Hemisphere.

The number of participating countries and the inclusion of both mathematics and science resulted in TIMSS becoming the largest, most complex IEA study to date and the largest international study of educational achievement ever undertaken. Traditionally, IEA studies have systematically worked toward gaining more in-depth understanding of how various factors contribute to the overall outcomes of schooling. Particular emphasis has been given to refining our understanding of students' opportunity to learn as this opportunity becomes successively defined and implemented by curricular and instructional practices. In an effort to extend what had been learned from previous studies and provide contextual and explanatory information, the magnitude of TIMSS expanded beyond the already substantial task of measuring achievement in two subject areas to also include a thorough investigation of curriculum and how it is delivered in classrooms around the world.

The State TIMSS Benchmarking Study provided states the opportunity to administer the TIMSS mathematics and science tests and background questionnaires at the eighth grade to obtain comparisons of achievement with the TIMSS countries. Missouri and Oregon availed of this opportunity to administer the Population 2 TIMSS tests to public-school students in the eighth grade. The TIMSS tests were administered in Missouri and Oregon in April-May 1997, two years after the main TIMSS data collection.

[1] Because a substantial amount of time has elapsed since earlier IEA studies in mathematics and science, curriculum and testing methods in these two subjects have undergone many changes. Because TIMSS has devoted considerable energy toward reflecting the most current educational and measurement practices, changes in items and methods as well as differences in the populations tested make comparisons of TIMSS results with those of previous studies very difficult. The focus of TIMSS was not on measuring achievement trends, but rather on providing up-to-date information about the current quality of education in mathematics and science. Trend data will be available after the 1999 replication of TIMSS at the eighth grade, TIMSS-R.

Components of TIMSS

Continuing the approach of previous IEA studies, TIMSS addressed three conceptual levels of curriculum. The **intended curriculum** is composed of the mathematics and science instructional and learning goals as defined at the system level. The **implemented curriculum** is the mathematics and science curriculum as interpreted by teachers and made available to students. The **attained curriculum** is the mathematics and science content that students have learned and their attitudes towards these subjects. To aid in meaningful interpretation and comparison of results, TIMSS also collected extensive information about the social and cultural contexts for learning, many of which are related to variation among different educational systems.

Even though slightly fewer countries completed all the steps necessary to have their data included in this report, nearly 50 countries participated in one or more of the various components of the TIMSS data collection effort, including the curriculum analysis. To gather information about the intended curriculum, mathematics and science specialists within each participating country worked section-by-section through curriculum guides, textbooks, and other curricular materials to categorize aspects of these materials in accordance with detailed specifications derived from the TIMSS mathematics and science curriculum frameworks.[2] Initial results from this component of TIMSS can be found in two companion volumes: *Many Visions, Many Aims: A Cross-National Investigation of Curricular Intentions in School Mathematics* and *Many Visions, Many Aims: A Cross-National Investigation of Curricular Intentions in School Science*.[3]

To measure the attained curriculum, TIMSS tested more than half a million students in mathematics and science at five grade levels. TIMSS included testing at three separate populations:

Population 1. Students enrolled in the two adjacent grades that contained the largest proportion of 9-year-old students at the time of testing – third- and fourth-grade students in most countries.

Population 2. Students enrolled in the two adjacent grades that contained the largest proportion of 13-year-old students at the time of testing – seventh- and eighth-grade students in most countries.

Population 3. Students in their final year of secondary education. As an additional option, countries could test two special subgroups of these students:

1) Students having taken advanced mathematics, and
2) Students having taken physics.

[2] Robitaille, D.F., McKnight, C., Schmidt, W., Britton, E., Raizen, S., and Nicol., C. (1993). *TIMSS Monograph No. 1: Curriculum Frameworks for Mathematics and Science*. Vancouver, B.C.: Pacific Educational Press.

[3] Schmidt, W.H., McKnight, C.C., Valverde, G.A., Houang, R.T., and Wiley, D.E. (1997). *Many Visions, Many Aims: A Cross-National Investigation of Curricular Intentions in School Mathematics*. Dordrecht, the Netherlands,: Kluwer Academic Publishers. Schmidt, W.H., Raizen, S.A., Britton, E.D., Bianchi, L.J., and Wolfe, R.G., (1997). *Many Visions, Many Aims: A Cross-National Investigation of Curricular Intentions in School Science*. Dordrecht, the Netherlands: Kluwer Academic Publishers.

Countries participating in the study were required to administer tests to the students in the two grades at Population 2, but could choose whether or not to participate at the other levels. In about half of the countries at Populations 1 and 2, subsets of the upper-grade students who completed the written tests also participated in a performance assessment. In the performance assessment, students engaged in a number of hands-on mathematics and science activities.

TIMSS also administered a broad array of questionnaires to collect data about how the curriculum is implemented in classrooms, including the instructional practices used to deliver it. The questionnaires also were used to collect information about the social and cultural contexts for learning. Questionnaires were administered at the **country level** about decision-making and organizational features within their educational systems. The **students** who were tested answered questions pertaining to their attitudes towards mathematics and science, classroom activities, home background, and out-of-school activities. The mathematics and science **teachers** of sampled students responded to questions about teaching emphasis on the topics in the curriculum frameworks, instructional practices, textbook usage, professional training and education, and their views on mathematics and science. The heads of **schools** responded to questions about school staffing and resources, mathematics and science course offerings, and teacher support. In addition, a volume was compiled that presents descriptions of the educational systems of the participating countries.[4]

As in the 1995 TIMSS assessment, for the 1997 State TIMSS Benchmarking Study, background questionnaires were administered to the students, teachers, and school principals. Both the teacher and school administrator questionnaires were abbreviated versions of those administered for TIMSS, adapted to minimize the burden on school personnel. The student questionnaire, however, was identical to those administered to students in the United States during the 1995 assessment. Like the 1995 assessment, the State TIMSS Benchmarking Study was directed by the TIMSS International Study Center at Boston College. The assessment was conducted using the same administrative procedures and applying the same technical standards as the international project.

[4] Robitaille, D.F. (1997). *National Contexts for Mathematics and Science Education: An Encyclopedia of the Education Systems Participating in TIMSS.* Vancouver, B.C.: Pacific Educational Press.

Developing the TIMSS Mathematics Test

The TIMSS curriculum framework underlying the mathematics tests at all three populations was developed by groups of mathematics educators with input from the TIMSS National Research Coordinators (NRCs). As shown in Figure A.1, the mathematics curriculum framework contains three dimensions or aspects. The **content** aspect represents the subject matter content of school mathematics. The **performance expectations** aspect describes, in a non-hierarchical way, the many kinds of performances or behaviors that might be expected of students in school mathematics. The **perspectives** aspect focuses on the development of students' attitudes, interest, and motivations in mathematics.[5]

Working within the mathematics curriculum framework, mathematics test specifications were developed for Population 2 that included items representing a wide range of mathematics topics and eliciting a range of skills from the students. The tests were developed through an international consensus involving input from experts in mathematics and measurement specialists. The TIMSS Subject Matter Advisory Committee, including distinguished scholars from 10 countries, ensured that the test reflected current thinking and priorities in mathematics. The items underwent an iterative development and review process, with one of the pilot testing efforts involving 43 countries. Every effort was made to help ensure that the tests represented the curricula of the participating countries and that the items did not exhibit any bias towards or against particular countries, including modifying specifications in accordance with data from the curriculum analysis component, obtaining ratings of the items by subject-matter specialists within the participating countries, and conducting thorough statistical item analysis of data collected in the pilot testing. The final forms of the test were endorsed by the NRCs of the participating countries.[6]

Table A.1 presents the six content areas included in the Population 2 mathematics test and the numbers of items and score points in each category. Distributions also are included for the four performance categories derived from the performance expectations aspect of the curriculum framework. Approximately one-fourth of the items were in the free-response format, requiring students to generate and write their own answers. Designed to represent approximately one-third of students' response time, some free-response questions asked for short answers while others required extended responses where students needed to show their work or provide explanations for their answers. The remaining questions used a multiple-choice format. In scoring the tests, correct answers to most questions were worth one point.

[5] The complete TIMSS curriculum frameworks can be found in Robitaille, D.F. et al. (1993). *TIMSS Monograph No. 1: Curriculum Frameworks for Mathematics and Science*. Vancouver, B.C.: Pacific Educational Press.

[6] For a full discussion of the TIMSS test development effort, please see: Garden, R.A. and Orpwood, G. (1996). "TIMSS Test Development" in M.O. Martin and D.L. Kelly (eds.), *Third International Mathematics and Science Study Technical Report, Volume I*. Chestnut Hill, MA: Boston College; and Garden, R.A. (1996). "Development of the TIMSS Achievement Items" in D.F. Robitaille and R.A. Garden (eds.), *TIMSS Monograph No. 2: Research Questions and Study Design*. Vancouver, B.C.: Pacific Educational Press.

Figure A.1

The Three Aspects and Major Categories of the Mathematics Framework

Content

- Numbers
- Measurement
- Geometry
- Proportionality
- Functions, relations, and equations
- Data representation, probability, and statistics
- Elementary analysis
- Validation and structure

Performance Expectations

- Knowing
- Using routine procedures
- Investigating and problem solving
- Mathematical reasoning
- Communicating

Perspectives

- Attitudes
- Careers
- Participation
- Increasing interest
- Habits of mind

Table A.1

Distribution of Mathematics Items by Content Reporting Category and Performance Category - Eighth Grade*

Content Category	Percentage of Items	Total Number of Items	Number of Multiple-Choice Items	Number of Short-Answer Items	Number of Extended-Response Items	Number of Score Points[1]
Fractions and Number Sense	34%	51	41	9	1	52
Geometry	15%	23	22	1	0	23
Algebra	18%	27	22	3	2	30
Data Representation, Analysis and Probability[2]	14%	21	19	1	1	23
Measurement	12%	18	13	3	2	23
Proportionality	7%	11	8	2	1	12
Total	100%	151	125	19	7	163

Performance Category	Percentage of Items	Total Number of Items	Number of Multiple-Choice Items	Number of Short-Answer Items	Number of Extended-Response Items	Number of Score Points[1]
Knowing	22%	33	31	2	0	33
Performing Routine Procedures	25%	38	32	6	0	38
Using Complex Procedures	21%	32	28	4	0	32
Solving Problems[3]	32%	48	34	7	7	60

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

[1]In scoring the tests correct answers to most items were worth one point. However, responses to some constructed-response items were evaluated for partial credit with a fully correct answer awarded up to three points. In addition, some items had two parts. Thus, the number of score points exceeds the number of items in the test.

[2]One item in the Data Representation, Analysis, and Probability category was deleted prior to analysis due to poor performing item statistics.

[3]Includes two extended-response items classified as "Justifying and Proving" and two extended-response items classified as "Communicating."

Consistent with the approach of allotting students longer response time for the constructed-response questions than for multiple-choice questions, however, responses to some of these questions (particularly those requiring extended responses) were evaluated for partial credit with a fully correct answer being awarded two or even three points (see later section on scoring). This, in addition to the fact that several items had two parts, means that the total number of score points available for analysis somewhat exceeds the number of items included in the test.

The TIMSS instruments were prepared in English and translated into 30 additional languages. In addition, it sometimes was necessary to adapt the international versions for cultural purposes, including the 11 countries that tested in English. This process represented an enormous effort for the national centers, with many checks along the way. The translation effort included: (1) developing explicit guidelines for translation and cultural adaptation, (2) translation of the instruments by the national centers in accordance with the guidelines and using two or more independent translations, (3) consultation with subject-matter experts regarding cultural adaptations to ensure that the meaning and difficulty of items did not change, (4) verification of the quality of the translations by professional translators from an independent translation company, (5) corrections by the national centers in accordance with the suggestions made, (6) verification that corrections were implemented, and (7) a series of statistical checks after the testing to detect items that did not perform comparably across countries.[7]

TIMSS Test Design

The tests administered in the 1997 State TIMSS Benchmarking Study were identical to those administered to eighth-grade students during the 1995 assessment. In accordance with the design, not all of the students responded to all of the mathematics items. To ensure broad subject matter coverage without overburdening individual students, a rotated design that included both the mathematics and science items was used. Thus, the same students participated in both the mathematics and science testing. The TIMSS Population 2 test consisted of eight booklets, with each booklet requiring 90 minutes of student response time. In accordance with the design, the mathematics and science items were assembled into 26 different clusters (labeled A through Z). Eight of the clusters were designed to take students 12 minutes to complete; 10 of the clusters, 22 minutes; and 8 clusters, 10 minutes. In all, the design provided a total of 396 unique testing minutes, 198 for mathematics and 198 for science. Cluster A was a core cluster assigned to all booklets. The remaining clusters were assigned to the booklets in accordance with the rotated design so that representative samples of students responded to each cluster.[8]

[7] More details about the translation verification procedures can be found in Mullis, I.V.S., Kelly, D.L., and Haley, K. (1996). "Translation Verification Procedures" in M.O. Martin and I.V.S. Mullis (eds.), *Third International Mathematics and Science Study: Quality Assurance in Data Collection*. Chestnut Hill, MA: Boston College; and Maxwell, B. (1996). "Translation and Cultural Adaptation of the TIMSS Instruments" in M.O. Martin and D.L. Kelly (eds.), *Third International Mathematics and Science Study Technical Report, Volume I*. Chestnut Hill, MA: Boston College.

[8] The design is fully documented in Adams, R. and Gonzalez, E. (1996). "Design of the TIMSS Achievement Instruments" in D.F. Robitaille and R.A. Garden (eds.), *TIMSS Monograph No. 2: Research Questions and Study Design*. Vancouver, B.C.: Pacific Educational Press; and Adams, R. and Gonzalez, E. (1996). "TIMSS Test Design" in M.O. Martin and D.L. Kelly (eds.), *Third International Mathematics and Science Study Technical Report, Volume I*. Chestnut Hill, MA: Boston College.

Sample Implementation and Participation Rates

The selection of valid and efficient samples is crucial to the quality and success of an international comparative study such as TIMSS. The accuracy of the survey results depends on the quality of sampling information available and on the quality of the sampling activities themselves. For the countries participating in TIMSS, NRCs worked on all phases of sampling with staff from Statistics Canada. NRCs received training in how to select the school and student samples and in the use of the sampling software. In consultation with the TIMSS sampling referee (Keith Rust, Westat, Inc.), staff from Statistics Canada reviewed the national sampling plans, sampling data, sampling frames, and sample execution. This documentation was used by the International Study Center in consultation with Statistics Canada, the sampling referee, and the Technical Advisory Committee, to evaluate the quality of the samples. For the State TIMSS Benchmarking Study, the school samples were drawn by Westat, Inc., following the international procedures.

In a few situations where it was not possible to implement TIMSS testing for the entire internationally desired definition of Population 2 (all students in the two adjacent grades with the greatest proportion of 13-year-olds), countries were permitted to define a national desired population which did not include part of the internationally desired population. Table A.2 shows any differences in coverage between the international and national desired populations. Most countries achieved 100% coverage (36 out of 41). In some instances, countries, as a matter of practicality, needed to define their tested population according to the structure of school systems, but in Germany and Switzerland, parts of the country were simply unwilling to take part in TIMSS. Because coverage fell below 65% for Latvia, the Latvian results have been labeled "Latvia (LSS)," for Latvian Speaking Schools, throughout the report. Unlike the United States which tested students in both public and private schools, Missouri and Oregon restricted the testing to public school students. Public school students account for 86% of the eighth-grade school population in Missouri, and 93% in Oregon. The sampling frames for both Missouri and Oregon included 100% of their public school students.

Within the desired population, countries could define a population that excluded a small percent (less than 10%) of certain kinds of schools or students that would be very difficult or resource intensive to test (e.g., schools for students with special needs or schools that were very small or located in extremely remote areas). Table A.2 also shows that the degree of such exclusions was small, only England exceeded the 10% limit. Missouri and Oregon had minimal exclusions. Both states had no exclusions at the school level and within-school exclusions of below 2% and 1%, respectively.

Table A.2

Coverage of TIMSS Target Population

The International Desired Population is defined as follows: All students enrolled in the two adjacent grades with the largest proportion of 13-year-old students at the time of testing (seventh and eighth grade in most countries). Missouri and Oregon tested only at the eighth grade.

Country	International Desired Population		National Desired Population		
	Coverage	Notes on Coverage	School-Level Exclusions	Within-Sample Exclusions	Overall Exclusions
‡ **UNITED STATES**	100%		0.4%	1.7%	2.1%
‡ **MISSOURI**	100%	Public Schools only (86%)	0.0%	1.4%	1.4%
OREGON	100%	Public Schools only (93%)	0.0%	0.9%	0.9%
Australia	100%		0.2%	0.7%	0.8%
Austria	100%		2.9%	0.2%	3.1%
‡ Belgium (Fl)	100%		3.8%	0.0%	3.8%
Belgium (Fr)	100%		4.5%	0.0%	4.5%
Bulgaria	100%		0.6%	0.0%	0.6%
Canada	100%		2.4%	2.1%	4.5%
Colombia	100%		3.8%	0.0%	3.8%
Cyprus	100%		0.0%	0.0%	0.0%
Czech Republic	100%		4.9%	0.0%	4.9%
Denmark	100%		0.0%	0.0%	0.0%
‡ England	100%		8.4%	2.9%	11.3%
‡ France	100%		2.0%	0.0%	2.0%
‡ Germany	88%	15 of 16 regions*	8.8%	0.9%	9.7%
Greece	100%		1.5%	1.3%	2.8%
Hong Kong	100%		2.0%	0.0%	2.0%
Hungary	100%		3.8%	0.0%	3.8%
Iceland	100%		1.7%	2.9%	4.5%
Iran, Islamic Rep.	100%		0.3%	0.0%	0.3%
Ireland	100%		0.0%	0.4%	0.4%
‡ Israel	74%	Hebrew Public Education System	3.1%	0.0%	3.1%
Japan	100%		0.6%	0.0%	0.6%
Korea	100%		2.2%	1.6%	3.8%
Kuwait	100%		0.0%	0.0%	0.0%
‡ Latvia (LSS)	51%	Latvian-speaking schools	2.9%	0.0%	2.9%
‡ Lithuania	84%	Lithuanian-speaking schools	6.6%	0.0%	6.6%
Netherlands	100%		1.2%	0.0%	1.2%
New Zealand	100%		1.3%	0.4%	1.7%
Norway	100%		0.3%	1.9%	2.2%
Portugal	100%		0.0%	0.3%	0.3%
Romania	100%		2.8%	0.0%	2.8%
Russian Federation	100%		6.1%	0.2%	6.3%
Scotland	100%		0.3%	1.9%	2.2%
Singapore	100%		4.6%	0.0%	4.6%
Slovak Republic	100%		7.4%	0.1%	7.4%
Slovenia	100%		2.4%	0.2%	2.6%
South Africa	100%		9.6%	0.0%	9.6%
Spain	100%		6.0%	2.7%	8.7%
Sweden	100%		0.0%	0.9%	0.9%
‡ Switzerland	86%	22 of 26 cantons	4.4%	0.8%	5.3%
Thailand	100%		6.2%	0.0%	6.2%

‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

*One region (Baden-Wuerttemberg) did not participate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

Within countries, TIMSS used a two-stage sample design at Population 2, where the first stage involved selecting 150 public and private schools within each country. Within each school, the basic approach required countries to use random procedures to select one mathematics class at the eighth grade and one at the seventh grade (or the corresponding upper and lower grades in that country). All of the students in those two classes were to participate in the TIMSS testing. This approach was designed to yield a representative sample of 7,500 students per country, with approximately 3,750 students at each grade.[9] Typically, between 450 and 3,750 students responded to each item at each grade level, depending on the booklets in which the items were located.

In the 1997 State TIMSS Benchmarking Study the sample design specified a probability sample of between 50 and 60 schools, with one eighth-grade classroom randomly selected within each school. This design was expected to yield a representative sample of 2000 to 2500 students in each state. Westat staff worked with the Missouri and Oregon state departments of education to obtain lists of the public schools and to draw the school samples. The states were responsible for obtaining the cooperation of the sampled schools.

Countries were required to obtain a participation rate of at least 85% for both schools and students, or a combined rate (the product of school and student participation) of 75%. Tables A.3 and A.4 show the school and student sample sizes, respectively. Table A.5 shows the school, student, and overall participation rates for the TIMSS countries, as well as for Missouri and Oregon.

Figure A.2 shows how the states and countries have been grouped in tables reporting achievement results. An acceptable participation rate was 85% for both the schools and students, or a combined rate (the product of school and student participation) of 75% – with or without replacement schools. Countries that achieved acceptable participation rates, and that complied with the TIMSS guidelines for grade selection and classroom sampling are shown in the first panel of Figure A.2. Missouri and Oregon both achieved acceptable participation rates, however Missouri met sample participation guidelines only after the replacement schools were included. Both states satisfied the TIMSS guidelines for grade selection and classroom sampling.

Countries not reaching at least 50% school participation without the use of replacements schools, or that failed to reach the sampling participation standard even with the inclusion of replacement schools, are shown in the second panel of Figure A.2. These countries are presented in a separate section of the achievement tables in Chapters 1, 2, and 3 in alphabetical order, and are shown in tables in Chapters 4 and 5 in italics.

[9] The sample design for TIMSS is described in detail in Foy, P., Rust, K., and Schleicher, A. (1996). "TIMSS Sample Design" in M.O. Martin and D.L. Kelly (eds.), *Third International Mathematics and Science Study Technical Report, Volume I.* Chestnut Hill, MA: Boston College.

Table A.3

School Sample Sizes - Eighth Grade*

Country	Number of Schools in Original Sample	Number of Eligible Schools in Original Sample	Number of Schools in Original Sample That Participated	Number of Replacement Schools That Participated	Total Number of Schools That Participated
UNITED STATES	220	217	169	14	183
MISSOURI	60	60	44	11	55
OREGON	58	58	54	4	58
Australia	214	214	158	3	161
Austria	159	159	62	62	124
Belgium (Fl)	150	150	92	49	141
Belgium (Fr)	150	150	85	34	119
Bulgaria	167	167	111	4	115
Canada	413	388	363	1	364
Colombia	150	150	136	4	140
Cyprus	55	55	55	0	55
Czech Republic	150	149	143	6	149
Denmark	158	157	144	0	144
England	150	144	80	41	121
France	151	151	127	0	127
Germany	153	150	102	32	134
Greece	180	180	156	0	156
Hong Kong	105	104	85	0	85
Hungary	150	150	150	0	150
Iceland	161	132	129	0	129
Iran, Islamic Rep.	192	191	191	0	191
Ireland	150	149	125	7	132
Israel	100	100	45	1	46
Japan	158	158	146	5	151
Korea	150	150	150	0	150
Kuwait	69	69	69	0	69
Latvia (LSS)	170	169	140	1	141
Lithuania	151	151	145	0	145
Netherlands	150	150	36	59	95
New Zealand	150	150	137	12	149
Norway	150	150	136	10	146
Portugal	150	150	142	0	142
Romania	176	176	163	0	163
Russian Federation	175	175	170	4	174
Scotland	153	153	119	8	127
Singapore	137	137	137	0	137
Slovak Republic	150	150	136	9	145
Slovenia	150	150	121	0	121
South Africa	180	180	107	7	114
Spain	155	154	147	6	153
Sweden	120	120	116	0	116
Switzerland	259	258	247	3	250
Thailand	150	150	147	0	147

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

Table A.4

Student Sample Sizes - Eighth Grade*

Country	Number of Students Sampled in Participating Schools	Number of Students Withdrawn from Class / School	Number of Students Excluded	Number of Students Eligible	Number of Students Absent	Total Number of Students Assessed
UNITED STATES	8026	104	108	7814	727	7087
MISSOURI	2324	35	30	2259	144	2115
OREGON	2446	50	18	2378	162	2216
Australia	8027	63	61	7903	650	7253
Austria	2969	14	4	2951	178	2773
Belgium (Fl)	2979	1	0	2978	84	2894
Belgium (Fr)	2824	0	1	2823	232	2591
Bulgaria	2300	0	0	2300	327	1973
Canada	9240	134	206	8900	538	8362
Colombia	2843	6	0	2837	188	2649
Cyprus	3045	15	0	3030	107	2923
Czech Republic	3608	6	0	3602	275	3327
Denmark	2487	0	0	2487	190	2297
England	2015	37	60	1918	142	1776
France	3141	0	0	3141	143	2998
Germany	3318	0	35	3283	413	2870
Greece	4154	27	23	4104	114	3990
Hong Kong	3415	12	0	3403	64	3339
Hungary	3339	0	0	3339	427	2912
Iceland	2025	10	65	1950	177	1773
Iran, Islamic Rep.	3770	20	0	3750	56	3694
Ireland	3411	28	10	3373	297	3076
Israel	1453	6	0	1447	32	1415
Japan	5441	0	0	5441	300	5141
Korea	2998	31	0	2967	47	2920
Kuwait	1980	3	0	1977	322	1655
Latvia (LSS)	2705	19	0	2686	277	2409
Lithuania	2915	2	0	2913	388	2525
Netherlands	2112	14	1	2097	110	1987
New Zealand	4038	121	12	3905	222	3683
Norway	3482	26	49	3407	140	3267
Portugal	3589	70	13	3506	115	3391
Romania	3899	0	0	3899	174	3725
Russian Federation	4311	42	10	4259	237	4022
Scotland	3289	0	46	3243	380	2863
Singapore	4910	18	0	4892	248	4644
Slovak Republic	3718	5	3	3710	209	3501
Slovenia	2869	15	8	2846	138	2708
South Africa	4793	0	0	4793	302	4491
Spain	4198	27	102	4069	214	3855
Sweden	4483	71	28	4384	309	4075
Switzerland	4989	16	24	4949	94	4855
Thailand	5850	0	0	5850	0	5850

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

Table A.5

Participation Rates - Eighth Grade*

Country	School Participation		Student Participation (Weighted Percentage)	Overall Participation	
	School Participation Before Replacement (Weighted Percentage)	School Participation After Replacement (Weighted Percentage)		Overall Participation Before Replacement (Weighted Percentage)	Overall Participation After Replacement (Weighted Percentage)
UNITED STATES	77.3	84.9	91.8	71.0	77.9
MISSOURI	73.3	90.0	93.9	68.8	84.5
OREGON	93.1	100.0	93.3	86.9	93.3
Australia	75.2	76.5	91.7	69.0	70.2
Austria	40.8	83.9	94.9	38.7	79.6
Belgium (Fl)	61.3	94.0	96.8	59.3	91.0
Belgium (Fr)	56.7	79.3	91.4	51.8	72.5
Bulgaria	71.9	73.7	85.9	61.8	63.3
Canada	90.4	90.6	93.0	84.1	84.3
Colombia	90.7	93.3	93.6	84.9	87.3
Cyprus	100.0	100.0	96.5	96.5	96.5
Czech Republic	96.0	100.0	92.4	88.7	92.4
Denmark	92.5	92.5	92.9	85.9	85.9
England	56.4	84.6	91.0	51.3	77.0
France	86.3	86.3	95.3	82.2	82.2
Germany	71.7	92.6	87.2	62.5	80.7
Greece	86.8	86.8	97.1	84.3	84.3
Hong Kong	82.2	82.2	98.2	80.7	80.7
Hungary	100.0	100.0	87.3	87.3	87.3
Iceland	97.7	97.7	89.8	87.7	87.7
Iran, Islamic Rep.	100.0	100.0	98.3	98.3	98.3
Ireland	83.9	88.6	91.1	76.4	80.7
Israel	45.0	46.0	97.5	43.9	44.9
Japan	91.7	94.8	94.7	86.8	89.8
Korea	100.0	100.0	94.7	94.7	94.7
Kuwait	100.0	100.0	83.4	83.4	83.4
Latvia (LSS)	82.8	83.4	90.3	74.8	75.3
Lithuania	96.0	96.0	86.6	83.1	83.1
Netherlands	24.0	63.3	95.0	22.8	60.1
New Zealand	91.4	99.3	94.3	86.2	93.6
Norway	90.7	97.3	95.9	87.0	93.3
Portugal	94.6	94.6	96.9	91.7	91.7
Romania	93.7	93.7	95.5	89.5	89.5
Russian Federation	97.3	99.5	95.1	92.5	94.6
Scotland	78.6	83.2	88.2	69.3	73.4
Singapore	100.0	100.0	95.1	95.1	95.1
Slovak Republic	90.7	96.7	94.5	85.7	91.4
Slovenia	80.7	80.7	95.0	76.7	76.7
South Africa	59.7	63.6	96.7	57.7	61.5
Spain	96.2	99.7	94.6	91.0	94.3
Sweden	96.7	96.7	93.3	90.2	90.2
Switzerland	93.3	95.3	98.3	91.7	93.7
Thailand	99.0	99.0	100.0	99.0	99.0

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

Figure A.2

Countries Grouped for Reporting of Achievement According to Their Compliance with Guidelines for Sample Implementation and Participation Rates

Eighth Grade*

Countries satisfying guidelines for sample participation rates, grade selection, and sampling procedures	
† Belgium (Fl)	[1] Lithuania
Canada	† Missouri
Cyprus	New Zealand
Czech Republic	Norway
†[2] England	Oregon
France	Portugal
Hong Kong	Russian Federation
Hungary	Singapore
Iceland	Slovak Republic
Iran, Islamic Rep.	Spain
Ireland	Sweden
Japan	[1] Switzerland
Korea	† United States
[1] Latvia (LSS)	
Countries not satisfying guidelines for sample participation	
Australia	Bulgaria
Austria	Netherlands
Belgium (Fr)	Scotland
Countries not meeting age/grade specifications (high percentage of older students)	
Colombia	Romania
†[1] Germany	Slovenia
Countries with unapproved sampling procedures at the classroom level	
Denmark	Thailand
Greece	
Countries with unapproved sampling procedures at classroom level and not meeting other guidelines	
[1] Israel	South Africa
Kuwait	

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

***** Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

† Met guidelines for sample participation rates only after replacement schools were included.

[1] National Desired Population does not cover all of Iternational Desired Population (see Table 1). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table 1).

The TIMSS target population was defined as students in the two adjacent grades with the most 13-year-olds at the time of testing, the seventh and eighth grades in most countries. To provide a better curricular match, four countries (i.e., Colombia, Germany, Romania, and Slovenia), elected to test their seventh- and eighth-grade students even though that meant not testing the two grades with the most 13-year-olds. This led to their students being somewhat older than in the other countries and states. These countries are also presented in a separate section of the achievement tables in Chapters 1, 2, and 3 in alphabetical order, and are shown in tables in Chapters 4 and 5 in italics.

For a variety of reasons, three countries (Denmark, Greece, and Thailand) did not comply with the guidelines for sampling classrooms. Their results are also presented in a separate section of the achievement tables in Chapters 1, 2, and 3 in alphabetical order, and are italicized in the tables in Chapters 4 and 5. Israel, Kuwait, and South Africa also had difficulty complying with the classroom selection guidelines, but in addition had other difficulties (Kuwait tested a single grade with relatively few 13-year-olds; Israel and South Africa had low sampling participation rates), and so these countries are also presented in separate sections in the tables in Chapters 1, 2, and 3, and are italicized in the tables in Chapters 4 and 5.

Data Collection

In the 1995 TIMSS assessment, each participating country was responsible for carrying out all aspects of the data collection, using standardized procedures developed for the study. Training manuals were developed for school coordinators and test administrators that explained procedures for receipt and distribution of materials as well as for the activities related to the testing sessions. The test administrator manuals covered procedures for test security, standardized scripts to regulate directions and timing, rules for answering students' questions, and steps to ensure that identification on the test booklets and questionnaires corresponded to the information on the forms used to track students.

For the 1997 State TIMSS Benchmarking Study, Westat, Inc., was responsible for collecting the data in Missouri and Oregon. Westat was also responsible for the TIMSS data collection in the United States during the 1995 assessment. Westat Supervisors and Test Administrators were trained, by Westat staff, in the TIMSS procedures and conducted the testing in the sampled schools in accordance with the procedures prescribed in the TIMSS manuals.

Each country participating in the 1995 assessment was responsible for conducting quality control procedures and describing this effort as part of the NRC's report documenting procedures used in the study. In addition, the International Study Center considered it essential to establish some method to monitor compliance with standardized procedures. NRCs were asked to nominate a person, such as a retired school teacher, to serve as quality control monitor for their countries, and in almost all cases, the International Study Center adopted the NRCs' first suggestion. The International Study Center developed manuals for the quality control monitors and briefed them in two-day training sessions about TIMSS, the responsibilities of the national centers in conducting the study, and their own roles and responsibilities.

The TIMSS quality control monitors interviewed the NRCs about data collection plans and procedures. They also selected a sample of approximately 10 schools to visit, where they observed testing sessions and interviewed school coordinators.[10] Quality control monitors observed test administrations and interviewed school coordinators in 37 countries, and interviewed school coordinators or test administrators in 3 additional countries.

The results of the interviews conducted during the 1995 assessment indicate that, in general, NRCs had prepared well for data collection and, despite the heavy demands of the schedule and shortages of resources, were in a position to conduct the data collection in an efficient and professional manner. Similarly, the TIMSS tests appeared to have been administered in compliance with international procedures, including the activities preliminary to the testing session, the activities during the testing sessions, and the school-level activities related to receiving, distributing, and returning materials from the national centers.

For the 1997 State TIMSS Benchmarking Study, the International Study Center engaged six quality control monitors to visit schools in Oregon and Missouri during the data collection. The quality control monitors attended a training session held at Boston College, modeled on the international training sessions held in 1995. Each quality control monitor visited between three and five schools to observe the testing and interview the school coordinators. Results of the interviews indicate that the TIMSS international procedures were closely followed in the 1997 State TIMSS Benchmarking Study.

Scoring the Free-Response Items

Because approximately one-third of the written test time was devoted to free-response items, TIMSS needed to develop procedures for reliably evaluating student responses within and across countries. Scoring utilized two-digit codes with rubrics specific to each item. Development of the rubrics was led by the Norwegian TIMSS national center. The first digit designates the correctness level of the response. The second digit, combined with the first digit, represents a diagnostic code used to identify specific types of approaches, strategies, or common errors and misconceptions. Although not specifically used in this report, analyses of responses based on the second digit should provide insight into ways to help students better understand mathematics concepts and problem-solving approaches.

To meet the goal of implementing reliable scoring procedures based on the TIMSS rubrics, the International Study Center prepared guides containing the rubrics and explanations of how to implement them together with example student responses for the various rubric categories. These guides, together with more examples of student responses for practice in applying the rubrics were used as a basis for an ambitious

[10] The results of the interviews and observations by the quality control monitors are presented in Martin M.O., Hoyle, C.D., and Gregory, K.D. (1996). "Monitoring the TIMSS Data Collection" and "Observing the TIMSS Test Administration" both in M.O. Martin and I.V.S. Mullis (eds.), *Third International Mathematics and Science Study: Quality Assurance in Data Collection*. Chestnut Hill, MA: Boston College.

series of regional training sessions. The training sessions were designed to assist representatives of national centers who would then be responsible for training personnel in their respective countries to apply the two-digit codes reliably.[11] In 1997, the International Study Center conducted a two-day training session for the State TIMSS Benchmarking Study, to ensure the same procedures would be followed. National Computer Systems (NCS), under contract with Westat, conducted the scoring for both the 1995 and the 1997 assessments.

To gather and document empirical information about the within-country agreement among scorers, TIMSS developed a procedure whereby systematic subsamples of approximately 10% of the students' responses were to be coded independently by two different readers. To provide information about the cross-country agreement among scorers, TIMSS conducted a special study at Population 2, where 39 scorers from 21 of the participating countries evaluated common sets of students' responses to more than half of the free-response items.[12]

Table A.6 shows the average and range of the within-country exact percent of agreement between scorers on the free-response items in the Population 2 mathematics test for 26 countries and Missouri and Oregon. Unfortunately, lack of resources precluded several countries from providing this information. A very high percent of exact agreement was observed, with averages across the items for the correctness score ranging from 97% to 100% and an overall average of 99% across the 26 countries and two states. Correctness score agreement across the items averaged 99% for Missouri and Oregon. As an extra check on the reliability of the scoring process, the NCS staff who worked on the state benchmarking project also scored a sample of the test booklets from the 1995 TIMSS data collection in the United States. Agreement between their scores and the scores originally assigned to the booklets was very high, averaging 98% in mathematics and 92% in science.

[11] The procedures used in the training sessions are documented in Mullis, I.V.S., Garden, R.A., and Jones, C.A. (1996). "Training for Scoring the TIMSS Free-Response Items" in M.O. Martin and D.L. Kelly (eds.), *Third International Mathematics and Science Study Technical Report, Volume I.* Chestnut Hill, MA: Boston College.

[12] Details about the reliability studies can be found in Mullis, I.V.S. and Smith, T.A. (1996). "Quality Control Steps for Free-Response Scoring" in M.O. Martin and I.V.S. Mullis (eds.), *Third International Mathematics and Science Study: Quality Assurance in Data Collection.* Chestnut Hill, MA: Boston College.

Table A.6

TIMSS Within-Country Free-Response Coding Reliability Data for Eighth Grade* Mathematics Items†

Country	Correctness Score Agreement			Diagnostic Code Agreement		
	Average of Exact Percent Agreement Across Items	Range of Exact Percent Agreement		Average of Exact Percent Agreement Across Items	Range of Exact Percent Agreement	
		Min	Max		Min	Max
UNITED STATES	99	95	100	96	85	99
MISSOURI	99	96	100	97	84	100
OREGON	99	93	100	97	89	100
Australia	98	90	100	90	61	98
Belgium (Fl)	100	98	100	99	92	100
Bulgaria	98	93	100	94	59	100
Canada	98	85	100	92	70	99
Colombia	99	97	100	96	91	100
Czech Republic	98	77	100	95	68	100
England	100	96	100	97	89	100
France	100	96	100	98	93	100
Germany	98	89	100	94	75	100
Hong Kong	99	94	100	96	84	100
Iceland	98	84	100	91	73	100
Iran, Islamic Rep.	98	94	100	93	70	100
Ireland	99	95	100	97	83	100
Japan	100	96	100	99	90	100
Netherlands	98	87	100	91	68	100
New Zealand	99	95	100	95	81	100
Norway	99	90	100	95	79	100
Portugal	98	88	100	93	82	99
Russian Federation	99	94	100	96	84	100
Scotland	97	81	100	89	63	99
Singapore	99	95	100	98	87	100
Slovak Republic	97	84	100	91	70	98
Spain	98	88	100	94	75	100
Sweden	99	90	100	94	75	100
Switzerland	100	95	100	98	83	100
AVERAGE	99	91	100	95	78	100

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

†Based on 26 mathematics items, including 6 multiple-part items.

Note: Percent agreement was computed separately for each part, and each part was treated as a separate item in computing averages and ranges.

Test Reliability

Table A.7 displays the mathematics test reliability coefficient for each country. This coefficient is the median KR-20 reliability across the eight test booklets. In the TIMSS countries, median reliabilities ranged from 0.91 in Australia, and Bulgaria to 0.73 in Kuwait. The international median, shown in the last row of the table, is the median of the reliability coefficients for all countries. The international median was 0.89. The median reliabilities for the United States, Missouri and Oregon were 0.89, 0.90, and 0.90, respectively.

Data Processing

To ensure the availability of comparable, high quality data for analysis, TIMSS engaged in a rigorous set of quality control steps to create the international database.[13] TIMSS prepared manuals and software for countries to use in entering their data so the information would be in a standardized international format before being forwarded to the IEA Data Processing Center in Hamburg for creation of the international database. Upon arrival at the IEA Data Processing Center, the data from each country underwent an exhaustive cleaning process. The data cleaning process involved several iterative steps and procedures designed to identify, document, and correct deviations from the international instruments, file structures, and coding schemes. This process also emphasized consistency of information within national data sets and appropriate linking among the many student, teacher, and school data files.

Throughout the process, the data were checked and double-checked by the IEA Data Processing Center, the International Study Center, and the national centers. The national centers were contacted regularly and given multiple opportunities to review the data for their countries. In conjunction with the Australian Council for Educational Research (ACER), the International Study Center conducted a review of item statistics for each of the cognitive items in each of the countries to identify poorly performing items. Twenty-one countries had one or more items deleted (in most cases, one). Usually the poor statistics (negative point-biserials for the key, large item-by-country interactions, and statistics indicating lack of fit with the model) were a result of translation, adaptation, or printing deviations.

For the State TIMSS Benchmarking Study, Westat, Inc., was responsible for having the data entered and preparing the data files, and for submitting the files to the IEA Data Processing Center. As with the 1995 assessment, the data underwent a comprehensive cleaning process during which the data was checked and double-checked for any inconsistencies and were put into the international format. In accordance with the procedures developed in the TIMSS assessment, both the International Study Center and ACER conducted a review of the item statistics.[14]

[13] These steps are detailed in Jungclaus, H. and Bruneforth, M. (1996). "Data Consistency Checking Across Countries" in M.O. Martin and D.L. Kelly (eds.), *Third International Mathematics and Science Study Technical Report, Volume I.* Chestnut Hill, MA: Boston College.

[14] See Mullis, I.V.S. and Martin, M.O. (1997). "Item Analysis and Review" in M.O. Martin and D.L. Kelly (eds.), *Third International Mathematics and Science Study Technical Report, Volume II: Implementation and Analysis - Primary and Middle School Years.* Chestnut Hill, MA: Boston College.

Table A.7

Cronbach's Alpha Reliability Coefficients[1] - TIMSS Mathematics Test Eighth Grade*

Country	Upper Grade
UNITED STATES	0.89
MISSOURI	0.90
OREGON	0.90
Australia	0.90
Austria	0.89
Belgium (Fl)	0.89
Belgium (Fr)	0.89
Bulgaria	0.91
Canada	0.88
Colombia	0.79
Cyprus	0.88
Czech Republic	0.89
Denmark	0.87
England	0.90
France	0.85
Germany	0.89
Greece	0.89
Hong Kong	0.90
Hungary	0.90
Iceland	0.87
Iran, Islamic Rep.	0.78
Ireland	0.90
Israel	0.89
Japan	0.90
Korea	0.92
Kuwait	0.73
Latvia (LSS)	0.88
Lithuania	0.88
Netherlands	0.89
New Zealand	0.90
Norway	0.87
Portugal	0.82
Romania	0.88
Russian Federation	0.89
Scotland	0.89
Singapore	0.83
Slovak Republic	0.89
Slovenia	0.89
South Africa	0.81
Spain	0.86
Sweden	0.88
Switzerland	0.88
Thailand	0.88
International Median	0.89

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.

[1]The reliability coefficient for each country is the median KR-20 reliability across the eight test booklets. The international median is the median of the reliability coefficients for all countries.

IRT Scaling and Data Analysis

Two general analysis approaches were used for this report – item response theory scaling methods and average percent correct technology. The overall mathematics results were summarized using an item response theory (IRT) scaling method (Rasch model).[15] This scaling method produces a mathematics score by averaging the responses of each student to the items which they took in a way that takes into account the difficulty of each item. The methodology used in TIMSS includes refinements that enable reliable scores to be produced even though individual students responded to relatively small subsets of the total mathematics item pool. Analyses of the response patterns of students from participating countries indicated that, although the items in the test address a wide range of mathematics content, the performance of the students across the items was sufficiently consistent that it could be usefully summarized in a single mathematics score.

The IRT methodology was preferred for developing comparable estimates of performance for all students, since students answered different test items depending upon which of the eight test booklets they received. The IRT analysis provides a common scale on which performance can be compared across countries. In addition to providing a basis for estimating mean achievement, scale scores permit estimates of how students within countries vary and provide information on percentiles of performance. The scale was standardized using students from both the grades tested in 1995. The metric of the scale was set so that the overall mean of the student scores corresponded to a score of 500, and a standard deviation corresponded to 100 scale score points.[16] The average and standard deviation of the scale scores are arbitrary and do not affect scale interpretations.

The analytic approach underlying the results in Chapters 2 and 3 of this report involved calculating the percentage of correct answers for each item for each participating country (as well as the percentages of different types of incorrect responses). The percents correct were averaged to summarize mathematics performance overall and in each of the content areas for each country as a whole and by gender. For items with more than one part, each part was analyzed separately in calculating the average percents correct. Also, for items with more than one point awarded for full credit, the average percents correct reflect an average of the points received by students in each country. This was achieved by including the percent of students receiving one score point as well as the percentage receiving two score points and three score points in the calculations. Thus, the average percents correct are based on the number of score points rather than the number of items, per se.

[15] Adams, R., Wu, M., and Macaskill, G. (1997). "Scaling Methodology and Procedures for the Mathematics and Science Scales" in M.O. Martin and D.L. Kelly (eds.), *Third International Mathematics and Science Study Technical Report, Volume II: Implementation and Analysis - Primary and Middle School Years.* Chestnut Hill, MA: Boston College.

[16] Gonzalez, E. (1997). "Reporting Student Achievement in Mathematics and Science" in M.O. Martin and D.L. Kelly (eds.), *Third International Mathematics and Science Study Technical Report, Volume II: Implementation and Analysis - Primary and Middle School Years.* Chestnut Hill, MA: Boston College.

Estimating Sampling Error

Because the statistics presented in this report are estimates of national performance based on samples of students, rather than the values that could be calculated if every student in every country would have answered every question, it is important to have measures of the degree of uncertainty of the estimates. The jackknife procedure was used to estimate the standard error associated with each statistic presented in this report.[17] The use of confidence intervals, based on the standard errors, provides a way to make inferences about the population means and proportions in a manner that reflects the uncertainty associated with the sample estimates. An estimated sample statistic plus or minus two standard errors represents a 95% confidence interval for the corresponding population result.

[17] Gonzalez, E. and Foy, P. (1997). "Estimation of Sampling Variability, Design Effects, and Effective Sample Sizes" in M.O. Martin and D.L. Kelly (eds.), *Third International Mathematics and Science Study Technical Report, Volume II: Implementation and Analysis - Primary and Middle School Years.* Chestnut Hill, MA: Boston College.

Appendix B

Percentiles and Standard Deviations of Achievement

Table B.1

Percentiles of Achievement in Mathematics
Eighth Grade*

Country	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
UNITED STATES	356 (3.3)	435 (3.4)	494 (6.4)	563 (8.2)	653 (3.7)
MISSOURI	359 (3.5)	434 (3.6)	497 (6.9)	572 (6.5)	670 (6.2)
OREGON	369 (6.3)	454 (3.4)	522 (7.5)	593 (4.8)	690 (5.7)
Australia	372 (4.1)	460 (1.5)	529 (7.0)	600 (7.2)	690 (5.4)
Austria	393 (5.1)	474 (4.1)	537 (5.8)	608 (2.6)	693 (6.4)
Belgium (Fl)	416 (7.7)	502 (8.7)	566 (8.7)	631 (5.7)	710 (3.5)
Belgium (Fr)	385 (13.8)	467 (1.1)	532 (5.5)	587 (3.7)	658 (6.2)
Bulgaria	378 (11.4)	460 (4.2)	530 (10.6)	621 (13.8)	728 (0.4)
Canada	389 (3.3)	468 (2.0)	527 (2.7)	587 (2.4)	670 (3.7)
Colombia	292 (5.8)	343 (4.4)	379 (3.6)	421 (6.1)	496 (7.5)
Cyprus	333 (3.3)	412 (1.2)	469 (1.6)	535 (3.2)	621 (7.3)
Czech Republic	423 (3.5)	496 (2.6)	558 (7.5)	633 (8.5)	725 (12.6)
Denmark	369 (9.8)	443 (2.9)	500 (4.9)	561 (2.2)	641 (5.9)
England	361 (8.8)	443 (4.8)	501 (3.5)	570 (2.7)	665 (4.1)
France	415 (5.2)	484 (1.4)	534 (3.0)	591 (2.5)	666 (3.4)
Germany	368 (8.2)	448 (9.4)	506 (6.3)	572 (7.5)	661 (10.9)
Greece	347 (2.8)	422 (1.9)	478 (3.8)	546 (3.6)	633 (6.6)
Hong Kong	415 (14.2)	526 (6.8)	595 (5.9)	659 (4.9)	742 (5.4)
Hungary	391 (2.3)	471 (2.1)	534 (2.6)	602 (2.7)	693 (9.2)
Iceland	365 (4.3)	435 (3.3)	481 (6.2)	540 (4.8)	615 (21.0)
Iran, Islamic Rep.	336 (4.4)	388 (2.2)	424 (2.9)	466 (5.8)	535 (9.8)
Ireland	381 (6.5)	462 (4.9)	526 (8.2)	594 (9.6)	681 (3.3)
Israel	371 (6.3)	459 (7.5)	523 (9.3)	586 (4.9)	672 (7.2)
Japan	435 (2.1)	536 (6.8)	608 (2.5)	676 (1.4)	771 (4.8)
Korea	418 (4.0)	540 (5.0)	609 (3.9)	682 (2.7)	786 (7.1)
Kuwait	302 (5.6)	355 (3.6)	389 (6.3)	427 (3.5)	493 (6.9)
Latvia (LSS)	375 (5.2)	435 (2.6)	487 (3.3)	550 (4.3)	638 (8.1)
Lithuania	348 (5.0)	422 (3.1)	473 (5.3)	533 (4.3)	616 (8.5)
Netherlands	397 (10.6)	477 (9.1)	543 (9.2)	604 (7.4)	688 (6.9)
New Zealand	366 (3.1)	443 (4.0)	503 (5.0)	570 (5.5)	663 (9.1)
Norway	372 (5.5)	445 (2.0)	499 (2.8)	560 (3.1)	649 (5.9)
Portugal	357 (3.0)	411 (1.0)	449 (2.2)	495 (6.7)	569 (7.1)
Romania	343 (3.1)	418 (3.0)	476 (5.5)	544 (5.2)	635 (9.7)
Russian Federation	388 (4.5)	471 (5.6)	536 (11.3)	600 (8.2)	687 (2.9)
Scotland	364 (3.6)	436 (3.2)	493 (7.5)	559 (8.1)	649 (15.3)
Singapore	499 (5.8)	584 (8.9)	642 (7.2)	704 (4.5)	792 (7.5)
Slovak Republic	401 (1.6)	483 (0.6)	543 (4.4)	612 (3.9)	700 (2.7)
Slovenia	404 (2.5)	477 (3.6)	535 (6.7)	604 (4.0)	690 (4.3)
South Africa	259 (3.7)	313 (2.2)	347 (2.0)	386 (4.9)	484 (10.4)
Spain	376 (2.0)	436 (2.5)	481 (1.8)	536 (3.5)	616 (3.9)
Sweden	384 (2.9)	460 (6.0)	515 (3.7)	579 (3.4)	661 (4.7)
Switzerland	401 (6.3)	485 (2.1)	549 (6.1)	607 (2.9)	685 (2.8)
Thailand	388 (3.3)	462 (4.4)	518 (5.9)	580 (6.9)	669 (10.7)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.
( ) Standard errors appear in parentheses.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

Table B.2

Standard Deviations of Achievement in Mathematics

Eighth Grade*

Country	Overall		Boys		Girls	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
UNITED STATES	500 (4.6)	91 (1.4)	502 (5.2)	93 (1.5)	497 (4.5)	89 (1.8)
MISSOURI	505 (4.8)	96 (1.7)	504 (5.5)	102 (2.0)	505 (4.3)	90 (2.0)
OREGON	525 (4.8)	98 (1.9)	527 (5.1)	99 (2.3)	523 (5.0)	96 (2.3)
Australia	530 (4.0)	98 (1.5)	527 (5.1)	100 (1.9)	532 (4.6)	96 (1.7)
Austria	539 (3.0)	92 (1.9)	544 (3.2)	94 (2.3)	536 (4.5)	90 (2.0)
Belgium (Fl)	565 (5.7)	92 (2.7)	563 (8.8)	96 (4.4)	567 (7.4)	88 (3.0)
Belgium (Fr)	526 (3.4)	86 (2.4)	530 (4.7)	88 (2.7)	524 (3.7)	83 (3.0)
Bulgaria	540 (6.3)	110 (2.5)	– –	– –	– –	– –
Canada	527 (2.4)	86 (1.4)	526 (3.2)	88 (1.7)	530 (2.7)	84 (1.9)
Colombia	385 (3.4)	64 (1.7)	386 (6.9)	66 (3.8)	384 (3.6)	63 (2.8)
Cyprus	474 (1.9)	88 (1.2)	472 (2.8)	89 (1.7)	475 (2.5)	86 (1.8)
Czech Republic	564 (4.9)	94 (2.3)	569 (4.5)	94 (2.6)	558 (6.3)	93 (2.8)
Denmark	502 (2.8)	84 (1.4)	511 (3.2)	86 (1.7)	494 (3.4)	80 (1.9)
England	506 (2.6)	93 (1.5)	508 (5.1)	95 (2.3)	504 (3.5)	91 (2.0)
France	538 (2.9)	76 (1.6)	542 (3.1)	74 (2.0)	536 (3.8)	78 (2.0)
Germany	509 (4.5)	90 (1.8)	512 (5.1)	89 (2.0)	509 (5.0)	88 (2.3)
Greece	484 (3.1)	88 (1.0)	490 (3.7)	91 (1.4)	478 (3.1)	85 (1.6)
Hong Kong	588 (6.5)	101 (3.3)	597 (7.7)	103 (4.3)	577 (7.7)	97 (3.6)
Hungary	537 (3.2)	93 (1.6)	537 (3.6)	92 (1.9)	537 (3.6)	94 (2.2)
Iceland	487 (4.5)	76 (1.5)	488 (5.5)	80 (2.0)	486 (5.6)	72 (2.3)
Iran, Islamic Rep.	428 (2.2)	59 (1.0)	434 (2.9)	59 (1.4)	421 (3.3)	59 (1.3)
Ireland	527 (5.1)	93 (2.0)	535 (7.2)	96 (2.9)	520 (6.0)	89 (2.5)
Israel	522 (6.2)	92 (2.3)	539 (6.6)	89 (3.2)	509 (6.9)	90 (3.1)
Japan	605 (1.9)	102 (0.9)	609 (2.6)	106 (1.3)	600 (2.1)	97 (1.4)
Korea	607 (2.4)	109 (1.4)	615 (3.2)	109 (1.9)	598 (3.4)	108 (1.9)
Kuwait	392 (2.5)	58 (1.4)	389 (4.3)	60 (2.4)	395 (2.6)	55 (1.5)
Latvia (LSS)	493 (3.1)	82 (1.6)	496 (3.8)	82 (2.3)	491 (3.5)	82 (2.2)
Lithuania	477 (3.5)	80 (1.5)	477 (4.0)	79 (1.9)	478 (4.1)	81 (2.2)
Netherlands	541 (6.7)	89 (3.6)	545 (7.8)	90 (4.2)	536 (6.4)	88 (3.5)
New Zealand	508 (4.5)	90 (1.8)	512 (5.9)	92 (2.7)	503 (5.3)	88 (2.0)
Norway	503 (2.2)	84 (1.2)	505 (2.8)	87 (1.7)	501 (2.7)	80 (1.5)
Portugal	454 (2.5)	64 (1.1)	460 (2.8)	64 (1.4)	449 (2.7)	64 (1.4)
Romania	482 (4.0)	89 (1.6)	483 (4.8)	91 (1.9)	480 (4.0)	87 (1.9)
Russian Federation	535 (5.3)	92 (1.6)	535 (6.3)	97 (2.0)	536 (5.0)	87 (2.0)
Scotland	499 (5.5)	87 (2.4)	506 (6.6)	89 (3.1)	490 (5.3)	85 (2.3)
Singapore	643 (4.9)	88 (1.7)	642 (6.3)	88 (2.2)	645 (5.4)	88 (2.0)
Slovak Republic	547 (3.3)	92 (1.2)	549 (3.7)	94 (1.5)	545 (3.6)	90 (1.9)
Slovenia	541 (3.1)	88 (1.1)	545 (3.8)	88 (1.5)	537 (3.3)	87 (1.5)
South Africa	354 (4.4)	65 (4.0)	360 (6.3)	68 (5.0)	349 (4.1)	62 (4.4)
Spain	487 (2.0)	73 (1.1)	492 (2.5)	75 (1.4)	483 (2.6)	72 (1.5)
Sweden	519 (3.0)	85 (1.2)	520 (3.6)	85 (1.6)	518 (3.1)	86 (1.5)
Switzerland	545 (2.8)	88 (1.5)	548 (3.5)	90 (2.2)	543 (3.1)	85 (1.6)
Thailand	522 (5.7)	86 (2.4)	517 (5.6)	83 (2.2)	526 (7.0)	87 (3.0)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95, Missouri and Oregon data collected in 1997.

*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.

A dash (–) indicates data are not available.

( ) Standard errors appear in parentheses.

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