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SCIENCE ACHIEVEMENT IN  
MISSOURI AND OREGON IN  
AN INTERNATIONAL CONTEXT:  
1997 TIMSS BENCHMARKING

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# Introduction

## SCIENCE

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),<sup>1</sup> 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 individuals 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.

<sup>1</sup> 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 science assessments in Oregon and Missouri in relation to the results obtained from the TIMSS countries. A companion report, *Mathematics Achievement in Missouri and Oregon in an International Context: 1997 TIMSS Benchmarking*, presents corresponding results about students' mathematics 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.

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## OVERVIEW OF RESULTS

### **Brief Summary of Results for Missouri**

The average science score for Missouri of 555 was significantly above the international average of the participating countries (516) and that of the United States (534). Missouri eighth graders were outperformed by students in only one country – Singapore. The average performance for Missouri’s eighth graders was above that of 25 countries and equivalent to 15 countries. In addition to Singapore, the Czech Republic, Japan, and Korea also were among the top-performing countries.

About 20% 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. This compared to 13% for the United States. There was a significant difference between average performance of males and females in Missouri that favored males by approximately 17 scale points. In the United States as a whole, there was no significant difference in average science achievement by gender. In the content areas, Missouri performed above the international average in earth science, life science, chemistry, and environmental issues and the nature of science. Missouri eighth graders performed similar to the international average in physics.

### **Brief Summary of Results for Oregon**

The average science score for Oregon (564) was significantly higher than the international average (516) and similar to many of the top-performing countries including the Czech Republic, Japan, and Korea. Only the Singaporean eighth graders outperformed those in Oregon. Eighth graders in Oregon outperformed their counterparts in 30 countries including the United States. They had performance equivalent with that of students in 10 countries.

About 21% of Oregon’s eighth graders achieved at or above the Top 10% level of students internationally. The gender differences among students in Oregon were significant, favoring boys. Eighth grade students in Oregon performed significantly above the international average in all of the content areas.

## 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 Science 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 science subject-matter specialists, and additional items were written to ensure that the desired science topics were covered adequately. Items were piloted, the results reviewed, and new items were written and piloted. The resulting TIMSS science test contained 135 items representing a range of science 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 science).<sup>2</sup> Five content areas are covered in the TIMSS science test for the eighth grade. These areas and the percentage of the test items devoted to each include: earth science (16%), life science (30%), physics (30%), chemistry (14%), and environmental issues and the nature of science (10%). The performance expectations include: understanding simple information (40%); understanding complex information (29%); theorizing, analyzing, and solving problems (21%); using tools, routine procedures, and science processes (6%); and investigating the natural world (4%).

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.<sup>3</sup>

<sup>2</sup> 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.

<sup>3</sup> 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**

• <b>MISSOURI</b>	• Israel
• <b>OREGON</b>	• Japan
• <b>UNITED STATES</b>	• Korea, Republic of
• Australia	• Kuwait
• Austria	• Latvia
• Belgium*	• Lithuania
• Bulgaria	• Netherlands
• Canada	• New Zealand
• Colombia	• Norway
• Cyprus	• Portugal
• Czech Republic	• Romania
• Denmark	• Russian Federation
• England	• Scotland
• France	• Singapore
• Germany	• Slovak Republic
• Greece	• Slovenia
• Hong Kong	• South Africa
• Hungary	• Spain
• Iceland	• Sweden
• Iran, Islamic Republic	• Switzerland
• Ireland	• 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 <sup>1</sup>	Average Age of Students
<b>UNITED STATES</b>	8	8	14.2
<b>MISSOURI</b>	8	8	14.6
<b>OREGON</b>	8	8	14.4
<sup>2</sup> 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
<sup>3</sup> 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
<sup>4</sup> 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.

<sup>1</sup>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.

<sup>2</sup>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.

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

<sup>4</sup>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 eight 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**

<b>Eighth Grade*</b>	
<b>Countries satisfying guidelines for sample participation rates, grade selection, and sampling procedures</b>	
<sup>†</sup> Belgium (Fl) Canada Cyprus Czech Republic <sup>12</sup> England France Hong Kong Hungary Iceland Iran, Islamic Rep. Ireland Japan Korea <sup>1</sup> Latvia (LSS)	<sup>1</sup> Lithuania <sup>†</sup> Missouri New Zealand Norway Oregon Portugal Russian Federation Singapore Slovak Republic Spain Sweden <sup>1</sup> Switzerland <sup>†</sup> United States
<b>Countries not satisfying guidelines for sample participation</b>	
Australia Austria Belgium (Fr)	Bulgaria Netherlands Scotland
<b>Countries not meeting age/grade specifications (high percentage of older students)</b>	
Colombia <sup>††</sup> Germany	Romania Slovenia
<b>Countries with unapproved sampling procedures at the classroom level</b>	
Denmark Greece	Thailand
<b>Countries with unapproved sampling procedures at classroom level and not meeting other guidelines</b>	
<sup>1</sup> Israel Kuwait	South Africa

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.  
<sup>†</sup> Met guidelines for sample participation rates only after replacement schools were included.  
<sup>1</sup> National Desired Population does not cover all of International Desired Population (see Table 1). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.  
<sup>2</sup> 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

## SCIENCE ACHIEVEMENT IN AN INTERNATIONAL CONTEXT

Chapter 1 summarizes the science 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.<sup>1</sup> 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) achievement for 41 countries and Missouri and Oregon at the eighth grade.<sup>2</sup> Missouri and Oregon as well as 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.<sup>3</sup>

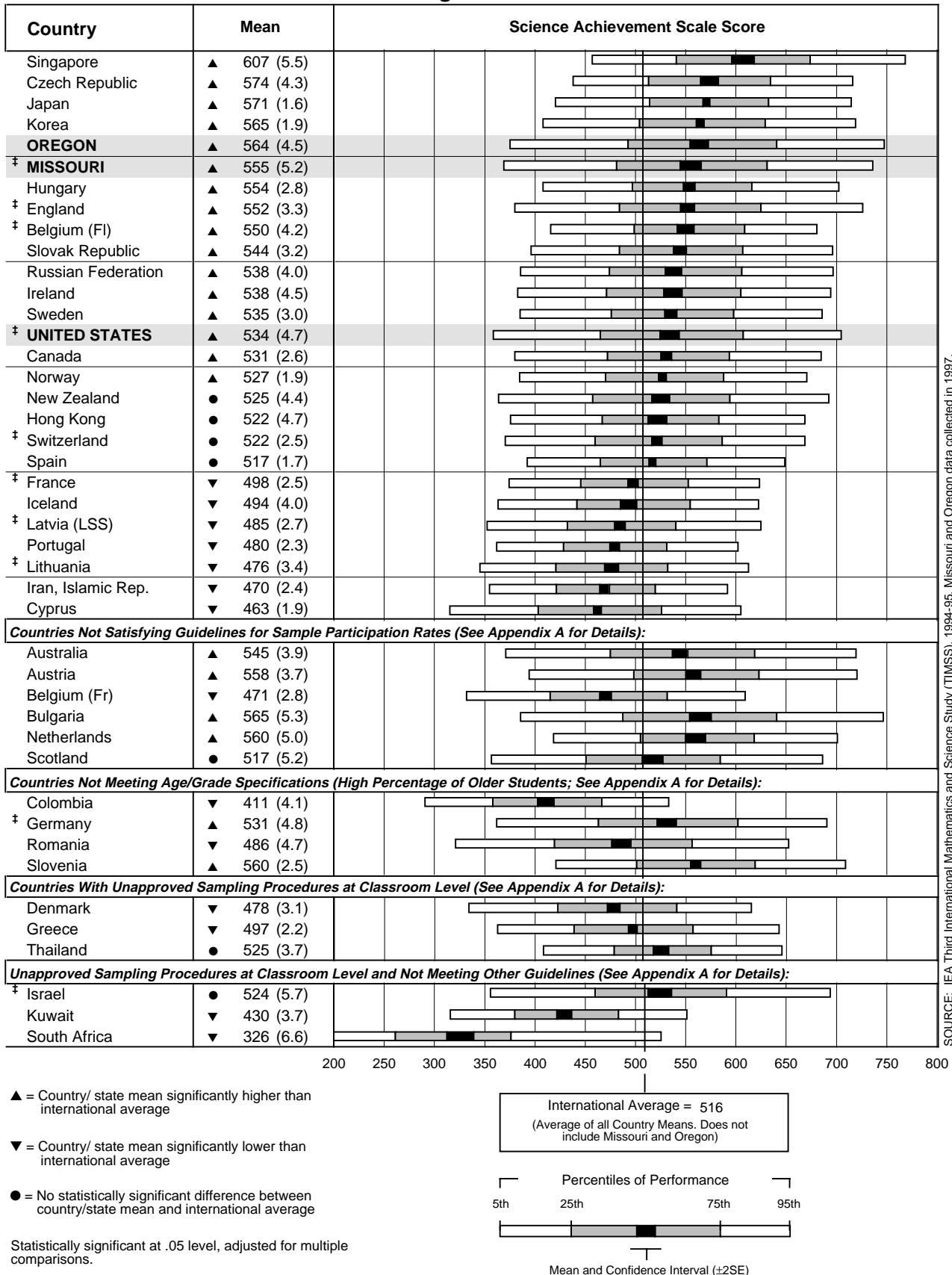
Like U.S. eighth-grade students in general, eighth graders in Oregon and Missouri performed rather well on the TIMSS science assessment. The average science scores for students in Oregon (564) and Missouri (555) were similar, and significantly above the international average (516). The average for eighth-grade students in the United States as a whole (534) was also above the international mean. Singapore, the Czech Republic, Japan, and Korea were the countries with the highest average performance, while Kuwait, Colombia, and South Africa had the lowest average performance.

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

<sup>2</sup> TIMSS used item response theory (IRT) methods to summarize the achievement results for both grades 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.

<sup>3</sup> 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 Science Achievement: 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 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 Science Performance at Eighth Grade\* Compared with Missouri and Oregon

Comparison with Missouri			Comparison with Oregon	
Country	Mean Scale Score		Country	Mean Scale Score
<b>Singapore</b>	607 (5.5)		<b>Singapore</b>	607 (5.5)
<b>Czech Republic</b>	574 (4.3)		<b>Czech Republic</b>	574 (4.3)
<b>Japan</b>	571 (1.6)		<b>Japan</b>	571 (1.6)
<b>Korea</b>	565 (1.9)		<b>Korea</b>	565 (1.9)
<i>Bulgaria</i>	565 (5.3)		<i>Bulgaria</i>	565 (5.3)
<i>Slovenia</i>	560 (2.5)		<b>OREGON</b>	564 (4.5)
<i>Netherlands</i>	560 (5.0)		<i>Slovenia</i>	560 (2.5)
<i>Austria</i>	558 (3.7)		<i>Netherlands</i>	560 (5.0)
<b>MISSOURI</b>	555 (5.2)	<b>MISSOURI</b>	<i>Austria</i>	558 (3.7)
<b>Hungary</b>	554 (2.8)	<b>555</b>	<b>Hungary</b>	554 (2.8)
<b>England</b>	552 (3.3)		<b>England</b>	552 (3.3)
<b>Belgium (Fl)</b>	550 (4.2)		<b>Belgium (Fl)</b>	550 (4.2)
<i>Australia</i>	545 (3.9)		<i>Australia</i>	545 (3.9)
<b>Slovak Republic</b>	544 (3.2)		<b>Slovak Republic</b>	544 (3.2)
<i>Russian Federation</i>	538 (4.0)		<i>Russian Federation</i>	538 (4.0)
<b>Ireland</b>	538 (4.5)		<b>Ireland</b>	538 (4.5)
<b>UNITED STATES</b>	534 (4.7)		<b>Sweden</b>	535 (3.0)
<b>Sweden</b>	535 (3.0)		<b>UNITED STATES</b>	534 (4.7)
<b>Canada</b>	531 (2.6)		<b>Canada</b>	531 (2.6)
<i>Germany</i>	531 (4.8)		<i>Germany</i>	531 (4.8)
<b>Norway</b>	527 (1.9)		<b>Norway</b>	527 (1.9)
<i>Thailand</i>	525 (3.7)		<i>Thailand</i>	525 (3.7)
<b>New Zealand</b>	525 (4.4)		<b>New Zealand</b>	525 (4.4)
<i>Israel</i>	524 (5.7)		<i>Israel</i>	524 (5.7)
<b>Hong Kong</b>	522 (4.7)		<b>Hong Kong</b>	522 (4.7)
<b>Switzerland</b>	522 (2.5)		<b>Switzerland</b>	522 (2.5)
<i>Scotland</i>	517 (5.2)		<i>Scotland</i>	517 (5.2)
<b>Spain</b>	517 (1.7)		<b>Spain</b>	517 (1.7)
<b>France</b>	498 (2.5)		<b>France</b>	498 (2.5)
<b>Greece</b>	497 (2.2)		<b>Greece</b>	497 (2.2)
<b>Iceland</b>	494 (4.0)		<b>Iceland</b>	494 (4.0)
<i>Romania</i>	486 (4.7)		<i>Romania</i>	486 (4.7)
<b>Latvia (LSS)</b>	485 (2.7)		<b>Latvia (LSS)</b>	485 (2.7)
<b>Portugal</b>	480 (2.3)		<b>Portugal</b>	480 (2.3)
<i>Denmark</i>	478 (3.1)		<i>Denmark</i>	478 (3.1)
<b>Lithuania</b>	476 (3.4)		<b>Lithuania</b>	476 (3.4)
<i>Belgium (Fr)</i>	471 (2.8)		<i>Belgium (Fr)</i>	471 (2.8)
<b>Iran, Islamic Rep.</b>	470 (2.4)		<b>Iran, Islamic Rep.</b>	470 (2.4)
<b>Cyprus</b>	463 (1.9)		<b>Cyprus</b>	463 (1.9)
<i>Kuwait</i>	430 (3.7)		<i>Kuwait</i>	430 (3.7)
<i>Colombia</i>	411 (4.1)		<i>Colombia</i>	411 (4.1)
<i>South Africa</i>	326 (6.6)		<i>South Africa</i>	326 (6.6)

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.

The broad range of achievement both across and within countries is illustrated in Table 1.1 by a graphical 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. Each percentile point indicates the percentages of students performing below and above that point on the scale. For example, 25% of the eighth-grade students in each country performed below the 25th percentile for that country, and 75% performed above the 25th percentile. 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.

Figure 1.1 presents the average science proficiency of each country in comparison to that of Missouri (first panel) and Oregon (second panel). Both Missouri and Oregon had higher average performance than most countries, with only Singapore outperforming them. Eighth grade students in Missouri performed better than their counterparts in 25 countries, whereas students in Oregon performed better than students in 30 countries.

### **What Are the Differences in Performance Compared to Three Marker Levels of International Science Achievement?**

Table 1.2 portrays science 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 655 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 592 and the Top Half marker level as 522.

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 distributions of eighth-grade students in several countries were quite close. Percentages close to the international norm were noted at the eighth grade for New Zealand, Sweden, Scotland, and Israel. In contrast, in Singapore nearly one-third (31%) of the eighth-grade students reached the Top 10% level, approximately half reached the Top Quarter level (56%), and more than four-fifths (82%) reached the Top Half level.

Missouri and Oregon both performed well in terms of the international benchmarks. In Oregon, 21% of students scored above the Top 10% marker, 40% above the Top Quarter, and 64% above the Top Half. Missouri was very similar, with 20%, 36%, and 62% reaching the markers, respectively. Only Singapore had a greater percentage exceeding the Top 10% marker. Both Missouri and Oregon had higher percentages of students scoring above the Top 10% marker than had the United States in general.



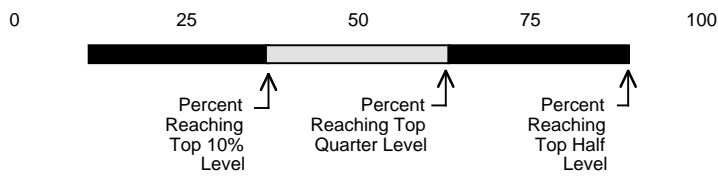
**Table 1.2**  
**Percentages of Students Achieving International Marker Levels in Science**  
**Eighth Grade\***

Country	Top 10% Level	Top Quarter Level	Top Half Level	Percent Reaching International Levels
Singapore	31 (2.3)	56 (2.5)	82 (1.6)	
<b>OREGON</b>	21 (1.3)	40 (1.5)	64 (1.7)	
‡ <b>MISSOURI</b>	20 (1.2)	36 (1.7)	62 (2.1)	
Czech Republic	19 (1.6)	41 (2.1)	72 (1.6)	
Korea	18 (0.8)	39 (0.9)	68 (0.9)	
Japan	18 (0.6)	41 (0.8)	71 (0.7)	
‡ England	17 (0.9)	34 (1.4)	60 (1.4)	
Hungary	14 (0.8)	34 (1.3)	63 (1.4)	
‡ <b>UNITED STATES</b>	13 (0.8)	30 (1.6)	55 (1.9)	
Slovak Republic	12 (0.9)	30 (1.4)	59 (1.5)	
Ireland	12 (0.9)	29 (1.6)	57 (2.0)	
Russian Federation	11 (0.8)	29 (1.3)	56 (1.8)	
New Zealand	11 (0.9)	26 (1.5)	51 (1.9)	
‡ Belgium (Fl)	10 (0.8)	31 (1.8)	64 (2.1)	
Canada	9 (0.6)	25 (0.9)	54 (1.3)	
Sweden	9 (0.6)	27 (1.2)	56 (1.5)	
Hong Kong	7 (0.8)	22 (1.5)	51 (2.3)	
‡ Switzerland	7 (0.6)	23 (1.0)	51 (1.2)	
Norway	7 (0.5)	24 (0.9)	52 (1.1)	
Spain	4 (0.3)	18 (0.7)	47 (1.0)	
‡ Latvia (LSS)	2 (0.3)	10 (0.7)	33 (1.3)	
Iceland	2 (0.5)	10 (1.3)	36 (2.1)	
‡ France	1 (0.2)	11 (0.8)	37 (1.5)	
Cyprus	1 (0.2)	7 (0.5)	26 (0.9)	
‡ Lithuania	1 (0.3)	8 (0.8)	29 (1.7)	
Portugal	1 (0.1)	7 (0.6)	28 (1.2)	
Iran, Islamic Rep.	1 (0.1)	5 (0.6)	24 (1.5)	
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>				
Australia	16 (0.9)	33 (1.3)	59 (1.6)	
Austria	16 (0.9)	35 (1.2)	64 (1.6)	
Belgium (Fr)	1 (0.2)	8 (0.6)	29 (1.4)	
Bulgaria	21 (1.4)	40 (2.2)	64 (2.3)	
Netherlands	12 (1.1)	35 (2.3)	67 (2.4)	
Scotland	9 (1.1)	23 (1.8)	48 (2.2)	
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>				
Colombia	0 (0.1)	1 (0.2)	8 (0.9)	
‡ Germany	11 (1.0)	29 (1.6)	54 (2.1)	
Romania	5 (0.6)	16 (1.3)	36 (2.0)	
Slovenia	14 (0.9)	34 (1.3)	65 (1.2)	
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>				
Denmark	2 (0.3)	9 (0.7)	32 (1.3)	
Greece	4 (0.4)	14 (0.7)	38 (1.3)	
Thailand	4 (0.5)	18 (1.7)	51 (2.2)	
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>				
‡ Israel	11 (1.2)	25 (2.3)	51 (2.6)	
Kuwait	0 (0.0)	2 (0.3)	11 (1.2)	
South Africa	1 (0.2)	1 (0.3)	5 (1.3)	

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and 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) = 655  
 Top Quarter Level (75th Percentile) = 592  
 Top Half Level (50th Percentile) = 522



\*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 Science Achievement?

Table 1.3 reveals that boys had significantly higher mean science achievement than girls at the eighth grade internationally and in many countries. The table presents mean science achievement separately for boys and girls for each country, as well as the difference between the means. Countries in the upper part of the tables are shown in increasing order of this gender difference. 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 favored girls or boys, and whether or not the difference is statistically significant (indicated by a darkened bar).

The United States was one of the few countries where the difference between boys and girls was not significant. However, statistically significant differences favoring boys were found in Missouri (17 points) and Oregon (24 points). This is in contrast to the results from the 1996 NAEP science assessment, which shows only small, non-significant differences favoring boys in each of the two states.<sup>4</sup>

<sup>4</sup> O'Sullivan, C.Y., Reese, C.M., and Mazzeo, J. (1997). *NAEP Science Report Card for the Nation and the States*. Washington, DC: National Center for Education Statistics.

**Table 1.3**  
**Gender Differences in Science Achievement: Eighth Grade\***

Country	Boys Mean	Girls Mean	Difference Absolute Value	Gender Difference
Cyprus	461 (2.2)	465 (2.7)	4 (3.4)	Girls Score Higher
‡ UNITED STATES	539 (4.9)	530 (5.2)	9 (7.2)	Boys Score Higher
Singapore	612 (6.7)	603 (7.0)	9 (9.7)	Boys Score Higher
Russian Federation	544 (4.9)	533 (3.7)	11 (6.2)	Boys Score Higher
Ireland	544 (6.6)	532 (5.2)	12 (8.4)	Boys Score Higher
Canada	537 (3.1)	525 (3.7)	12 (4.8)	Boys Score Higher
Norway	534 (3.2)	520 (2.0)	14 (3.8)	Boys Score Higher
‡ Lithuania	484 (3.8)	470 (4.0)	14 (5.5)	Boys Score Higher
Sweden	543 (3.4)	528 (3.4)	15 (4.8)	Boys Score Higher
‡ Latvia (LSS)	492 (3.3)	478 (3.2)	15 (4.6)	Boys Score Higher
‡ Belgium (Fl)	558 (6.0)	543 (5.8)	15 (8.4)	Boys Score Higher
‡ Switzerland	529 (3.2)	514 (3.0)	15 (4.4)	Boys Score Higher
Slovak Republic	552 (3.5)	537 (3.9)	15 (5.2)	Boys Score Higher
Iceland	501 (5.1)	486 (4.6)	16 (6.9)	Boys Score Higher
‡ France	506 (2.7)	490 (3.3)	16 (4.3)	Boys Score Higher
Japan	579 (2.4)	562 (2.0)	17 (3.1)	Boys Score Higher
Iran, Islamic Rep.	477 (3.8)	461 (3.2)	17 (4.9)	Boys Score Higher
‡ MISSOURI	564 (6.1)	547 (4.8)	17 (7.8)	Boys Score Higher
Spain	526 (2.1)	508 (2.3)	18 (3.1)	Boys Score Higher
Hungary	563 (3.1)	545 (3.4)	18 (4.7)	Boys Score Higher
‡ England	562 (5.6)	542 (4.2)	20 (7.1)	Boys Score Higher
Portugal	490 (2.8)	468 (2.7)	22 (3.9)	Boys Score Higher
OREGON	576 (5.5)	552 (3.8)	24 (6.7)	Boys Score Higher
Czech Republic	586 (4.2)	562 (5.8)	24 (7.2)	Boys Score Higher
Korea	576 (2.7)	551 (2.3)	24 (3.6)	Boys Score Higher
New Zealand	538 (5.4)	512 (5.2)	25 (7.6)	Boys Score Higher
Hong Kong	535 (5.5)	507 (5.1)	27 (7.5)	Boys Score Higher
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>				
Australia	550 (5.2)	540 (4.1)	10 (6.6)	Boys Score Higher
Austria	566 (4.0)	549 (4.6)	18 (6.1)	Boys Score Higher
Belgium (Fr)	479 (4.8)	463 (2.9)	16 (5.6)	Boys Score Higher
Netherlands	570 (6.4)	550 (4.9)	20 (8.1)	Boys Score Higher
Scotland	528 (6.4)	507 (4.8)	21 (8.0)	Boys Score Higher
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>				
Colombia	418 (7.3)	405 (4.6)	13 (8.6)	Boys Score Higher
‡ Germany	542 (5.9)	524 (4.9)	18 (7.6)	Boys Score Higher
Romania	492 (5.3)	480 (5.0)	12 (7.3)	Boys Score Higher
Slovenia	573 (3.2)	548 (3.2)	25 (4.5)	Boys Score Higher
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>				
Denmark	494 (3.6)	463 (3.9)	31 (5.3)	Boys Score Higher
Greece	505 (2.6)	489 (3.1)	16 (4.0)	Boys Score Higher
Thailand	524 (3.9)	526 (4.3)	2 (5.8)	Girls Score Higher
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>				
‡ Israel	545 (6.4)	512 (6.1)	33 (8.9)	Boys Score Higher
South Africa	337 (9.5)	315 (6.0)	21 (11.3)	Boys Score Higher

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

International Averages  
Boys 525 Girls 509 Difference 17  
(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 THE SCIENCE CONTENT AREAS

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

- earth science
- life science
- physics
- chemistry
- environmental issues and the nature of science

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

### How Does Achievement Differ Across Science Content Areas?

The results reported in Chapter 1 revealed substantial differences in achievement among the participating countries on the TIMSS science test. Given that the science 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 science content area in relation to the TIMSS countries.

The results for the average percent correct across all science 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. For example, according to the scale scores reported in Table 1.1, students in the United States performed significantly above the international mean, while their performance in terms of average percent correct is not significantly different from the mean.

**Table 2.1**  
**Average Percent Correct by Science Content Areas: Eighth Grade\***

Country	Science Overall	Earth Science	Life Science	Physics	Chemistry	Environmental Issues and the Nature of Science
	(135 items)	(22 items)	(40 items)	(40 items)	(19 Items)	(14 items)
Singapore	▲ 70 (1.0)	▲ 65 (1.1)	▲ 72 (1.0)	▲ 69 (0.8)	▲ 69 (1.2)	▲ 74 (1.1)
Korea	▲ 66 (0.3)	▲ 63 (0.5)	▲ 70 (0.4)	▲ 65 (0.5)	▲ 63 (0.5)	▲ 64 (0.8)
Japan	▲ 65 (0.3)	▲ 61 (0.4)	▲ 71 (0.4)	▲ 67 (0.3)	▲ 61 (0.5)	▲ 60 (0.7)
Czech Republic	▲ 64 (0.8)	▲ 63 (1.2)	▲ 69 (0.8)	▲ 64 (0.7)	▲ 60 (1.2)	▲ 59 (1.1)
<b>OREGON</b>	▲ 62 (0.8)	▲ 62 (0.9)	▲ 67 (0.8)	▲ 60 (0.7)	▲ 56 (1.0)	▲ 64 (0.9)
‡ England	▲ 61 (0.6)	▲ 59 (0.8)	▲ 64 (0.8)	▲ 62 (0.6)	▲ 55 (0.8)	▲ 65 (1.0)
Hungary	▲ 61 (0.6)	▲ 60 (0.8)	▲ 65 (0.7)	▲ 60 (0.6)	▲ 60 (0.8)	● 53 (0.8)
‡ <b>MISSOURI</b>	▲ 60 (1.0)	▲ 61 (1.1)	▲ 64 (1.0)	● 57 (0.8)	▲ 56 (1.1)	▲ 62 (1.3)
‡ Belgium (Fl)	▲ 60 (1.1)	▲ 62 (1.2)	▲ 64 (1.1)	▲ 61 (1.1)	● 51 (1.3)	● 58 (1.5)
Slovak Republic	▲ 59 (0.6)	▲ 60 (0.7)	● 60 (0.6)	▲ 61 (0.6)	▲ 57 (0.8)	● 53 (0.9)
Sweden	▲ 59 (0.6)	▲ 62 (0.7)	▲ 63 (0.7)	▲ 57 (0.5)	▲ 56 (0.7)	● 52 (0.8)
Canada	▲ 59 (0.5)	▲ 58 (0.6)	▲ 62 (0.6)	▲ 59 (0.4)	● 52 (0.7)	▲ 61 (0.7)
Ireland	● 58 (0.9)	▲ 61 (1.0)	● 60 (1.1)	● 56 (0.8)	● 54 (1.0)	▲ 60 (1.1)
‡ <b>UNITED STATES</b>	● 58 (1.0)	▲ 58 (1.0)	▲ 63 (1.1)	● 56 (0.8)	● 53 (1.2)	▲ 61 (1.0)
Russian Federation	▲ 58 (0.8)	▲ 58 (0.8)	▲ 62 (0.7)	● 57 (0.9)	▲ 57 (1.3)	▼ 50 (0.8)
New Zealand	● 58 (0.8)	● 56 (0.9)	● 60 (1.0)	▲ 58 (0.7)	● 53 (1.1)	▲ 59 (1.2)
Norway	▲ 58 (0.4)	▲ 61 (0.6)	▲ 61 (0.5)	● 57 (0.4)	▼ 49 (0.6)	● 55 (0.8)
Hong Kong	● 58 (1.0)	● 54 (1.0)	● 61 (1.0)	● 58 (0.9)	▲ 55 (1.0)	● 55 (1.3)
‡ Switzerland	● 56 (0.5)	▲ 58 (0.6)	● 59 (0.6)	▲ 58 (0.5)	▲ 50 (0.7)	● 51 (0.8)
Spain	● 56 (0.4)	▲ 57 (0.5)	● 58 (0.5)	● 55 (0.4)	● 51 (0.7)	● 53 (0.6)
‡ France	● 54 (0.6)	● 55 (0.8)	▼ 56 (0.8)	● 54 (0.5)	▼ 47 (0.9)	● 53 (0.9)
Iceland	▼ 52 (0.9)	▼ 50 (1.2)	● 58 (1.0)	● 53 (0.9)	▼ 42 (0.8)	▼ 49 (1.0)
‡ Latvia (LSS)	▼ 50 (0.6)	▼ 48 (0.8)	▼ 53 (0.7)	▼ 51 (0.7)	▼ 48 (0.8)	▼ 47 (1.0)
Portugal	▼ 50 (0.6)	▼ 50 (0.7)	▼ 53 (0.6)	▼ 48 (0.5)	● 50 (0.9)	▼ 45 (0.8)
‡ Lithuania	▼ 49 (0.7)	▼ 46 (0.9)	▼ 52 (0.9)	▼ 51 (0.7)	▼ 48 (0.9)	▼ 40 (1.0)
Iran, Islamic Rep.	▼ 47 (0.6)	▼ 45 (0.6)	▼ 49 (0.6)	▼ 48 (0.7)	● 52 (0.8)	▼ 39 (1.1)
Cyprus	▼ 47 (0.4)	▼ 46 (0.6)	▼ 49 (0.5)	▼ 46 (0.4)	▼ 45 (0.6)	▼ 46 (0.8)
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>						
Australia	▲ 60 (0.7)	▲ 57 (0.8)	▲ 63 (0.8)	▲ 60 (0.7)	● 54 (0.9)	▲ 62 (1.0)
Austria	▲ 61 (0.7)	▲ 62 (0.8)	▲ 65 (0.7)	▲ 62 (0.7)	▲ 58 (1.1)	● 55 (0.9)
Belgium (Fr)	▼ 50 (0.7)	▼ 50 (0.9)	▼ 55 (0.9)	▼ 51 (0.7)	▼ 41 (0.8)	▼ 46 (1.0)
Bulgaria	▲ 62 (1.0)	● 58 (1.2)	▲ 64 (1.0)	▲ 60 (1.0)	▲ 65 (1.7)	▲ 59 (1.5)
Netherlands	▲ 62 (1.0)	▲ 61 (1.4)	▲ 67 (1.4)	▲ 63 (0.9)	● 52 (0.9)	▲ 65 (1.6)
Scotland	● 55 (1.0)	▲ 52 (1.0)	● 56 (1.1)	● 57 (0.8)	● 51 (1.3)	▲ 57 (1.4)
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>						
Colombia	▼ 39 (0.8)	▼ 37 (0.8)	▼ 44 (0.9)	▼ 37 (0.8)	▼ 32 (1.0)	▼ 40 (1.1)
‡ Germany	● 58 (1.0)	● 57 (1.0)	▲ 63 (1.1)	● 57 (1.0)	● 54 (1.3)	● 51 (1.3)
Romania	▼ 50 (0.8)	▼ 49 (1.0)	▼ 55 (1.0)	▼ 49 (0.8)	▼ 46 (1.0)	▼ 42 (1.0)
Slovenia	▲ 62 (0.5)	▲ 64 (0.7)	▲ 65 (0.6)	▲ 61 (0.6)	▲ 56 (0.9)	▲ 59 (0.9)
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>						
Denmark	▼ 51 (0.6)	▼ 49 (0.7)	▼ 56 (0.7)	▼ 53 (0.7)	▼ 41 (0.8)	▼ 47 (1.0)
Greece	▼ 52 (0.5)	▼ 49 (0.6)	▼ 54 (0.6)	▼ 53 (0.5)	● 51 (0.5)	● 51 (1.0)
Thailand	● 57 (0.9)	● 56 (1.0)	▲ 66 (0.9)	● 54 (0.7)	▼ 43 (1.2)	▲ 62 (1.1)
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>						
‡ Israel	● 57 (1.1)	● 55 (1.1)	● 61 (1.1)	● 57 (1.1)	● 53 (1.5)	● 52 (1.6)
Kuwait	▼ 43 (0.9)	▼ 43 (1.0)	▼ 45 (1.1)	▼ 43 (0.7)	▼ 40 (1.5)	▼ 39 (1.3)
South Africa	▼ 27 (1.3)	▼ 26 (1.1)	▼ 27 (1.3)	▼ 27 (1.4)	▼ 26 (1.4)	▼ 26 (1.3)
<b>International Average Percent Correct (Does not include Missouri and Oregon)</b>	56 (0.1)	55 (0.1)	59 (0.1)	55 (0.1)	51 (0.2)	53 (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 average      ● = No statistically significant difference between country/state mean and international average      ▼ = Country/state mean significantly lower than international average

\*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 life science content area were easiest, while chemistry items were the most difficult. Thus, in comparing across columns most countries will appear to have higher performance in life science than in chemistry. The results in this chapter are most appropriate for comparing performance *within* specific content areas. For each content area, 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.

Figure 2.1 provides a comparison of the performance of Missouri students with those in other countries in each of the science content areas. In relative terms, students from Missouri performed best in environmental issues and the nature of science. They outperformed students in 25 countries in this area, and were outperformed only by students in Singapore. Missouri students performed at about the same relative level in life science and in chemistry, with four countries having significantly better performance (Singapore, Japan, Korea, and the Czech Republic in life science, and Singapore, Bulgaria, Korea, and Japan in chemistry). Students from Missouri did relatively least well in physics, where they were outperformed by students in nine countries: Singapore, Japan, Korea, the Czech Republic, the Netherlands, Austria, England, the Slovak Republic, and Slovenia.

Figure 2.2 presents a similar comparison for Oregon. The pattern of achievement across content areas is quite similar to that for Missouri in three of the content areas. The Oregon students also did best in environmental issues and the nature of science, outperforming students in 31 countries. Only students in Singapore performed better in this area. Like the Missouri students, students in Oregon did relatively well in life science and chemistry, with just three countries doing better in life science (Singapore, Japan, and Korea), and four doing better in chemistry (Singapore, Bulgaria, Korea, and Japan). However, students in Oregon performed relatively better in physics than the Missouri students, where they performed better than students from 20 countries, and were outperformed by students in just four countries (Singapore, Japan, Korea, and the Czech Republic).

**Figure 2.1**

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

Earth Science		Life Science		Physics		Chemistry		Environmental Issues and the Nature of Science	
Country	Average Percent Correct	Country	Average Percent Correct	Country	Average Percent Correct	Country	Average Percent Correct	Country	Average Percent Correct
Singapore	65 (1.1)	Singapore	72 (1.0)	Singapore	69 (0.8)	Singapore	69 (1.2)	Singapore	74 (1.1)
Slovenia	64 (0.7)	Japan	71 (0.4)	Japan	67 (0.3)	Bulgaria	65 (1.7)	Netherlands	65 (1.6)
Korea	63 (0.5)	Korea	70 (0.4)	Korea	65 (0.5)	Korea	63 (0.5)	England	65 (1.0)
Czech Republic	63 (1.2)	Czech Republic	69 (0.8)	Czech Republic	64 (0.7)	Japan	61 (0.5)	Korea	64 (0.8)
Belgium (Fl)	62 (1.2)	Netherlands	67 (1.4)	Netherlands	63 (0.9)	Czech Republic	60 (1.2)	Australia	62 (1.0)
Austria	62 (0.8)	Thailand	66 (0.9)	Austria	62 (0.7)	Hungary	60 (0.8)	MISSOURI	62 (1.3)
Sweden	62 (0.7)	Austria	65 (0.7)	England	62 (0.6)	Austria	58 (1.1)	Thailand	62 (1.1)
Japan	61 (0.4)	Hungary	65 (0.7)	Slovak Republic	61 (0.6)	Russian Fed.	57 (1.3)	Canada	61 (0.7)
Netherlands	61 (1.4)	Slovenia	65 (0.6)	Slovenia	61 (0.6)	Slovak Republic	57 (0.8)	UNITED STATES	61 (1.0)
Ireland	61 (1.0)	Belgium (Fl)	64 (1.1)	Belgium (Fl)	61 (1.1)	Slovak Republic	56 (0.9)	Japan	60 (0.7)
Norway	61 (0.6)	Bulgaria	64 (1.0)	Bulgaria	60 (1.0)	MISSOURI	56 (1.1)	Ireland	60 (1.1)
MISSOURI	61 (1.1)	MISSOURI	64 (1.0)	Hungary	60 (0.6)	Sweden	56 (0.7)	Czech Republic	59 (1.1)
Slovak Republic	60 (0.7)	England	64 (0.8)	Australia	60 (0.7)	Hong Kong	55 (1.0)	Slovenia	59 (0.9)
Hungary	60 (0.8)	Sweden	63 (0.7)	Canada	59 (0.4)	England	55 (0.8)	New Zealand	59 (1.2)
England	59 (0.8)	Australia	63 (0.8)	Hong Kong	58 (0.9)	Australia	54 (0.9)	Bulgaria	59 (1.5)
Switzerland	58 (0.6)	UNITED STATES	63 (1.1)	Switzerland	58 (0.5)	Ireland	54 (1.0)	Belgium (Fl)	58 (1.5)
Bulgaria	58 (1.2)	Germany	63 (1.1)	New Zealand	58 (0.7)	Germany	54 (1.3)	Scotland	57 (1.4)
Russian Fed.	58 (0.8)	Canada	62 (0.6)	Russian Fed.	57 (0.9)	UNITED STATES	53 (1.5)	Hong Kong	55 (1.3)
Canada	58 (0.6)	Russian Fed.	62 (0.7)	Israel	57 (1.1)	UNITED STATES	53 (1.2)	Austria	55 (0.9)
UNITED STATES	58 (1.0)	Hong Kong	61 (1.0)	Scotland	57 (0.8)	New Zealand	53 (1.1)	Norway	55 (0.8)
Australia	57 (0.8)	Israel	61 (1.1)	Germany	57 (1.0)	Canada	52 (0.7)	France	55 (0.9)
Germany	57 (1.0)	Norway	61 (0.5)	Norway	57 (0.4)	Netherlands	52 (0.9)	Hungary	53 (0.8)
Spain	57 (0.5)	Ireland	60 (1.1)	MISSOURI	57 (0.8)	Iran, Islamic Rep.	52 (0.8)	Slovak Republic	53 (0.9)
Thailand	56 (1.0)	New Zealand	60 (1.0)	Sweden	57 (0.5)	Belgium (Fl)	51 (1.3)	Spain	53 (0.6)
New Zealand	56 (0.9)	Slovak Republic	60 (0.6)	Ireland	56 (0.8)	Scotland	51 (1.3)	Sweden	52 (0.8)
France	55 (0.8)	Iceland	58 (1.0)	UNITED STATES	56 (0.8)	Spain	51 (0.7)	Israel	52 (1.6)
Hong Kong	54 (1.0)	Spain	58 (0.5)	Spain	55 (0.4)	Greece	51 (0.5)	Switzerland	51 (0.8)
Scotland	52 (1.0)	France	56 (0.8)	France	54 (0.5)	Switzerland	50 (0.7)	Germany	51 (1.3)
Belgium (Fr)	52 (0.9)	Denmark	56 (0.7)	Thailand	54 (0.7)	Portugal	50 (0.9)	Greece	51 (1.0)
Iceland	50 (1.2)	Denmark	56 (0.7)	Denmark	53 (0.7)	Norway	49 (0.6)	Russian Fed.	50 (0.8)
Portugal	50 (0.7)	Scotland	56 (1.1)	Iceland	53 (0.9)	Latvia (LSS)	48 (0.8)	Iceland	49 (1.0)
Denmark	49 (0.7)	Belgium (Fr)	55 (0.9)	Greece	53 (0.5)	Lithuania	48 (0.9)	Denmark	47 (1.0)
Greece	49 (0.6)	Romania	55 (1.0)	Belgium (Fr)	51 (0.7)	France	47 (0.9)	Latvia (LSS)	47 (1.0)
Romania	49 (1.0)	Greece	54 (0.6)	Latvia (LSS)	51 (0.7)	Romania	46 (1.0)	Belgium (Fr)	46 (1.0)
Latvia (LSS)	48 (0.8)	Latvia (LSS)	53 (0.7)	Lithuania	51 (0.7)	Cyprus	45 (0.6)	Cyprus	46 (0.8)
Lithuania	46 (0.9)	Portugal	52 (0.9)	Romania	49 (0.8)	Thailand	43 (1.2)	Portugal	45 (0.8)
Cyprus	46 (0.6)	Lithuania	49 (0.5)	Portugal	48 (0.5)	Iceland	42 (0.8)	Romania	45 (0.8)
Iran, Islamic Rep.	45 (0.6)	Cyprus	49 (0.6)	Iran, Islamic Rep.	48 (0.7)	Belgium (Fr)	41 (0.8)	Lithuania	42 (1.0)
Kuwait	43 (1.0)	Kuwait	45 (1.1)	Cyprus	46 (0.4)	Denmark	41 (0.8)	Colombia	40 (1.1)
Colombia	37 (0.8)	Colombia	44 (0.9)	Kuwait	43 (0.7)	Kuwait	40 (1.5)	Iran, Islamic Rep.	39 (1.1)
South Africa	26 (1.1)	South Africa	27 (1.3)	Colombia	37 (0.8)	Colombia	32 (1.0)	Kuwait	39 (1.3)
				South Africa	27 (1.3)	South Africa	26 (1.4)	South Africa	26 (1.3)

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 Science Content Areas Compared with Oregon: Eighth Grade\***

Earth Science		Life Science		Physics		Chemistry		Environmental Issues and the Nature of Science	
Country	Average Percent Correct	Country	Average Percent Correct	Country	Average Percent Correct	Country	Average Percent Correct	Country	Average Percent Correct
Singapore	65 (1.1)	Singapore	72 (1.0)	Singapore	69 (0.8)	Singapore	69 (1.2)	Singapore	74 (1.1)
Slovenia	64 (0.7)	Japan	71 (0.4)	Japan	67 (0.3)	Bulgaria	65 (1.7)	Netherlands	65 (1.6)
Korea	63 (0.5)	Korea	70 (0.4)	Korea	65 (0.5)	Korea	63 (0.5)	England	65 (1.0)
Czech Republic	63 (1.2)	Czech Republic	69 (0.8)	Czech Republic	64 (0.7)	Japan	61 (0.5)	Korea	64 (0.8)
Belgium (Fl)	62 (1.2)	Netherlands	67 (1.4)	Netherlands	63 (0.9)	Hungary	60 (0.8)	OREGON	64 (0.9)
Austria	62 (0.8)	OREGON	67 (0.8)	Austria	62 (0.7)	Czech Republic	60 (1.2)	Australia	62 (1.0)
OREGON	62 (0.9)	Thailand	66 (0.9)	England	62 (0.6)	Austria	58 (1.1)	Thailand	62 (1.1)
Sweden	62 (0.7)	Austria	65 (0.7)	Belgium (Fl)	61 (1.1)	Slovak Republic	57 (0.8)	Canada	61 (0.7)
Japan	61 (0.4)	Hungary	65 (0.7)	Slovak Republic	61 (0.6)	Russian Fed.	57 (1.3)	UNITED STATES	61 (1.0)
Netherlands	61 (1.4)	Hungary	65 (0.6)	Slovenia	61 (0.6)	Slovenia	56 (0.9)	Ireland	60 (1.1)
Ireland	61 (1.0)	Belgium (Fl)	64 (1.1)	Bulgaria	60 (1.0)	OREGON	56 (1.0)	Bulgaria	59 (1.5)
Norway	61 (0.6)	Bulgaria	64 (1.0)	Hungary	60 (0.6)	Sweden	56 (0.7)	Japan	60 (0.7)
Slovak Republic	60 (0.7)	England	64 (0.8)	Australia	60 (0.7)	Hong Kong	55 (1.0)	New Zealand	59 (1.2)
Hungary	60 (0.8)	Germany	63 (1.1)	OREGON	60 (0.7)	England	55 (0.8)	Czech Republic	59 (1.1)
England	59 (0.8)	Sweden	63 (0.7)	Canada	59 (0.4)	Ireland	54 (1.0)	Slovenia	59 (0.9)
Bulgaria	58 (1.2)	Australia	63 (0.8)	Hong Kong	58 (0.9)	Australia	54 (0.9)	Belgium (Fl)	58 (1.5)
Russian Fed.	58 (0.8)	UNITED STATES	63 (1.1)	Switzerland	58 (0.5)	Germany	54 (1.3)	Scotland	57 (1.4)
UNITED STATES	58 (1.0)	Canada	62 (0.6)	New Zealand	58 (0.7)	UNITED STATES	53 (1.2)	Austria	55 (0.9)
Switzerland	58 (0.6)	Russian Fed.	62 (0.7)	Russian Fed.	57 (0.9)	Israel	53 (1.5)	Hong Kong	55 (1.3)
Canada	58 (0.6)	Hong Kong	61 (1.0)	Israel	57 (1.1)	New Zealand	53 (1.1)	Norway	55 (0.8)
Australia	57 (0.8)	Israel	61 (1.1)	Scotland	57 (0.8)	Netherlands	52 (0.9)	France	53 (0.9)
Germany	57 (1.0)	Norway	61 (0.5)	Germany	57 (1.0)	Iran, Islamic Rep.	52 (0.8)	Spain	53 (0.6)
Spain	57 (0.5)	Slovak Republic	60 (0.6)	Norway	57 (0.4)	Belgium (Fl)	51 (1.3)	Slovak Republic	53 (0.9)
Thailand	56 (1.0)	Ireland	60 (1.1)	Sweden	57 (0.5)	Scotland	51 (1.3)	Hungary	53 (0.8)
New Zealand	56 (0.9)	New Zealand	60 (1.0)	Ireland	56 (0.8)	Canada	52 (0.7)	Sweden	52 (0.8)
France	55 (0.8)	Switzerland	59 (0.6)	UNITED STATES	56 (0.8)	Spain	51 (0.7)	Israel	52 (1.6)
Israel	55 (1.1)	Iceland	58 (1.0)	Spain	55 (0.4)	Greece	51 (0.5)	Switzerland	51 (0.8)
Hong Kong	54 (1.0)	France	58 (0.5)	France	54 (0.5)	Switzerland	50 (0.7)	Greece	51 (1.0)
Scotland	52 (1.0)	Spain	56 (0.8)	Thailand	54 (0.7)	Portugal	50 (0.9)	Germany	51 (1.3)
Belgium (Fr)	50 (0.9)	Denmark	56 (0.7)	Denmark	53 (0.7)	Norway	49 (0.6)	Russian Fed.	50 (0.8)
Iceland	50 (1.2)	Denmark	56 (0.7)	Iceland	53 (0.9)	Lithuania	48 (0.9)	Iceland	49 (1.0)
Portugal	50 (0.7)	Belgium (Fr)	55 (0.9)	Greece	53 (0.5)	Latvia (LSS)	48 (0.8)	Denmark	47 (1.0)
Denmark	49 (0.7)	Romania	55 (1.0)	Belgium (Fr)	51 (0.7)	France	47 (0.9)	Latvia (LSS)	47 (1.0)
Greece	49 (0.6)	Greece	54 (0.6)	Latvia (LSS)	51 (0.7)	Romania	46 (1.0)	Belgium (Fr)	46 (1.0)
Romania	49 (1.0)	Latvia (LSS)	53 (0.7)	Lithuania	49 (0.8)	Cyprus	45 (0.6)	Cyprus	46 (0.8)
Latvia (LSS)	48 (0.8)	Portugal	53 (0.6)	Romania	49 (0.8)	Thailand	43 (1.2)	Portugal	45 (0.8)
Lithuania	46 (0.9)	Lithuania	52 (0.9)	Portugal	48 (0.5)	Iceland	42 (0.8)	Romania	42 (1.0)
Cyprus	46 (0.6)	Cyprus	49 (0.5)	Iran, Islamic Rep.	48 (0.7)	Iran, Islamic Rep.	41 (0.8)	Colombia	40 (1.1)
Iran, Islamic Rep.	45 (0.6)	Iran, Islamic Rep.	49 (0.6)	Cyprus	46 (0.4)	Denmark	41 (0.8)	Lithuania	40 (1.0)
Kuwait	43 (1.0)	Kuwait	45 (1.1)	Kuwait	43 (0.7)	Kuwait	40 (1.5)	Iran, Islamic Rep.	39 (1.3)
Colombia	37 (0.8)	Colombia	44 (0.9)	Colombia	37 (0.8)	Colombia	32 (1.0)	Iran, Islamic Rep.	39 (1.1)
South Africa	26 (1.1)	South Africa	27 (1.3)	South Africa	27 (1.4)	South Africa	26 (1.4)	South Africa	26 (1.3)

○ 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?

Table 2.2 presents the gender differences for science overall and for the science content areas for eighth-grade students. Although these differences for science overall are comparable to those for the TIMSS science scale discussed in Chapter 1, the reduced number of statistically significant differences reinforces the idea of less precision in the percent-correct metric. This is particularly noticeable for Missouri and Oregon, since gender differences which were significant using the science scale score (Table 1.3) are not significant in the average percent correct metric.

The science content area data reveal that the gender differences vary depending on the science subject. The gender differences in earth science, physics, and chemistry reflect advantages for boys. In earth science, the boys had significantly higher averages than girls in 18 countries. In physics, the corresponding results revealed advantages for boys in 25 countries. In chemistry, boys out-performed girls in 16 countries. For the remaining countries, except Thailand, even though the differences were not statistically significant, the direction of the differences favored boys in all three content areas. Similar trends could be observed in Missouri and Oregon, although the results were not statistically significant. Boys had higher average percent correct in earth science, physics, and chemistry.

In life science and for the items covering environmental issues and the nature of science, girls and boys had similar performances. In life science, there were very few gender differences in average performance. In Spain, boys had significantly higher achievement than girls. However, girls did better than boys in Cyprus. For the items in the area of environmental issues and the nature of science, boys had higher achievement than girls in two countries – the Czech Republic and Korea. Although the differences were not statistically significant, girls in Missouri had slightly higher performance than boys in life science and in environmental issues and the nature of science. In Oregon, there was no performance difference between boys and girls in life science, but a slight (non-significant) difference favoring boys in environmental issues and the nature of science.

IEA's second science study conducted in 1983-84 found similar results for 14-year-olds in the content areas. There were negligible gender differences in biology, larger, but still small differences favoring boys in chemistry and earth science, and moderate to large advantages for boys in physics.<sup>1</sup>

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<sup>1</sup> Keeves, J.P. and Kotte, D. (1992). "Disparities Between the Sexes in Science Education: 1970-84" in J.P. Keeves (ed.), *The IEA Study of Science (Vol.) III: Changes in Science Education and Achievement: 1970 to 1984*. New York, NY: Pergamon Press.

**Table 2.2**  
**Average Percent Correct for Boys and Girls by Science Content Areas: Eighth Grade\***

Country	Science Overall		Earth Science		Life Science	
	Boys	Girls	Boys	Girls	Boys	Girls
‡ UNITED STATES	59 (1.0)	57 (1.0)	60 (1.0)	56 (1.1)	63 (1.2)	63 (1.1)
‡ MISSOURI	61 (1.4)	59 (1.0)	63 (1.5)	59 (1.3)	64 (1.5)	65 (1.3)
OREGON	64 (1.4)	61 (1.2)	65 (1.7)	59 (1.4)	67 (1.6)	67 (1.3)
‡ Belgium (Fl)	62 (1.7)	59 (1.5)	64 (2.0)	60 (1.5)	64 (1.7)	64 (1.5)
Canada	60 (0.6)	58 (0.6)	59 (0.8)	56 (0.8)	62 (0.8)	63 (0.8)
Cyprus	46 (0.4)	47 (0.6)	47 (0.7)	46 (0.9)	47 (0.6)	▲ 51 (0.7)
Czech Republic	▲ 67 (0.8)	61 (1.1)	66 (1.1)	60 (1.6)	70 (0.9)	67 (1.2)
‡ England	63 (1.0)	60 (0.7)	61 (1.2)	58 (0.9)	65 (1.2)	63 (1.1)
‡ France	▲ 55 (0.7)	52 (0.7)	57 (0.9)	53 (1.0)	57 (0.8)	55 (0.9)
Hong Kong	▲ 60 (1.1)	55 (1.1)	▲ 57 (1.2)	51 (1.1)	63 (1.2)	59 (1.2)
Hungary	▲ 63 (0.7)	59 (0.7)	▲ 62 (1.0)	57 (0.9)	66 (0.8)	65 (0.8)
Iceland	53 (1.2)	51 (0.9)	52 (1.5)	48 (1.3)	58 (1.2)	58 (1.2)
Iran, Islamic Rep.	▲ 49 (0.8)	45 (0.8)	▲ 47 (0.8)	42 (0.9)	50 (0.9)	47 (0.9)
Ireland	60 (1.3)	57 (1.0)	64 (1.4)	59 (1.2)	60 (1.4)	60 (1.3)
Japan	▲ 67 (0.5)	64 (0.4)	▲ 64 (0.5)	58 (0.6)	71 (0.5)	70 (0.5)
Korea	▲ 67 (0.5)	64 (0.5)	▲ 65 (0.7)	60 (0.7)	71 (0.6)	69 (0.7)
‡ Latvia (LSS)	▲ 52 (0.8)	48 (0.6)	▲ 51 (1.1)	45 (1.0)	54 (0.9)	52 (0.8)
‡ Lithuania	▲ 51 (0.8)	47 (0.8)	▲ 49 (1.1)	44 (1.1)	52 (1.0)	52 (1.0)
New Zealand	60 (1.0)	56 (1.0)	▲ 59 (1.1)	52 (1.1)	61 (1.2)	60 (1.1)
Norway	59 (0.6)	56 (0.4)	▲ 64 (0.8)	59 (0.7)	60 (0.8)	62 (0.6)
Portugal	▲ 52 (0.7)	48 (0.6)	▲ 53 (1.0)	47 (0.8)	55 (0.8)	52 (0.8)
Russian Federation	60 (0.9)	57 (0.7)	61 (0.9)	57 (0.9)	62 (0.9)	63 (0.7)
Singapore	71 (1.2)	69 (1.1)	66 (1.4)	63 (1.3)	72 (1.2)	71 (1.2)
Slovak Republic	▲ 62 (0.6)	57 (0.7)	▲ 62 (0.9)	58 (0.9)	61 (0.7)	59 (0.8)
Spain	▲ 58 (0.5)	54 (0.5)	▲ 59 (0.7)	54 (0.7)	▲ 60 (0.7)	57 (0.6)
Sweden	▲ 60 (0.6)	57 (0.6)	63 (0.8)	60 (0.8)	63 (0.7)	63 (0.8)
‡ Switzerland	▲ 58 (0.6)	54 (0.5)	60 (0.9)	56 (0.7)	59 (0.8)	59 (0.7)
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>						
Australia	61 (1.0)	59 (0.8)	59 (1.0)	55 (0.9)	62 (1.0)	64 (0.8)
Austria	63 (0.8)	60 (0.8)	▲ 65 (0.9)	59 (1.0)	65 (0.8)	64 (0.9)
Belgium (Fr)	52 (1.0)	49 (0.7)	52 (1.3)	48 (0.9)	55 (1.1)	55 (1.0)
Netherlands	64 (1.2)	60 (1.1)	64 (1.6)	58 (1.4)	67 (1.4)	66 (1.6)
Scotland	57 (1.2)	53 (0.9)	▲ 56 (1.2)	48 (1.0)	58 (1.3)	55 (1.1)
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>						
Colombia	40 (1.4)	37 (0.8)	39 (1.4)	35 (1.1)	45 (1.6)	42 (1.0)
‡ Germany	59 (1.2)	57 (1.0)	58 (1.1)	56 (1.3)	63 (1.3)	63 (1.1)
Romania	51 (0.9)	49 (0.9)	50 (1.1)	48 (1.1)	55 (1.1)	55 (1.1)
Slovenia	▲ 64 (0.6)	59 (0.7)	▲ 67 (0.8)	62 (0.9)	66 (0.7)	63 (0.8)
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>						
Denmark	▲ 54 (0.6)	48 (0.8)	▲ 53 (0.9)	44 (0.9)	57 (0.9)	55 (1.0)
Greece	▲ 54 (0.6)	50 (0.6)	▲ 51 (0.8)	46 (0.7)	55 (0.7)	53 (0.7)
Thailand	57 (0.9)	58 (1.0)	56 (1.2)	56 (1.1)	65 (1.0)	67 (1.1)
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>						
‡ Israel	▲ 61 (1.2)	54 (1.1)	▲ 59 (1.4)	52 (1.3)	63 (1.5)	59 (1.4)
South Africa	28 (1.8)	25 (1.2)	28 (1.6)	24 (1.0)	29 (1.9)	25 (1.3)
<b>International Average Percent Correct</b>	57 (0.1)	54 (0.1)	57 (0.2)	53 (0.2)	59 (0.2)	59 (0.2)

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

▲ = 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 Science Content Areas: Eighth Grade\***

Country	Physics		Chemistry		Environmental Issues and the Nature of Science	
	Boys	Girls	Boys	Girls	Boys	Girls
‡ UNITED STATES	57 (0.9)	54 (0.9)	55 (1.3)	51 (1.2)	59 (1.2)	62 (1.2)
‡ MISSOURI	59 (1.4)	55 (1.0)	56 (1.7)	55 (1.1)	60 (2.2)	63 (1.5)
OREGON	63 (1.5)	58 (1.1)	59 (1.7)	54 (1.9)	64 (1.6)	63 (1.7)
‡ Belgium (Fl)	63 (1.7)	58 (1.4)	53 (1.6)	50 (1.8)	59 (1.6)	57 (2.3)
Canada	▲ 61 (0.6)	57 (0.5)	53 (0.9)	50 (0.9)	62 (0.8)	60 (1.0)
Cyprus	47 (0.6)	45 (0.7)	45 (0.9)	44 (0.8)	45 (1.0)	47 (0.9)
Czech Republic	▲ 67 (0.8)	60 (0.9)	▲ 64 (1.2)	56 (1.7)	▲ 64 (1.2)	55 (1.6)
‡ England	63 (1.0)	60 (0.8)	57 (1.2)	53 (1.4)	65 (1.6)	64 (1.2)
‡ France	▲ 57 (0.7)	52 (0.7)	49 (1.2)	45 (1.2)	54 (1.3)	53 (1.1)
Hong Kong	▲ 62 (0.9)	54 (1.1)	▲ 57 (1.3)	52 (1.2)	57 (1.6)	53 (1.5)
Hungary	▲ 63 (0.7)	56 (0.8)	▲ 62 (0.9)	58 (1.0)	55 (1.2)	52 (1.1)
Iceland	54 (1.6)	52 (0.9)	43 (1.1)	41 (1.4)	49 (1.8)	48 (1.2)
Iran, Islamic Rep.	▲ 51 (1.0)	44 (0.8)	53 (1.0)	51 (1.1)	40 (1.4)	37 (1.4)
Ireland	▲ 59 (1.3)	54 (1.0)	56 (1.5)	52 (1.2)	60 (1.6)	60 (1.3)
Japan	▲ 68 (0.5)	65 (0.4)	▲ 62 (0.7)	59 (0.6)	61 (0.9)	58 (0.8)
Korea	▲ 67 (0.7)	62 (0.6)	65 (0.8)	61 (0.9)	▲ 66 (1.0)	61 (1.1)
‡ Latvia (LSS)	▲ 55 (1.0)	48 (0.7)	50 (1.2)	46 (1.1)	48 (1.3)	46 (1.2)
‡ Lithuania	▲ 56 (0.9)	48 (0.7)	50 (1.1)	45 (1.1)	41 (1.4)	38 (1.2)
New Zealand	▲ 60 (0.8)	55 (0.8)	▲ 56 (1.3)	50 (1.4)	60 (1.5)	58 (1.3)
Norway	▲ 59 (0.6)	55 (0.5)	▲ 52 (0.9)	47 (0.8)	56 (1.0)	55 (1.1)
Portugal	▲ 52 (0.6)	45 (0.6)	▲ 54 (1.1)	46 (1.0)	45 (1.1)	45 (1.1)
Russian Federation	▲ 60 (1.0)	55 (0.9)	60 (1.6)	55 (1.2)	49 (1.0)	50 (1.0)
Singapore	71 (1.0)	67 (1.0)	70 (1.6)	68 (1.5)	74 (1.3)	74 (1.4)
Slovak Republic	▲ 65 (0.7)	58 (0.8)	▲ 61 (1.0)	54 (1.0)	55 (1.1)	52 (1.1)
Spain	▲ 58 (0.5)	52 (0.6)	▲ 54 (0.9)	49 (0.8)	53 (0.8)	53 (1.0)
Sweden	▲ 60 (0.6)	54 (0.7)	▲ 59 (1.0)	52 (0.7)	53 (1.0)	51 (0.9)
‡ Switzerland	▲ 60 (0.7)	55 (0.6)	▲ 53 (0.9)	46 (0.9)	53 (1.0)	49 (1.0)
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>						
Australia	62 (0.9)	58 (0.8)	56 (1.2)	52 (1.0)	62 (1.3)	63 (1.1)
Austria	▲ 64 (0.8)	59 (0.9)	61 (1.3)	56 (1.5)	56 (1.1)	54 (1.3)
Belgium (Fr)	53 (1.1)	50 (0.6)	44 (1.1)	39 (1.1)	47 (1.6)	46 (1.1)
Netherlands	▲ 65 (1.2)	60 (1.0)	▲ 56 (1.0)	49 (1.1)	66 (2.1)	65 (1.9)
Scotland	59 (1.0)	55 (0.9)	▲ 55 (1.7)	47 (1.1)	58 (1.7)	56 (1.6)
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>						
Colombia	39 (1.5)	35 (0.9)	34 (1.6)	30 (1.0)	41 (2.0)	40 (1.0)
‡ Germany	60 (1.1)	55 (1.0)	57 (1.6)	52 (1.6)	50 (1.6)	52 (1.3)
Romania	51 (0.9)	46 (1.0)	48 (1.2)	45 (1.1)	42 (1.2)	41 (1.3)
Slovenia	▲ 64 (0.7)	58 (0.8)	59 (1.1)	54 (1.1)	60 (1.1)	57 (1.1)
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>						
Denmark	▲ 57 (0.7)	49 (0.9)	▲ 44 (1.1)	38 (1.1)	50 (1.4)	44 (1.3)
Greece	▲ 55 (0.6)	50 (0.6)	▲ 54 (0.7)	49 (0.7)	51 (1.1)	51 (1.1)
Thailand	54 (0.8)	54 (0.9)	42 (1.2)	44 (1.5)	62 (1.2)	62 (1.3)
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>						
‡ Israel	▲ 62 (1.1)	54 (1.1)	▲ 58 (1.7)	50 (1.6)	57 (2.1)	49 (1.9)
South Africa	29 (1.9)	25 (1.3)	28 (2.0)	25 (1.2)	27 (1.9)	24 (1.5)
<b>International Average Percent Correct</b>	58 (0.2)	53 (0.1)	53 (0.2)	49 (0.2)	54 (0.2)	52 (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.

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



# Chapter 3

## PERFORMANCE ON ITEMS WITHIN EACH SCIENCE CONTENT AREA

This chapter presents four to six example items within each of the science content areas, including the performance on these items for Missouri and Oregon and 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 have been released for use by the public.<sup>1</sup>

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. This discussion is followed by a series of tables, one for each of the example items, showing the percent correct on the example item for Missouri, Oregon, and the United States, as well as for each of the other TIMSS countries. 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 country-by-country results, there is a figure relating achievement on each of the example items to performance on the TIMSS international science scale. This "difficulty map" provides a pictorial representation of achievement on the scale in relation to achievement on the items.

<sup>1</sup> 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 Earth Science?

Items in the earth science category measure students' knowledge of the scientific principles related to earth features, earth processes, and the earth in the universe.

Example Item 1 presented in Table 3.1 asks students to apply scientific principles of water sources and physical cycles to explain why a plain containing a river might be both a good place (Part A) and a bad place (Part B) for farming. Most students were able to answer the first part of this open-ended item (international average of 79%). Students were given credit for mentioning that the soil was fertile, good, or abundant; that the river would provide irrigation or water for animals; that there was plenty of space or flat areas for farmland; or any other acceptable reason related to facilitating farming. Missouri and Oregon performed above the international average at 89% and 90%, respectively. For the majority of countries, more than 70% of the students provided a correct response, and several countries had more than 90% correct responses. Substantially fewer students were able to provide a correct response to the second part of this item. Reasons given credit for Part B included the possibility of flooding, wind or water erosion, or other acceptable problems related to farming. The international average percent correct level was 42%. In addition, a much broader range of performance was observed across countries for this part of the item, with the percent of correct responses ranging from 14% in South Africa to more than 70% in Missouri (73%), England (74%), Ireland (71%), and Thailand (75%). Oregon also performed well above the international average with 65% of the students responding correctly to this item.

As presented in Table 3.2, Example Item 2 is a multiple-choice item requiring knowledge of the source of fossil fuels. Missouri (71%) and Oregon (68%) both fared well on this item, performing just above the international average of 62%. Across the countries differences ranged widely. Students in several countries had 80% or more correct responses, with Ireland and England having two of the highest performances, together with Korea, Singapore, Austria, and Slovenia.

Example Item 3 required students to write down a reason for the importance of the ozone layer. As shown in Table 3.3, about half of the students internationally provided a correct response related to protection from the sun's ultraviolet radiation. Ultraviolet radiation did not need to be mentioned specifically; responses that included the idea of the ozone layer protecting humans from sunburn or skin cancer also were given credit. Missouri and Oregon performed similarly to many of the countries with percent correct averages near the international average of 53%.

Table 3.4 presents Example Item 4, an extended-response item that required students to apply scientific principles and use a diagram to explain the earth's water cycle. A fully-correct response to this item needed to depict or otherwise indicate all three steps in the water cycle – evaporation, transportation, and precipitation. As the results in Table 3.4 indicate, on average, students found this item to be rather difficult, with fewer than one-third of the students providing a fully-correct drawing or diagram. The performance across countries ranged from less than 10% to 60%, with South Africa posting 6% and Belgium (Flemish) 60%. Students in Missouri (40%) and Oregon (46%) performed at the higher end of this range.



Example Item 5, requiring students to identify the most abundant gas found in air, was the most difficult earth science item. As shown in Table 3.5, only about one-quarter of the students could identify the correct response of nitrogen gas (international average 27%). The most common misconception, chosen by more than 50% of students, was that oxygen is the most abundant gas in air. Performance patterns were very inconsistent for this item. The across-country performance varied dramatically, ranging from below 10% correct in several countries to 58% in Singapore. Although the patterns across countries were inconsistent, performance within the United States was consistent, with 20% of students in the United States, and in Missouri and Oregon, responding correctly.

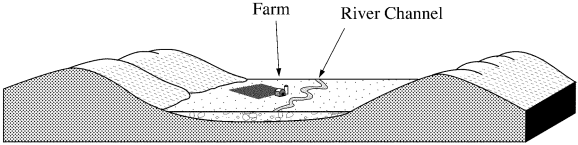
The international item difficulty map shown in Figure 3.1 presents a pictorial representation of the relationship between performance on the TIMSS international science scale and achievement on the five example items for earth science.<sup>2</sup> The international achievement on each example item is indicated by the international average percent correct and by the international science scale value, or item difficulty level, for each item.

For the figure, the items results are placed on the scale at the point where students at the corresponding achievement level were more likely than not (65% probability) to answer the question correctly. Items at higher scale values are the more difficult items. For example, students scoring at or above 383 on the science scale were likely to correctly answer the question about advantages of farming by a river (Example Item 1) but not the question about the source of fossil fuels (Example Item 2), while students scoring at or above 526 were also likely to answer this second item.

The international average on the science scale of 516 indicates that students from many countries would be likely to correctly answer the lowest-difficulty items, such as Example Item 1, but would not be likely to answer the more difficult items. These results, however, varied dramatically across countries. In Singapore, with an average scale value of 607, students were likely to respond correctly to more of the earth science example items than did students in other, lower-performing countries. This is reflected in Singapore's average percent correct for the earth science items, which was 65% compared to 55% internationally. Students in Missouri and Oregon, who had relatively high average scale scores, were also likely to respond correctly to more of the earth science example items than students in many other countries.

<sup>2</sup> 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: Earth Science**  
**Percent Correct for Example Item 1, Part A - Eighth Grade\***

Country	Percent Correct	Example 1, Part A River on the plain: Good place for farming	
‡ UNITED STATES	91 (0.8)	<p>The diagram shows a river flowing through a wide plain. The plain is covered with several layers of soil and sediment.</p>  <p>a. Write down one reason why this plain is a good place for farming.</p> <p>This is a good place because the soil is soft, and fertile.</p> <p>b. Write down one reason why this plain is NOT a good place for farming.</p> <p>This is not a good place because the river might flood.</p>	
‡ MISSOURI	89 (1.1)		
OREGON	90 (1.1)		
‡ Belgium (Fl)	86 (1.8)		
Canada	88 (1.1)		
Cyprus	77 (1.8)		
Czech Republic	84 (1.9)		
‡ England	92 (1.5)		
France	76 (1.8)		
Hong Kong	70 (2.0)		
Hungary	77 (1.7)		
Iceland	81 (2.2)		
Iran, Islamic Rep.	82 (1.6)		
Ireland	91 (1.2)		
Japan	91 (0.7)		
Korea	92 (1.2)		
‡ Latvia (LSS)	71 (2.2)		
‡ Lithuania	68 (1.9)		
New Zealand	89 (1.3)		
Norway	86 (1.3)		
Portugal	79 (1.6)		
Russian Federation	74 (1.6)		
Singapore	94 (0.8)		
Slovak Republic	83 (1.8)		
Spain	87 (1.2)		
Sweden	83 (1.4)		
‡ Switzerland	81 (1.5)		
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>			
Australia	83 (1.4)		
Austria	78 (2.0)		
Belgium (Fr)	62 (2.8)		
Bulgaria	65 (3.9)		
Netherlands	78 (2.3)		
Scotland	81 (1.7)		
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>			
Colombia	62 (3.0)		
‡ Germany	72 (2.1)		
Romania	68 (2.3)		
Slovenia	90 (1.2)		
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>			
Denmark	62 (2.2)		
Greece	86 (1.2)		
Thailand	95 (0.7)		
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>			
‡ Israel	84 (2.4)		
Kuwait	59 (4.5)		
South Africa	38 (2.5)		
<b>International Average Percent Correct</b>	<b>79 (0.3)</b>		

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 3.1: Earth Science (Continued)**  
**Percent Correct for Example Item 1, Part B - Eighth Grade\***

Country	Percent Correct	Example 1, Part B River on the plain: Bad place for farming
‡ UNITED STATES	58 (1.7)	The diagram shows a river flowing through a wide plain. The plain is covered with several layers of soil and sediment.
‡ MISSOURI OREGON	73 (2.0) 65 (1.3)	
‡ Belgium (Fl)	57 (3.2)	<div> </div> <p>a. Write down one reason why this plain is a good place for farming.</p> <p>This is a good place because the soil is soft and fertile.</p> <p>b. Write down one reason why this plain is NOT a good place for farming.</p> <p>This is not a good place because the river might flood.</p>
Canada	47 (1.8)	
Cyprus	23 (1.8)	
Czech Republic	42 (2.5)	
‡ England	74 (2.2)	
France	37 (2.4)	
Hong Kong	42 (2.4)	
Hungary	45 (1.9)	
Iceland	26 (2.9)	
Iran, Islamic Rep.	25 (2.0)	
Ireland	71 (1.8)	
Japan	25 (1.3)	
Korea	35 (2.1)	
‡ Latvia (LSS)	30 (2.1)	
‡ Lithuania	39 (2.4)	
New Zealand	68 (1.8)	
Norway	42 (1.8)	
Portugal	24 (1.6)	
Russian Federation	39 (2.3)	
Singapore	62 (1.9)	
Slovak Republic	40 (2.1)	
Spain	35 (1.8)	
Sweden	44 (2.0)	
‡ Switzerland	53 (1.6)	
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>		
Australia	58 (1.8)	
Austria	44 (2.3)	
Belgium (Fr)	34 (2.3)	
Bulgaria	36 (3.5)	
Netherlands	54 (2.5)	
Scotland	52 (2.0)	
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>		
Colombia	26 (2.0)	
‡ Germany	47 (3.0)	
Romania	33 (2.5)	
Slovenia	49 (2.1)	
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>		
Denmark	29 (2.3)	
Greece	31 (1.8)	
Thailand	75 (1.6)	
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>		
‡ Israel	35 (3.8)	
Kuwait	20 (2.8)	
South Africa	14 (2.0)	
<b>International Average Percent Correct</b>	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 3.2: Earth Science**  
**Percent Correct for Example Item 2 - Eighth Grade\***

Country	Percent Correct	Example 2 Fossil fuels
‡ UNITED STATES	71 (2.0)	Fossil fuels were formed from  A. uranium  B. sea water  C. sand and gravel  <input checked="" type="radio"/> D. dead plants and animals
‡ MISSOURI	71 (2.3)	
OREGON	68 (2.1)	
‡ Belgium (Fl)	70 (3.5)	
Canada	69 (2.4)	
Cyprus	33 (2.7)	
Czech Republic	60 (3.1)	
‡ England	85 (2.6)	
France	61 (2.1)	
Hong Kong	74 (2.6)	
Hungary	55 (2.9)	
Iceland	46 (6.4)	
Iran, Islamic Rep.	75 (2.8)	
Ireland	87 (2.3)	
Japan	53 (2.3)	
Korea	84 (2.2)	
‡ Latvia (LSS)	46 (3.6)	
‡ Lithuania	34 (3.4)	
New Zealand	60 (2.1)	
Norway	69 (2.6)	
Portugal	78 (2.3)	
Russian Federation	62 (3.3)	
Singapore	85 (1.6)	
Slovak Republic	55 (3.0)	
Spain	73 (2.2)	
Sweden	70 (2.0)	
‡ Switzerland	52 (2.5)	
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>		
Australia	62 (2.2)	
Austria	83 (2.2)	
Belgium (Fr)	47 (3.2)	
Bulgaria	68 (3.8)	
Netherlands	71 (3.7)	
Scotland	65 (2.8)	
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>		
Colombia	51 (3.7)	
‡ Germany	59 (3.1)	
Romania	71 (2.7)	
Slovenia	82 (2.4)	
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>		
Denmark	46 (3.2)	
Greece	29 (2.6)	
Thailand	58 (2.6)	
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>		
‡ Israel	54 (4.1)	
Kuwait	55 (2.8)	
South Africa	24 (2.4)	
<b>International Average Percent Correct</b>	62 (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 3.3: Earth Science**  
**Percent Correct for Example Item 3 - Eighth Grade\***

Country	Percent Correct	Example 3 Ozone layer
‡ UNITED STATES	52 (2.7)	<p>Write down one reason why the ozone layer is important for all living things on Earth.</p> <p><i>It protects a living thing from over-exposure to the sun's harmful rays -</i></p>
‡ MISSOURI	46 (2.7)	
OREGON	51 (3.0)	
‡ Belgium (Fl)	47 (3.1)	
Canada	63 (2.2)	
Cyprus	42 (3.0)	
Czech Republic	74 (2.7)	
‡ England	38 (3.1)	
France	42 (3.0)	
Hong Kong	56 (3.2)	
Hungary	63 (2.7)	
Iceland	56 (4.2)	
Iran, Islamic Rep.	20 (3.0)	
Ireland	53 (3.1)	
Japan	60 (2.0)	
Korea	57 (2.5)	
‡ Latvia (LSS)	36 (3.4)	
‡ Lithuania	38 (3.6)	
New Zealand	64 (2.7)	
Norway	71 (2.5)	
Portugal	50 (2.9)	
Russian Federation	39 (3.3)	
Singapore	78 (2.4)	
Slovak Republic	71 (2.0)	
Spain	68 (2.4)	
Sweden	69 (2.0)	
‡ Switzerland	51 (2.6)	
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>		
Australia	51 (1.8)	
Austria	65 (3.1)	
Belgium (Fr)	48 (3.5)	
Bulgaria	67 (3.7)	
Netherlands	57 (4.1)	
Scotland	42 (2.7)	
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>		
Colombia	55 (4.0)	
‡ Germany	64 (2.9)	
Romania	41 (3.0)	
Slovenia	61 (2.8)	
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>		
Denmark	29 (3.1)	
Greece	56 (2.5)	
Thailand	45 (2.7)	
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>		
‡ Israel	63 (4.9)	
Kuwait	65 (4.4)	
South Africa	6 (1.8)	
<b>International Average Percent Correct</b>	<b>53 (0.5)</b>	

\*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 3.4: Earth Science**  
**Percent Correct for Example Item 4 - Eighth Grade\***

Country	Percent Partially Correct	Percent Fully Correct	Example 4 Diagram of Earth's water cycle
‡ UNITED STATES	17 (1.4)	40 (2.3)	<p>Draw a diagram to show how the water that falls as rain in one place may come from another place that is far away.</p>
‡ MISSOURI	14 (1.3)	40 (1.8)	
OREGON	16 (1.0)	46 (1.5)	
‡ Belgium (Fl)	11 (1.6)	60 (3.4)	
Canada	19 (1.3)	39 (1.7)	
Cyprus	20 (1.6)	24 (2.0)	
Czech Republic	12 (1.2)	27 (2.9)	
‡ England	17 (1.9)	53 (2.3)	
France	21 (1.9)	32 (1.9)	
Hong Kong	15 (1.2)	25 (1.7)	
Hungary	33 (2.0)	22 (1.6)	
Iceland	17 (2.5)	33 (3.3)	
Iran, Islamic Rep.	19 (2.1)	11 (1.4)	
Ireland	20 (1.5)	51 (2.2)	
Japan	27 (1.3)	43 (1.6)	
Korea	23 (1.7)	23 (1.7)	
‡ Latvia (LSS)	24 (2.1)	19 (2.0)	
‡ Lithuania	19 (1.7)	9 (1.4)	
New Zealand	16 (1.3)	29 (1.9)	
Norway	17 (1.4)	55 (2.0)	
Portugal	14 (1.3)	24 (1.5)	
Russian Federation	12 (1.4)	59 (2.0)	
Singapore	19 (1.4)	57 (2.4)	
Slovak Republic	12 (1.2)	25 (1.8)	
Spain	17 (1.4)	34 (1.8)	
Sweden	14 (1.4)	49 (2.0)	
‡ Switzerland	15 (1.3)	38 (1.9)	
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>			
Australia	20 (1.2)	33 (1.7)	
Austria	12 (1.5)	43 (2.3)	
Belgium (Fr)	14 (1.6)	32 (2.0)	
Bulgaria	32 (4.3)	19 (2.8)	
Netherlands	13 (1.5)	57 (2.7)	
Scotland	19 (1.5)	40 (2.2)	
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>			
Colombia	15 (2.0)	15 (1.9)	
‡ Germany	13 (1.3)	35 (2.5)	
Romania	9 (1.3)	21 (2.0)	
Slovenia	26 (2.0)	24 (1.9)	
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>			
Denmark	14 (1.6)	39 (2.3)	
Greece	15 (1.3)	17 (1.4)	
Thailand	53 (1.9)	16 (1.4)	
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>			
‡ Israel	53 (2.5)	17 (2.3)	
Kuwait	14 (2.6)	25 (2.5)	
South Africa	15 (1.9)	6 (1.2)	
<b>International Average Percent Correct</b>	19 (0.3)	32 (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 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 3.5: Earth Science**  
**Percent Correct for Example Item 5 - Eighth Grade\***

Country	Percent Correct	Example 5 Gases in air	
‡ UNITED STATES	20 (1.8)	<p>Air is made up of many gases. Which gas is found in the greatest amount?</p> <p><input checked="" type="radio"/> A. Nitrogen</p> <p>B. Oxygen</p> <p>C. Carbon dioxide</p> <p>D. Hydrogen</p>	
‡ MISSOURI	20 (2.2)		
OREGON	20 (2.0)		
‡ Belgium (Fl)	17 (2.1)		
Canada	21 (2.0)		
Cyprus	33 (3.3)		
Czech Republic	38 (3.8)		
‡ England	17 (2.6)		
France	13 (2.0)		
Hong Kong	50 (3.3)		
Hungary	43 (3.0)		
Iceland	14 (2.3)		
Iran, Islamic Rep.	4 (1.3)		
Ireland	30 (3.0)		
Japan	54 (2.2)		
Korea	41 (3.2)		
‡ Latvia (LSS)	18 (2.6)		
‡ Lithuania	22 (2.7)		
New Zealand	18 (2.2)		
Norway	27 (2.7)		
Portugal	8 (1.5)		
Russian Federation	27 (3.4)		
Singapore	58 (3.1)		
Slovak Republic	32 (2.9)		
Spain	9 (1.5)		
Sweden	25 (2.5)		
‡ Switzerland	20 (2.5)		
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>			
Australia	16 (1.6)		
Austria	42 (3.6)		
Belgium (Fr)	20 (4.5)		
Bulgaria	45 (5.1)		
Netherlands	31 (3.1)		
Scotland	25 (2.9)		
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>			
Colombia	--		
‡ Germany	27 (3.2)		
Romania	40 (2.9)		
Slovenia	31 (3.2)		
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>			
Denmark	11 (1.8)		
Greece	34 (2.7)		
Thailand	18 (2.3)		
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>			
‡ Israel	33 (4.6)		
Kuwait	37 (4.2)		
South Africa	11 (1.5)		
<b>International Average Percent Correct</b>	27 (0.5)		

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

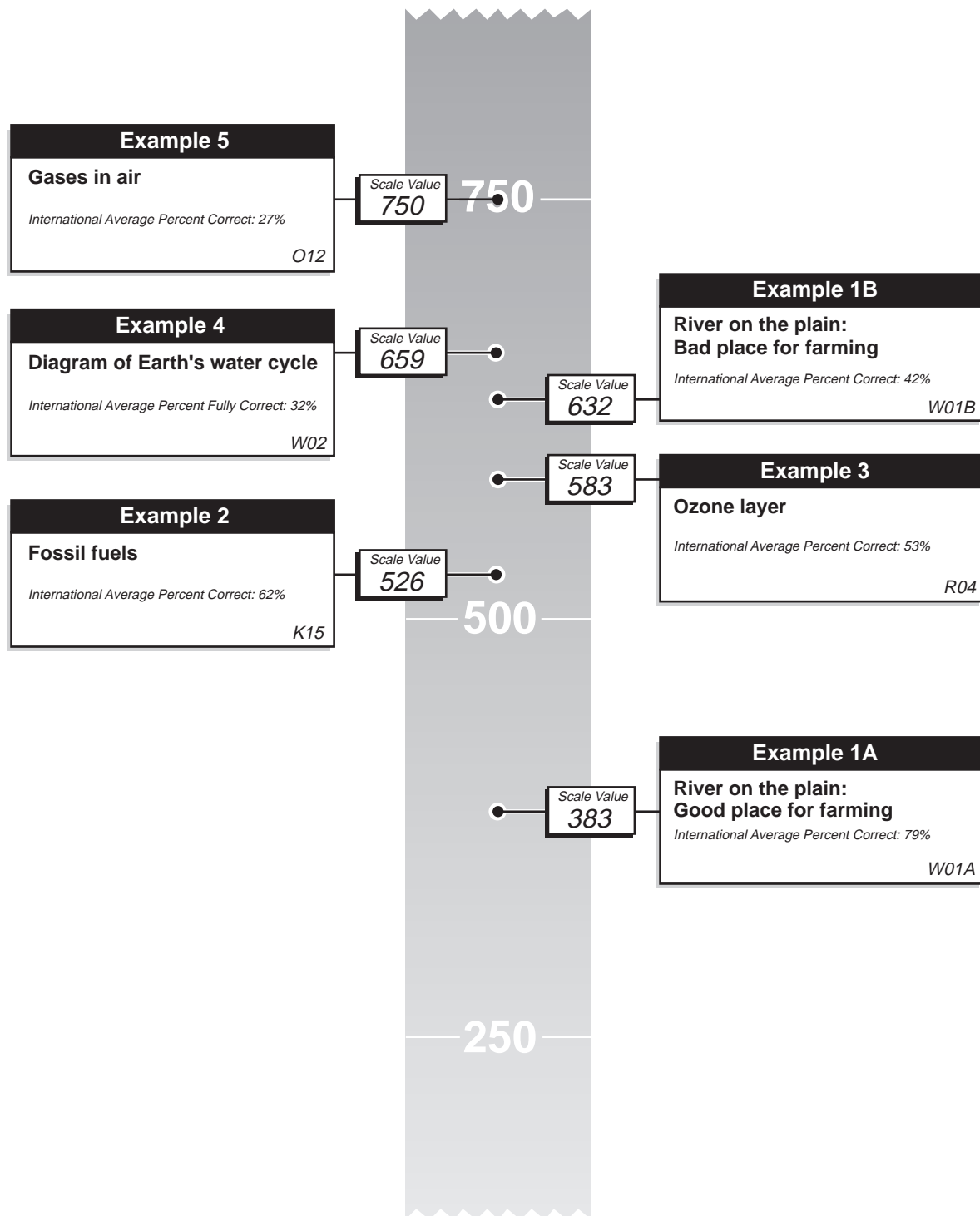
‡Did not meet sampling guidelines for population coverage or use of replacement schools. See Figure 1.

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

A dash (–) indicates data are not available. Internationally comparable data are unavailable for Colombia on Example 5.

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

**Figure 3.1** International Difficulty Map for Earth Science 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 science 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 Life Science?

Items in the life science category cover a broad range of content areas related to the structure, diversity, classification, processes, cycles, and interactions of plant and animal life. To answer these items, students were required to demonstrate and apply their knowledge of both simple and complex information.

Most students performed well on Example Item 6 (Table 3.6) which deals with the growth and development of trees (75% average correct). Performance by students in Missouri and Oregon exceeded this average. Students across countries also performed very well on this item. Belgium (Flemish), Iceland, Korea, the Slovak Republic, Austria, the Netherlands, Slovenia and all three Scandinavian countries had 90% or more correct responses.

Explaining the importance of plants and light in an aquarium ecosystem in Example Item 7 was more difficult for students as indicated in Table 3.7. On average, Part A of this item, related to the importance of plants, was answered correctly by more than half of the students (64% international average correct), with the majority identifying oxygen production. However, responses that mentioned that plants clean the water, provide food for fish, or provide a place to hide or to hide eggs, or other appropriate benefits also were counted as correct. Students in Oregon performed at the international average whereas students in Missouri performed slightly better with 72% of the students providing correct responses. One-third or fewer of the students, on average, provided a correct explanation for the importance of light (33% for Part B), with these students most frequently referring to photosynthesis or energy production. Other more general responses, such as “it helps to keep the plants alive,” also were given credit. Students in Missouri and Oregon performed near the international average with 32% and 28%, respectively.

Example Item 8, presented in Table 3.8, also measures students’ knowledge of photosynthesis. On average, about half of the students (54%) correctly identified the function of chloroplasts in plant cells. Students in Oregon (60%) performed above the international average while students in Missouri (50%) were closer to the international average. Students in Hong Kong, Japan, Korea, and the Russian Federation did particularly well (75% or greater) on this item.

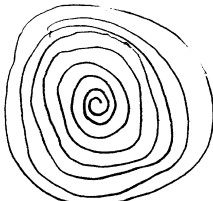
Fewer than half of the students selected the correct response to Example Item 9 about insect features (46% international average). As Table 3.9 indicates, the percent correct ranged from 20% in Colombia to 82% in Japan. Missouri (49%) and Oregon (55%) performed in the middle of this range.

Example Item 10 required students to design and communicate a scientific investigation in the area of human biology. More specifically, students were asked to investigate how the heart rate changes with changes in activity. Fully-correct responses described a procedure in which the pulse is measured at rest using a timer or watch, the individual does an exercise or engages in some type of physical activity, and then the pulse is remeasured during or after the exercise. In general, students found this item to be quite difficult. As can be seen from Table 3.10, only 14% of the students, on average, provided a fully-correct extended response. A fully-correct response required the student to include the use of a timer and describe the measurement of pulse rate

both before and after exercise. Students in the United States and in Missouri and Oregon were above average for partial credit, but about average for fully-correct responses. Across countries students found this item difficult as well. In only seven countries did one-fourth or more of the students receive full credit for their responses (Flemish-speaking Belgium, England, New Zealand, Scotland, Singapore, the Netherlands, and Israel).

Figure 3.2 presents the international difficulty map for the example items in life science. Example Item 10, which elicited a fully-correct response from only 14% of students in each country, on average, was the most difficult of the life science items with a scale value of 797. The easiest of the example items, Example Item 6, which was answered correctly by about three-quarters of students on average, had a scale value of 413.

**Table 3.6: Life Science**  
**Percent Correct for Example Item 6 - Eighth Grade\***

Country	Percent Correct	Example 6 Tree rings	
‡ UNITED STATES	81 (2.1)	<p>How could you find out how old a tree is after it is cut?</p> <p>You could find out how old a tree was after it is cut by counting the rings. Every ring equals one year</p> 	
‡ MISSOURI	82 (2.5)		
OREGON	88 (1.6)		
‡ Belgium (Fl)	92 (2.2)		
Canada	86 (1.7)		
Cyprus	62 (3.1)		
Czech Republic	88 (2.5)		
‡ England	79 (2.6)		
France	66 (2.5)		
Hong Kong	39 (2.5)		
Hungary	81 (2.4)		
Iceland	90 (2.4)		
Iran, Islamic Rep.	81 (3.1)		
Ireland	89 (1.8)		
Japan	88 (1.5)		
Korea	95 (1.2)		
‡ Latvia (LSS)	87 (2.2)		
‡ Lithuania	85 (2.5)		
New Zealand	86 (2.0)		
Norway	96 (1.0)		
Portugal	45 (2.8)		
Russian Federation	89 (1.6)		
Singapore	59 (2.7)		
Slovak Republic	96 (0.9)		
Spain	73 (1.9)		
Sweden	93 (1.1)		
‡ Switzerland	86 (1.9)		
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>			
Australia	67 (2.0)		
Austria	92 (2.0)		
Belgium (Fr)	63 (3.5)		
Bulgaria	87 (2.7)		
Netherlands	95 (1.3)		
Scotland	81 (2.1)		
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>			
Colombia	20 (3.0)		
‡ Germany	87 (2.1)		
Romania	59 (2.9)		
Slovenia	90 (1.6)		
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>			
Denmark	91 (1.8)		
Greece	62 (2.5)		
Thailand	48 (2.7)		
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>			
‡ Israel	63 (2.8)		
Kuwait	31 (4.7)		
South Africa	17 (2.9)		
<b>International Average Percent Correct</b>	<b>75 (0.4)</b>		

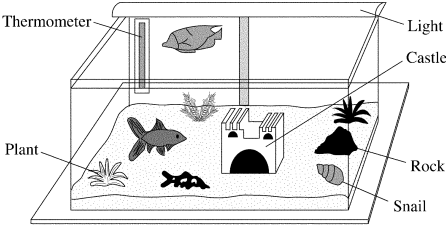
\*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡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 3.7: Life Science**  
**Percent Correct for Example Item 7, Part A - Eighth Grade\***

Country	Percent Correct	Example 7, Part A Aquarium: Importance of plant
‡ UNITED STATES	63 (1.6)	<p>In the picture of an aquarium, six items are labeled.</p>  <p>Explain why each of the following is important in maintaining the ecosystem in the aquarium.</p> <div style="border: 1px solid black; padding: 5px;"> <p>(a) the plant</p> <p><i>to give off oxygen and take in carbon dioxide which the animals breath out</i></p> </div> <p>(b) the light</p> <p><i>to help the plant make photosynthesis and make its own food</i></p>
‡ MISSOURI	72 (2.3)	
OREGON	64 (1.6)	
‡ Belgium (Fl)	75 (2.5)	
Canada	62 (1.6)	
Cyprus	57 (1.7)	
Czech Republic	74 (2.0)	
‡ England	69 (2.5)	
France	63 (1.7)	
Hong Kong	53 (2.6)	
Hungary	65 (2.2)	
Iceland	61 (3.9)	
Iran, Islamic Rep.	44 (2.6)	
Ireland	60 (2.3)	
Japan	85 (1.0)	
Korea	67 (1.9)	
‡ Latvia (LSS)	53 (2.6)	
‡ Lithuania	57 (2.9)	
New Zealand	78 (1.4)	
Norway	72 (1.6)	
Portugal	56 (1.8)	
Russian Federation	65 (2.4)	
Singapore	96 (0.7)	
Slovak Republic	67 (2.8)	
Spain	57 (2.1)	
Sweden	68 (1.6)	
‡ Switzerland	73 (2.1)	
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>		
Australia	63 (1.5)	
Austria	85 (1.8)	
Belgium (Fr)	47 (2.4)	
Bulgaria	66 (4.5)	
Netherlands	70 (2.3)	
Scotland	54 (2.3)	
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>		
Colombia	55 (3.4)	
‡ Germany	74 (2.3)	
Romania	62 (2.1)	
Slovenia	74 (2.0)	
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>		
Denmark	69 (2.4)	
Greece	47 (1.6)	
Thailand	79 (1.6)	
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>		
‡ Israel	59 (3.0)	
Kuwait	48 (4.0)	
South Africa	34 (2.8)	
<b>International Average Percent Correct</b>	<b>64 (0.4)</b>	

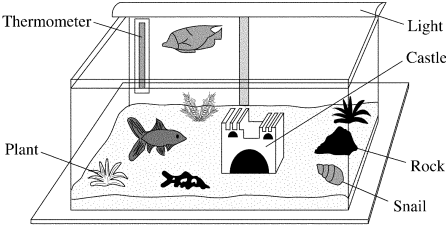
SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

\*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 3.7: Life Science (Continued)**  
**Percent Correct for Example Item 7, Part B - Eighth Grade\***

Country	Percent Correct	Example 7, Part B Aquarium: Importance of light	
‡ UNITED STATES	26 (1.3)	<p>In the picture of an aquarium, six items are labeled.</p>  <p>Explain why each of the following is important in maintaining the ecosystem in the aquarium.</p> <p>(a) the plant</p> <p><i>to give off oxygen and take in carbon dioxide which the animals breath out</i></p> <p>(b) the light</p> <p><i>to help the plant make photosynthesis and make its own food</i></p>	
‡ MISSOURI	32 (1.9)		
OREGON	28 (2.1)		
‡ Belgium (Fl)	43 (2.1)		
Canada	26 (1.5)		
Cyprus	38 (2.4)		
Czech Republic	42 (2.9)		
‡ England	22 (2.1)		
France	27 (2.0)		
Hong Kong	26 (2.0)		
Hungary	40 (2.2)		
Iceland	17 (2.2)		
Iran, Islamic Rep.	32 (2.7)		
Ireland	22 (2.0)		
Japan	56 (1.8)		
Korea	56 (1.7)		
‡ Latvia (LSS)	13 (1.3)		
‡ Lithuania	38 (2.6)		
New Zealand	20 (1.9)		
Norway	35 (1.9)		
Portugal	27 (1.8)		
Russian Federation	41 (2.6)		
Singapore	78 (2.0)		
Slovak Republic	34 (2.5)		
Spain	35 (1.9)		
Sweden	24 (1.4)		
‡ Switzerland	33 (1.8)		
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>			
Australia	24 (1.4)		
Austria	45 (2.8)		
Belgium (Fr)	27 (2.2)		
Bulgaria	55 (4.7)		
Netherlands	27 (3.0)		
Scotland	13 (1.9)		
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>			
Colombia	20 (2.3)		
‡ Germany	43 (2.2)		
Romania	43 (2.4)		
Slovenia	45 (2.2)		
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>			
Denmark	32 (2.1)		
Greece	33 (1.8)		
Thailand	49 (2.5)		
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>			
‡ Israel	29 (2.9)		
Kuwait	22 (2.8)		
South Africa	9 (1.7)		
<b>International Average Percent Correct</b>	33 (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 3.8: Life Science**  
**Percent Correct for Example Item 8 - Eighth Grade\***

Country	Percent Correct	Example 8 Chloroplasts in cells
‡ UNITED STATES	54 (2.3)	<p>What is the main function of chloroplasts in a plant cell?</p> <p>(A) To absorb light energy and manufacture food</p> <p>B. To remove waste materials by active transport</p> <p>C. To manufacture chemical energy from food</p> <p>D. To control the shape of the cell</p>
‡ MISSOURI	50 (2.4)	
OREGON	60 (2.3)	
‡ Belgium (Fl)	65 (4.9)	
Canada	50 (1.9)	
Cyprus	52 (2.5)	
Czech Republic	64 (2.6)	
‡ England	58 (3.3)	
France	48 (3.0)	
Hong Kong	86 (1.8)	
Hungary	26 (2.9)	
Iceland	63 (3.2)	
Iran, Islamic Rep.	38 (3.5)	
Ireland	47 (2.6)	
Japan	89 (1.3)	
Korea	86 (2.0)	
‡ Latvia (LSS)	39 (3.4)	
‡ Lithuania	66 (2.8)	
New Zealand	48 (2.3)	
Norway	43 (2.6)	
Portugal	39 (2.2)	
Russian Federation	79 (1.3)	
Singapore	57 (2.7)	
Slovak Republic	55 (2.3)	
Spain	54 (2.4)	
Sweden	67 (2.2)	
‡ Switzerland	48 (2.7)	
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>		
Australia	54 (1.9)	
Austria	54 (3.2)	
Belgium (Fr)	49 (3.2)	
Bulgaria	58 (4.2)	
Netherlands	72 (3.6)	
Scotland	49 (2.7)	
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>		
Colombia	31 (2.8)	
‡ Germany	60 (3.4)	
Romania	48 (3.0)	
Slovenia	72 (3.1)	
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>		
Denmark	60 (3.3)	
Greece	52 (2.8)	
Thailand	47 (2.2)	
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>		
‡ Israel	42 (4.4)	
Kuwait	37 (3.5)	
South Africa	30 (2.4)	
<b>International Average Percent Correct</b>	54 (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 3.9: Life Science**  
**Percent Correct for Example Item 9 - Eighth Grade\***

Country	Percent Correct	Example 9 Insect features															
‡ UNITED STATES	44 (2.1)	What features do all insects have?															
‡ MISSOURI	49 (2.7)																
OREGON	55 (2.4)																
‡ Belgium (Fl)	50 (3.5)	<table border="0"> <thead> <tr> <th></th> <th>Number of LEGS</th> <th>Number of BODY PARTS</th> </tr> </thead> <tbody> <tr> <td>A.</td> <td>2</td> <td>4</td> </tr> <tr> <td>B.</td> <td>4</td> <td>2</td> </tr> <tr> <td>Ⓒ.</td> <td>6</td> <td>3</td> </tr> <tr> <td>D.</td> <td>8</td> <td>3</td> </tr> </tbody> </table>		Number of LEGS	Number of BODY PARTS	A.	2	4	B.	4	2	Ⓒ.	6	3	D.	8	3
	Number of LEGS		Number of BODY PARTS														
A.	2	4															
B.	4	2															
Ⓒ.	6	3															
D.	8	3															
Canada	49 (2.3)																
Cyprus	36 (3.1)																
Czech Republic	47 (3.0)																
‡ England	50 (3.4)																
France	35 (2.8)																
Hong Kong	57 (2.7)																
Hungary	53 (2.6)																
Iceland	31 (3.4)																
Iran, Islamic Rep.	28 (3.0)																
Ireland	35 (2.7)																
Japan	82 (1.6)																
Korea	74 (2.4)																
‡ Latvia (LSS)	44 (2.8)																
‡ Lithuania	41 (3.3)																
New Zealand	56 (2.6)																
Norway	57 (2.3)																
Portugal	27 (2.5)																
Russian Federation	53 (2.2)																
Singapore	68 (1.9)																
Slovak Republic	47 (3.0)																
Spain	30 (2.1)																
Sweden	61 (2.1)																
‡ Switzerland	49 (2.2)																
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>																	
Australia	52 (2.3)																
Austria	52 (3.1)																
Belgium (Fr)	53 (3.2)																
Bulgaria	42 (4.3)																
Netherlands	53 (4.5)																
Scotland	36 (3.0)																
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>																	
Colombia	20 (2.5)																
‡ Germany	54 (3.1)																
Romania	33 (2.7)																
Slovenia	45 (3.2)																
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>																	
Denmark	41 (3.4)																
Greece	44 (2.6)																
Thailand	44 (2.5)																
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>																	
‡ Israel	36 (4.0)																
Kuwait	37 (4.4)																
South Africa	27 (2.5)																
<b>International Average Percent Correct</b>	<b>46 (0.5)</b>																

\*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 3.10: Life Science**  
**Percent Correct for Example Item 10 - Eighth Grade\***

Country	Percent Partially Correct	Percent Fully Correct	Example 10 Heart rate changes
‡ UNITED STATES	33 (1.7)	14 (1.2)	<p>Suppose you want to investigate how the human heart rate changes with changes in activity. What materials would you use and what procedures would you follow?</p> <p>materials: stopwatch</p> <p>procedures: I would have a person sit and then take their pulse.</p> <p>I would have the person walk, then take their pulse again.</p> <p>Finally, I would <del>to</del> have the person run and take their pulse.</p> <p>Each time I took their pulse <sup>times</sup></p> <p>I would time how many <del>beats</del> per minute their heart was beating</p>
‡ MISSOURI	31 (1.7)	9 (1.0)	
OREGON	33 (1.5)	13 (1.3)	
‡ Belgium (Fl)	27 (2.3)	27 (1.7)	
Canada	26 (1.6)	21 (1.6)	
Cyprus	26 (1.6)	6 (1.1)	
Czech Republic	23 (2.0)	19 (1.6)	
‡ England	29 (2.1)	26 (2.3)	
France	29 (1.9)	10 (1.2)	
Hong Kong	22 (1.9)	6 (0.9)	
Hungary	30 (2.0)	8 (1.1)	
Iceland	16 (2.6)	8 (1.5)	
Iran, Islamic Rep.	29 (3.0)	4 (1.1)	
Ireland	32 (2.0)	16 (1.5)	
Japan	51 (1.4)	20 (1.4)	
Korea	30 (2.1)	23 (1.9)	
‡ Latvia (LSS)	19 (2.0)	3 (0.6)	
‡ Lithuania	15 (1.9)	5 (0.9)	
New Zealand	22 (1.4)	26 (1.9)	
Norway	26 (1.6)	24 (1.8)	
Portugal	11 (1.2)	3 (0.6)	
Russian Federation	21 (2.0)	5 (1.2)	
Singapore	29 (1.7)	32 (1.8)	
Slovak Republic	15 (1.2)	12 (1.4)	
Spain	20 (1.6)	10 (1.1)	
Sweden	24 (1.5)	18 (1.6)	
‡ Switzerland	25 (1.7)	14 (1.2)	
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>			
Australia	24 (1.3)	15 (1.2)	
Austria	20 (1.5)	9 (1.3)	
Belgium (Fr)	18 (1.7)	13 (1.4)	
Bulgaria	35 (6.5)	7 (2.6)	
Netherlands	19 (1.9)	25 (3.1)	
Scotland	21 (1.9)	25 (2.4)	
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>			
Colombia	7 (1.1)	6 (2.1)	
‡ Germany	15 (1.7)	16 (2.0)	
Romania	15 (1.9)	9 (1.6)	
Slovenia	30 (2.2)	20 (1.9)	
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>			
Denmark	15 (1.8)	12 (1.8)	
Greece	19 (1.2)	10 (1.0)	
Thailand	15 (1.4)	18 (1.7)	
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>			
‡ Israel	45 (3.3)	26 (3.0)	
Kuwait	23 (2.4)	8 (1.7)	
South Africa	6 (0.8)	5 (1.4)	
<b>International Average Percent Correct</b>	23 (0.3)	14 (0.3)	

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

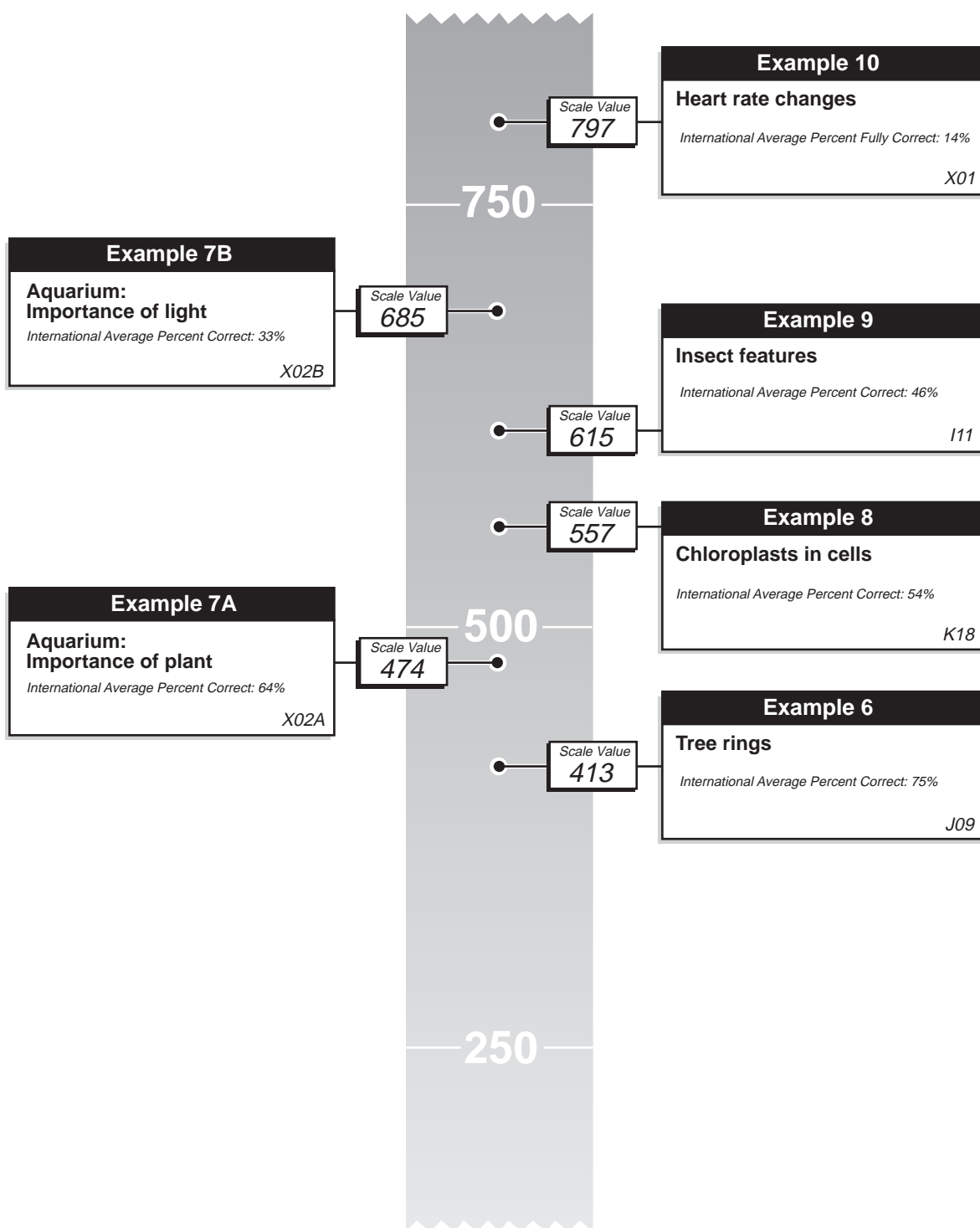
\*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡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 3.2** International Difficulty Map for Life Science 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 science 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 Physics?

Major topics covered by the physics items include different energy forms, physical transformations, forces and motion, and the properties of matter. Students were asked to solve problems and demonstrate their knowledge of scientific principles. Six example items (Example Items 11 - 16) are included to illustrate the range of item types and content areas as well as student performance in physics.

Example Item 11 (Table 3.11) requires extrapolating from a simple linear distance-versus-time graph, which proved to be an easy problem for most students. On average, more than three-fourths of the students answered correctly. Students in Missouri and Oregon also had little difficulty with this problem, with students' correct responses averaging 86% and 90%, respectively. Overall, students' performance on this item was quite high in most countries, with only one country having performance below 50% – Kuwait (45%).

Students also did well on Example Item 12, which measured their knowledge of complete electronic circuits and conductive materials. As presented in Table 3.12, students across the United States performed at the international average of 78%, while students in Missouri (84%) and Oregon (86%) performed above it.

Performance on Example Item 13, measuring knowledge about the transmission of sound waves, averaged 71%, as indicated in the results presented in Table 3.13. With 65% of students responding correctly, Oregon and the United States both performed just below the international average, while students in Missouri (73% correct) were close to the international average. The variability across countries was moderately low on this item, with very few countries having percent correct levels below 60%. Korea and Japan had very high performances, both with 90% correct.

Example Item 14 asked students to demonstrate their knowledge of gravitational force. As indicated in Table 3.14, on average, only approximately half the students responded correctly (55%). The most commonly chosen incorrect option (B) reflected the misconception that the earth's gravitational force does not act upon a stationary object when it is on the ground. While students in Missouri (56%) performed near the international average, their counterparts in Oregon (73%) performed closer to the top-performing country, the Czech Republic, where more than 80% of the students responded correctly.

As presented in Table 3.15, Example Item 15 asked students to interpret data presented in a table to determine which of two machines would be more efficient. This is a relatively complex problem that required understanding the concepts of energy conversion and efficiency, recognizing and calculating the appropriate ratios, and explaining the results. In their explanations, students needed to choose machine A because it uses less gas per hectare, or to document this fact with the idea that  $\frac{3}{8}$  is less than  $\frac{1}{2}$ , or a similar expression. On average, only 36% of the students answered correctly. Performance in Missouri (56%) and Oregon (61%) was 20 percentage points or more above the international average, placing these states among the nine countries where half or more of the students gave a fully-correct response.

Students also found Example Item 16 to be very difficult. This is a practical problem related to the nature of light which required students to apply scientific principles to provide an explanation. Essentially, students needed to communicate that the same amount of light reaches the wall regardless of the distance the flashlight is from the wall. They may or may not have included the idea that the light becomes more or less spread out. As indicated by Table 3.16, on average, fewer than one-fourth of the students correctly answered this item (23%). A common misconception identified in more than 30% of the student responses was that a larger area of illumination means there is more light. Performance on this item in Missouri and Oregon was 32% and 38% correct, respectively.

The international difficulty map showing the physics example items is shown in Figure 3.3. The item positions and the international averages for correct responses indicate that for the most part, the majority of students had considerable difficulty on the more complex physics items.

**Table 3.11: Physics**  
**Percent Correct for Example Item 11 - Eighth Grade\***

Country	Percent Correct	Example 11 Distance versus time graph	
‡ UNITED STATES	87 (1.8)	<p>The graph shows the progress made by an ant moving along a straight line.</p> <p>If the ant keeps moving at the same speed, how far will it have traveled at the end of 30 seconds?</p> <p>A. 5 cm  <input checked="" type="radio"/> B. 6 cm            C. 20 cm            D. 30 cm</p>	
‡ MISSOURI	86 (1.6)		
OREGON	90 (1.4)		
‡ Belgium (Fl)	84 (5.2)		
Canada	92 (1.2)		
Cyprus	64 (2.5)		
Czech Republic	90 (1.7)		
‡ England	88 (2.2)		
France	97 (0.9)		
Hong Kong	89 (1.7)		
Hungary	83 (1.9)		
Iceland	86 (3.1)		
Iran, Islamic Rep.	65 (3.4)		
Ireland	92 (1.4)		
Japan	94 (0.9)		
Korea	90 (1.7)		
‡ Latvia (LSS)	82 (2.6)		
‡ Lithuania	77 (2.9)		
New Zealand	92 (1.6)		
Norway	89 (1.8)		
Portugal	89 (1.5)		
Russian Federation	83 (2.4)		
Singapore	96 (1.0)		
Slovak Republic	86 (1.9)		
Spain	85 (1.7)		
Sweden	88 (1.6)		
‡ Switzerland	90 (1.5)		
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>			
Australia	90 (1.2)		
Austria	87 (2.0)		
Belgium (Fr)	86 (2.6)		
Bulgaria	78 (2.5)		
Netherlands	95 (1.7)		
Scotland	92 (1.5)		
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>			
Colombia	59 (3.9)		
‡ Germany	84 (2.3)		
Romania	67 (2.6)		
Slovenia	92 (1.4)		
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>			
Denmark	86 (2.0)		
Greece	71 (2.3)		
Thailand	83 (1.6)		
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>			
‡ Israel	83 (3.6)		
Kuwait	45 (3.2)		
South Africa	59 (2.8)		
<b>International Average Percent Correct</b>	<b>83 (0.4)</b>		

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: Physics**  
**Percent Correct for Example Item 12 - Eighth Grade\***

Country	Percent Correct	Example 12 Light bulb in circuit
‡ UNITED STATES	78 (2.0)	<p>The following diagrams show a flashlight battery and a bulb connected by wires to various substances.</p> <p>Which of the bulbs will light?</p> <p>A. 1 and 2 only  <input checked="" type="radio"/> B. 2 and 3 only  C. 3 and 4 only  D. 1, 2, and 3 only  E. 2, 3, and 4 only</p>
‡ MISSOURI	84 (1.9)	
OREGON	86 (1.3)	
‡ Belgium (Fl)	87 (2.8)	
Canada	79 (1.9)	
Cyprus	73 (2.6)	
Czech Republic	89 (1.4)	
‡ England	90 (1.9)	
France	79 (1.9)	
Hong Kong	88 (1.7)	
Hungary	85 (2.0)	
Iceland	66 (4.2)	
Iran, Islamic Rep.	59 (3.0)	
Ireland	69 (2.6)	
Japan	92 (1.1)	
Korea	93 (1.3)	
‡ Latvia (LSS)	60 (3.5)	
‡ Lithuania	64 (3.0)	
New Zealand	82 (1.7)	
Norway	74 (2.4)	
Portugal	74 (2.3)	
Russian Federation	74 (2.3)	
Singapore	97 (0.8)	
Slovak Republic	91 (1.5)	
Spain	82 (1.8)	
Sweden	88 (1.8)	
‡ Switzerland	77 (2.1)	
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>		
Australia	83 (1.4)	
Austria	91 (1.7)	
Belgium (Fr)	62 (3.0)	
Bulgaria	75 (3.1)	
Netherlands	81 (4.1)	
Scotland	82 (2.6)	
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>		
Colombia	63 (3.2)	
‡ Germany	83 (2.7)	
Romania	69 (2.6)	
Slovenia	88 (1.7)	
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>		
Denmark	74 (2.9)	
Greece	69 (2.4)	
Thailand	78 (1.7)	
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>		
‡ Israel	86 (1.9)	
Kuwait	65 (2.9)	
South Africa	42 (3.2)	
<b>International Average Percent Correct</b>	<b>78 (0.4)</b>	

\*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 3.13: Physics**  
**Percent Correct for Example Item 13 - Eighth Grade\***

Country	Percent Correct	Example 13 Sound in space
‡ UNITED STATES	65 (2.6)	<p>The crews of two boats at sea can communicate with each other by shouting. Why is it impossible for the crews of two spaceships a similar distance apart in space to do this?</p> <p>A. The sound is reflected more in space.</p> <p>B. The pressure is too high inside the spaceships.</p> <p>C. The spaceships are traveling faster than sound.</p> <p><input checked="" type="radio"/> D. There is no air in space for the sound to travel through.</p>
‡ MISSOURI	73 (2.2)	
OREGON	65 (2.6)	
* Belgium (Fl)	62 (3.3)	
Canada	72 (1.7)	
Cyprus	62 (2.4)	
Czech Republic	76 (2.8)	
* England	76 (3.0)	
France	72 (2.4)	
Hong Kong	81 (2.2)	
Hungary	82 (2.2)	
Iceland	65 (4.8)	
Iran, Islamic Rep.	65 (4.1)	
Ireland	75 (2.3)	
Japan	90 (1.2)	
Korea	90 (1.5)	
* Latvia (LSS)	80 (2.9)	
* Lithuania	64 (2.9)	
New Zealand	74 (2.0)	
Norway	74 (2.6)	
Portugal	71 (2.1)	
Russian Federation	69 (2.4)	
Singapore	86 (1.9)	
Slovak Republic	73 (2.2)	
Spain	69 (2.8)	
Sweden	71 (2.3)	
* Switzerland	76 (2.3)	
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>		
Australia	73 (2.0)	
Austria	80 (2.5)	
Belgium (Fr)	74 (2.6)	
Bulgaria	74 (4.4)	
Netherlands	58 (3.4)	
Scotland	77 (2.2)	
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>		
Colombia	52 (4.0)	
* Germany	74 (2.4)	
Romania	53 (2.8)	
Slovenia	76 (2.5)	
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>		
Denmark	60 (3.0)	
Greece	82 (1.8)	
Thailand	70 (2.0)	
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>		
* Israel	76 (3.4)	
Kuwait	64 (3.1)	
South Africa	32 (2.6)	
<b>International Average Percent Correct</b>	<b>71 (0.4)</b>	

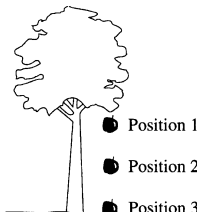
SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

\*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: Physics**  
**Percent Correct for Example Item 14 - Eighth Grade\***

Country	Percent Correct	Example 14 Falling apple	
‡ UNITED STATES	64 (2.2)	<p>The drawing shows an apple falling to the ground. In which of the three positions does gravity act on the apple?</p> <p>A. 2 only</p> <p>B. 1 and 2 only</p> <p>C. 1 and 3 only</p> <p><b>D.</b> 1, 2, and 3</p> 	
‡ MISSOURI	56 (1.8)		
OREGON	73 (2.3)		
‡ Belgium (Fl)	62 (2.3)		
Canada	63 (2.7)		
Cyprus	36 (2.6)		
Czech Republic	81 (2.6)		
‡ England	51 (3.4)		
France	51 (3.0)		
Hong Kong	74 (2.2)		
Hungary	72 (2.3)		
Iceland	40 (5.0)		
Iran, Islamic Rep.	51 (3.6)		
Ireland	55 (2.7)		
Japan	58 (2.2)		
Korea	72 (2.6)		
‡ Latvia (LSS)	41 (3.3)		
‡ Lithuania	61 (3.1)		
New Zealand	54 (2.7)		
Norway	49 (2.9)		
Portugal	53 (2.7)		
Russian Federation	42 (2.4)		
Singapore	59 (2.4)		
Slovak Republic	72 (2.5)		
Spain	55 (2.4)		
Sweden	59 (2.6)		
‡ Switzerland	53 (2.9)		
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>			
Australia	57 (2.0)		
Austria	61 (2.9)		
Belgium (Fr)	52 (3.3)		
Bulgaria	41 (5.0)		
Netherlands	58 (2.9)		
Scotland	48 (2.6)		
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>			
Colombia	48 (3.6)		
‡ Germany	55 (3.2)		
Romania	50 (2.6)		
Slovenia	57 (2.9)		
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>			
Denmark	51 (3.3)		
Greece	30 (2.2)		
Thailand	57 (2.3)		
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>			
‡ Israel	61 (2.9)		
Kuwait	50 (3.7)		
South Africa	36 (2.5)		
<b>International Average Percent Correct</b>	<b>55 (0.5)</b>		

\*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 3.15: Physics**  
**Percent Correct for Example Item 15 - Eighth Grade\***

Country	Percent Correct	Example 15 More efficient machine									
‡ UNITED STATES	48 (2.6)	<p>Machine A and Machine B are each used to clear a field. The table shows how large an area each cleared in 1 hour and how much gasoline each used.</p> <table border="1"> <thead> <tr> <th></th> <th>Area of field cleared in 1 hour</th> <th>Gasoline used in 1 hour</th> </tr> </thead> <tbody> <tr> <td>Machine A</td> <td>2 hectares</td> <td>3/4 liter</td> </tr> <tr> <td>Machine B</td> <td>1 hectare</td> <td>1/2 liter</td> </tr> </tbody> </table> <p>Which machine is more efficient in converting the energy in gasoline to work? Explain your answer.</p> <p><i>Machine A because it did double the amount of work but didn't use <del>double</del> double the amount of gasoline.</i></p>		Area of field cleared in 1 hour	Gasoline used in 1 hour	Machine A	2 hectares	3/4 liter	Machine B	1 hectare	1/2 liter
	Area of field cleared in 1 hour		Gasoline used in 1 hour								
Machine A	2 hectares		3/4 liter								
Machine B	1 hectare		1/2 liter								
‡ MISSOURI	56 (3.1)										
OREGON	61 (2.5)										
* Belgium (Fl)	49 (2.3)										
Canada	49 (2.2)										
Cyprus	36 (2.6)										
Czech Republic	48 (3.2)										
* England	51 (4.1)										
France	29 (2.4)										
Hong Kong	26 (2.5)										
Hungary	36 (3.0)										
Iceland	33 (4.4)										
Iran, Islamic Rep.	25 (3.4)										
Ireland	54 (2.7)										
Japan	36 (2.0)										
Korea	47 (2.6)										
* Latvia (LSS)	18 (2.5)										
* Lithuania	13 (2.1)										
New Zealand	49 (2.6)										
Norway	37 (2.4)										
Portugal	21 (2.4)										
Russian Federation	25 (2.8)										
Singapore	48 (2.7)										
Slovak Republic	48 (2.8)										
Spain	24 (2.1)										
Sweden	42 (2.8)										
* Switzerland	50 (2.5)										
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>											
Australia	51 (2.1)										
Austria	62 (3.2)										
Belgium (Fr)	42 (3.2)										
Bulgaria	19 (3.3)										
Netherlands	58 (4.2)										
Scotland	51 (2.7)										
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>											
Colombia	10 (2.1)										
* Germany	42 (3.2)										
Romania	19 (2.4)										
Slovenia	52 (2.7)										
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>											
Denmark	36 (3.3)										
Greece	24 (2.2)										
Thailand	5 (1.0)										
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>											
* Israel	53 (3.9)										
Kuwait	19 (3.6)										
South Africa	8 (1.8)										
<b>International Average Percent Correct</b>	<b>36 (0.4)</b>										

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: Physics**  
**Percent Correct for Example Item 16 - Eighth Grade\***

Country	Percent Correct	Example 16 Flashlight shining on wall	
‡ UNITED STATES	27 (2.5)	<p>A flashlight close to a wall produces a small circle of light compared to the circle it makes when the flashlight is far from the wall. Does more light reach the wall when the flashlight is further away?</p> <p><input type="checkbox"/> Yes</p> <p><input checked="" type="checkbox"/> No (Check one)</p> <p>Explain your answer.</p> <p><i>The same amount of light reaches the wall except when it is close it is all on a smaller area.</i></p>	
‡ MISSOURI	32 (2.7)		
OREGON	38 (2.5)		
‡ Belgium (Fl)	31 (3.1)		
Canada	29 (1.7)		
Cyprus	6 (1.4)		
Czech Republic	23 (2.7)		
‡ England	35 (3.6)		
France	19 (2.3)		
Hong Kong	17 (2.2)		
Hungary	40 (2.7)		
Iceland	14 (2.6)		
Iran, Islamic Rep.	37 (2.8)		
Ireland	21 (2.1)		
Japan	37 (2.0)		
Korea	37 (2.5)		
‡ Latvia (LSS)	20 (2.4)		
‡ Lithuania	13 (2.5)		
New Zealand	31 (2.5)		
Norway	25 (2.4)		
Portugal	17 (2.1)		
Russian Federation	10 (1.6)		
Singapore	28 (2.4)		
Slovak Republic	28 (2.4)		
Spain	20 (2.2)		
Sweden	29 (1.8)		
‡ Switzerland	11 (1.2)		
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>			
Australia	28 (1.6)		
Austria	11 (2.3)		
Belgium (Fr)	15 (2.2)		
Bulgaria	29 (3.6)		
Netherlands	30 (3.8)		
Scotland	22 (2.6)		
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>			
Colombia	6 (1.2)		
‡ Germany	22 (2.9)		
Romania	15 (2.3)		
Slovenia	27 (2.7)		
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>			
Denmark	26 (2.7)		
Greece	28 (2.7)		
Thailand	5 (1.1)		
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>			
‡ Israel	43 (5.2)		
Kuwait	24 (3.1)		
South Africa	4 (1.2)		
<b>International Average Percent Correct</b>	<b>23 (0.4)</b>		

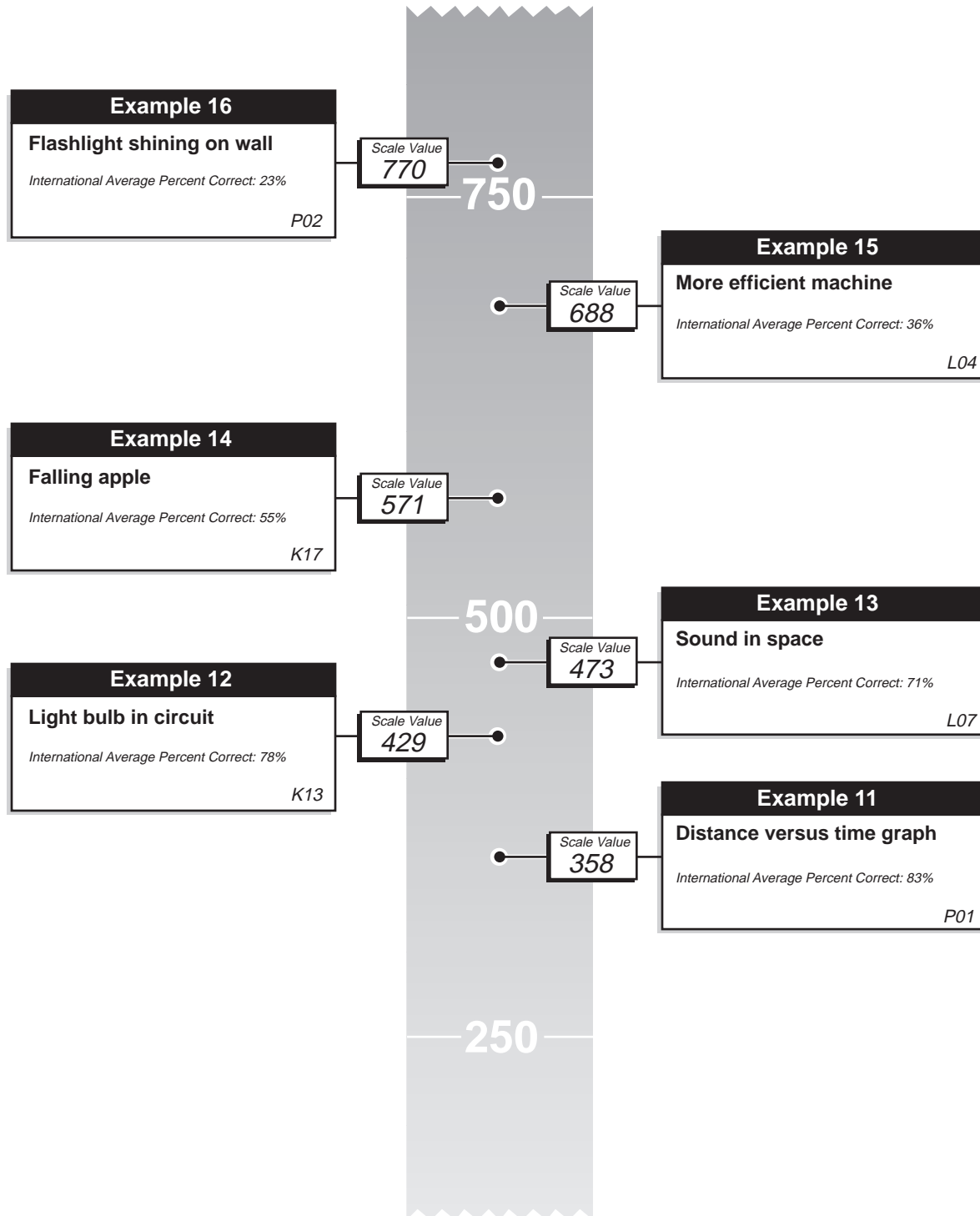
\*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡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 Physics 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 science 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 Chemistry?

The chemistry items measured students' knowledge of topics related to chemical transformations as well as the chemical properties and classification of matter.

Both Example Items 17 and 18 required students to supply explanations that demonstrated knowledge of the necessity of oxygen for combustion, but performance was very different on the two items. As indicated in Table 3.17, on average, nearly 89% of the students explained the loss of oxygen or air using either scientific or non-scientific language (Example Item 17), which directly indicates the isolation of the flame from the air in the provided diagram. Ninety percent of the students in the United States and in Missouri responded correctly to this item. In Oregon, 92% of the students responded correctly.

Compared to Example Item 17, Example Item 18 (Table 3.18) was more complicated, requiring students to explain that carbon dioxide in fire extinguishers displaces oxygen and prevents it from reaching the fire. As might be expected, this item was much more difficult for students, which is reflected in the international average of 51%. Across countries, 70% or more of the students responded correctly in England (71%), Singapore (70%), Sweden (70%), and Austria (74%). Performance by students in Missouri and Oregon was closer to the higher performing countries than the lower performing countries, with 65% and 68% responding correctly, respectively.

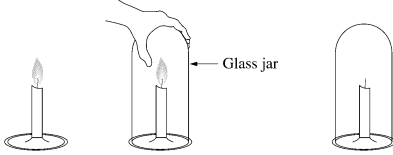
Students found Example Item 19 to be rather difficult. As indicated in Table 3.19, on average, 43% of the students identified ion formation as the correct response. About one-third of the students, on average, incorrectly identified the formation of molecules as the result of electron loss. Both Missouri and Oregon performed at about the international average. Dramatic across-country variations in performance point to differences in the stage at which atomic structure is first introduced into the curriculum.

In Example Item 20 (Table 3.20), students were required to use knowledge of the difference between chemical and physical transformations. International averages were low (31%), and only three countries had more than 50% correct responses (Iran, Japan, and Singapore). Students in Missouri (44%) and Oregon (41%) performed significantly above the international average on this item.

As presented in Table 3.21, Example Item 21 measured knowledge about the chemical make-up of cells. Most students found this short-answer item to be quite difficult, with about one-third of the students providing the correct response, on average. Oregon performed above the international average with 43% of their students responding correctly. Students in Missouri were about at the international average with 31%. The highest performance on this item was achieved in Bulgaria, with 68% of the students responding correctly.

The item difficulty map for the chemistry example items is portrayed in Figure 3.4. As discussed in Chapter 2, the items covering chemistry were the most difficult for students compared to the other science content areas (international averages correct across all chemistry items of 51%).

**Table 3.17: Chemistry**  
**Percent Correct for Example Item 17 - Eighth Grade\***

Country	Percent Correct	Example 17 Glass over candle flame	
‡ UNITED STATES	90 (1.3)	<p>When a glass jar is placed over a lighted candle, the flame goes out.</p>  <p>Why does this happen?</p> <p>The flame needs a supply of oxygen to stay alive. The jar cuts off the supply and when it is all burnt by the candle the candle cannot burn any more so it goes out.</p>	
‡ MISSOURI	90 (1.3)		
OREGON	92 (1.1)		
‡ Belgium (Fl)	97 (1.3)		
Canada	93 (1.2)		
Cyprus	82 (1.8)		
Czech Republic	98 (1.0)		
‡ England	97 (1.1)		
France	86 (2.0)		
Hong Kong	91 (1.9)		
Hungary	98 (0.6)		
Iceland	91 (2.6)		
Iran, Islamic Rep.	94 (1.2)		
Ireland	93 (1.5)		
Japan	90 (1.2)		
Korea	93 (1.3)		
‡ Latvia (LSS)	86 (2.8)		
‡ Lithuania	95 (1.7)		
New Zealand	93 (1.3)		
Norway	95 (1.1)		
Portugal	89 (1.5)		
Russian Federation	93 (1.5)		
Singapore	96 (0.7)		
Slovak Republic	95 (1.4)		
Spain	89 (1.7)		
Sweden	97 (0.9)		
‡ Switzerland	96 (1.0)		
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>			
Australia	91 (1.2)		
Austria	95 (1.5)		
Belgium (Fr)	84 (2.5)		
Bulgaria	92 (2.5)		
Netherlands	96 (1.3)		
Scotland	93 (1.4)		
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>			
Colombia	58 (3.1)		
‡ Germany	92 (2.0)		
Romania	87 (1.7)		
Slovenia	99 (0.4)		
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>			
Denmark	97 (1.0)		
Greece	86 (1.8)		
Thailand	81 (1.8)		
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>			
‡ Israel	82 (2.9)		
Kuwait	71 (4.5)		
South Africa	35 (3.3)		
<b>International Average Percent Correct</b>	<b>89 (0.3)</b>		

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 3.18: Chemistry**  
**Percent Correct for Example Item 18 - Eighth Grade\***

Country	Percent Correct	Example 18 Carbon dioxide fire extinguisher
‡ UNITED STATES	62 (2.7)	<p>Carbon dioxide is the active material in some fire extinguishers. How does carbon dioxide extinguish a fire?</p> <p><i>A fire needs oxygen to burn so a fire extinguisher sprays out the carbon dioxide to replace the presence of oxygen. Without oxygen, a fire can't burn.</i></p>
‡ MISSOURI	65 (3.0)	
OREGON	68 (2.0)	
‡ Belgium (Fl)	58 (4.1)	
Canada	61 (2.0)	
Cyprus	41 (3.3)	
Czech Republic	57 (2.8)	
‡ England	71 (3.1)	
France	50 (3.6)	
Hong Kong	37 (2.6)	
Hungary	62 (2.4)	
Iceland	57 (4.5)	
Iran, Islamic Rep.	63 (2.7)	
Ireland	66 (3.2)	
Japan	45 (2.0)	
Korea	54 (2.5)	
‡ Latvia (LSS)	42 (3.0)	
‡ Lithuania	29 (3.2)	
New Zealand	65 (2.4)	
Norway	63 (2.2)	
Portugal	35 (2.7)	
Russian Federation	54 (3.2)	
Singapore	70 (2.3)	
Slovak Republic	46 (2.8)	
Spain	43 (2.9)	
Sweden	70 (2.3)	
‡ Switzerland	57 (2.5)	
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>		
Australia	61 (1.9)	
Austria	74 (2.9)	
Belgium (Fr)	33 (3.5)	
Bulgaria	46 (4.0)	
Netherlands	56 (3.3)	
Scotland	59 (3.5)	
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>		
Colombia	23 (4.1)	
‡ Germany	69 (3.0)	
Romania	33 (2.5)	
Slovenia	52 (3.2)	
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>		
Denmark	33 (3.0)	
Greece	37 (2.3)	
Thailand	34 (2.4)	
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>		
‡ Israel	63 (4.5)	
Kuwait	49 (4.7)	
South Africa	15 (2.9)	
<b>International Average Percent Correct</b>	<b>51 (0.5)</b>	

\*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 3.19: Chemistry**  
**Percent Correct for Example Item 19 - Eighth Grade\***

Country	Percent Correct	Example 19 Atom loses electron
‡ UNITED STATES	47 (2.7)	<p>If a neutral atom loses an electron, what is formed?</p> <p>A. A gas</p> <p><input checked="" type="radio"/> B. An ion</p> <p>C. An acid</p> <p>D. A molecule</p>
‡ MISSOURI	49 (3.9)	
OREGON	42 (3.1)	
* Belgium (Fl)	20 (2.7)	
Canada	25 (2.1)	
Cyprus	22 (2.8)	
Czech Republic	73 (3.0)	
* England	28 (2.9)	
France	40 (3.6)	
Hong Kong	58 (2.2)	
Hungary	73 (2.7)	
Iceland	9 (2.5)	
Iran, Islamic Rep.	40 (3.8)	
Ireland	46 (2.9)	
Japan	33 (2.0)	
Korea	45 (3.0)	
* Latvia (LSS)	39 (3.0)	
* Lithuania	65 (3.4)	
New Zealand	18 (2.2)	
Norway	19 (1.9)	
Portugal	68 (2.5)	
Russian Federation	75 (2.4)	
Singapore	51 (2.9)	
Slovak Republic	77 (2.6)	
Spain	70 (2.3)	
Sweden	44 (3.1)	
* Switzerland	22 (2.2)	
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>		
Australia	31 (2.2)	
Austria	64 (3.1)	
Belgium (Fr)	25 (4.6)	
Bulgaria	70 (4.4)	
Netherlands	21 (3.2)	
Scotland	21 (2.1)	
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>		
Colombia	40 (4.1)	
* Germany	38 (4.0)	
Romania	74 (2.6)	
Slovenia	80 (2.1)	
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>		
Denmark	17 (2.2)	
Greece	53 (2.6)	
Thailand	16 (1.7)	
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>		
* Israel	72 (4.9)	
Kuwait	31 (3.8)	
South Africa	13 (1.7)	
<b>International Average Percent Correct</b>	<b>43 (0.5)</b>	

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: Chemistry**  
**Percent Correct for Example Item 20 - Eighth Grade\***

Country	Percent Correct	Example 20 Chemical change	
‡ UNITED STATES	43 (2.7)	<p>Which is NOT an example of a chemical change?</p> <p><input checked="" type="radio"/> A. Boiling water</p> <p>B. Rusting iron</p> <p>C. Burning wood</p> <p>D. Baking bread</p>	
‡ MISSOURI	44 (2.1)		
OREGON	41 (1.7)		
‡ Belgium (Fl)	31 (3.0)		
Canada	38 (2.6)		
Cyprus	--		
Czech Republic	34 (4.0)		
‡ England	41 (3.5)		
France	19 (2.8)		
Hong Kong	30 (2.5)		
Hungary	18 (2.2)		
Iceland	20 (2.9)		
Iran, Islamic Rep.	52 (2.5)		
Ireland	39 (2.9)		
Japan	54 (1.9)		
Korea	48 (3.0)		
‡ Latvia (LSS)	26 (3.0)		
‡ Lithuania	37 (3.4)		
New Zealand	42 (2.4)		
Norway	12 (1.7)		
Portugal	40 (2.7)		
Russian Federation	31 (4.6)		
Singapore	62 (2.1)		
Slovak Republic	31 (2.4)		
Spain	17 (2.2)		
Sweden	22 (1.9)		
‡ Switzerland	25 (2.4)		
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>			
Australia	47 (2.3)		
Austria	34 (3.5)		
Belgium (Fr)	13 (1.9)		
Bulgaria	33 (4.1)		
Netherlands	35 (3.7)		
Scotland	33 (2.9)		
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>			
Colombia	18 (3.9)		
‡ Germany	25 (2.7)		
Romania	21 (2.4)		
Slovenia	22 (2.6)		
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>			
Denmark	32 (3.1)		
Greece	27 (2.0)		
Thailand	16 (1.9)		
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>			
‡ Israel	23 (3.5)		
Kuwait	31 (3.7)		
South Africa	26 (2.1)		
<b>International Average Percent Correct</b>	<b>31 (0.5)</b>		

\*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 Cyprus on Example Item 20.

**Table 3.21: Chemistry**  
**Percent Correct for Example Item 21 - Eighth Grade\***

Country	Percent Correct	Example 21 Molecules, atoms, and cells
‡ UNITED STATES	29 (1.9)	<p>The words <i>cloth</i>, <i>thread</i>, and <i>fiber</i> can be used in the following sentence: <i>cloth</i> consists of <i>threads</i> which are made of <i>fiber</i>.</p> <p>Use the words <i>molecules</i>, <i>atoms</i>, and <i>cells</i> to complete the following sentence:</p> <p><u>cells</u> consist of <u>molecules</u> which are made of <u>atoms</u>.</p>
‡ MISSOURI	31 (2.9)	
OREGON	43 (2.8)	
* Belgium (Fl)	19 (2.3)	
Canada	24 (1.6)	
Cyprus	35 (2.9)	
Czech Republic	43 (3.9)	
* England	34 (3.0)	
France	25 (2.6)	
Hong Kong	32 (2.5)	
Hungary	42 (3.1)	
Iceland	12 (2.8)	
Iran, Islamic Rep.	23 (2.4)	
Ireland	25 (2.4)	
Japan	47 (2.2)	
Korea	30 (2.3)	
* Latvia (LSS)	38 (2.9)	
* Lithuania	39 (2.9)	
New Zealand	27 (2.5)	
Norway	29 (1.9)	
Portugal	37 (2.4)	
Russian Federation	53 (3.6)	
Singapore	66 (2.6)	
Slovak Republic	42 (2.6)	
Spain	41 (2.2)	
Sweden	39 (2.6)	
* Switzerland	20 (1.6)	
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>		
Australia	27 (2.0)	
Austria	28 (3.6)	
Belgium (Fr)	20 (2.8)	
Bulgaria	68 (4.7)	
Netherlands	24 (3.1)	
Scotland	27 (2.8)	
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>		
Colombia	21 (2.5)	
* Germany	21 (2.5)	
Romania	31 (3.2)	
Slovenia	28 (2.9)	
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>		
Denmark	29 (2.8)	
Greece	44 (2.5)	
Thailand	31 (2.8)	
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>		
* Israel	26 (3.6)	
Kuwait	20 (2.8)	
South Africa	7 (1.6)	
<b>International Average Percent Correct</b>	<b>32 (0.4)</b>	

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

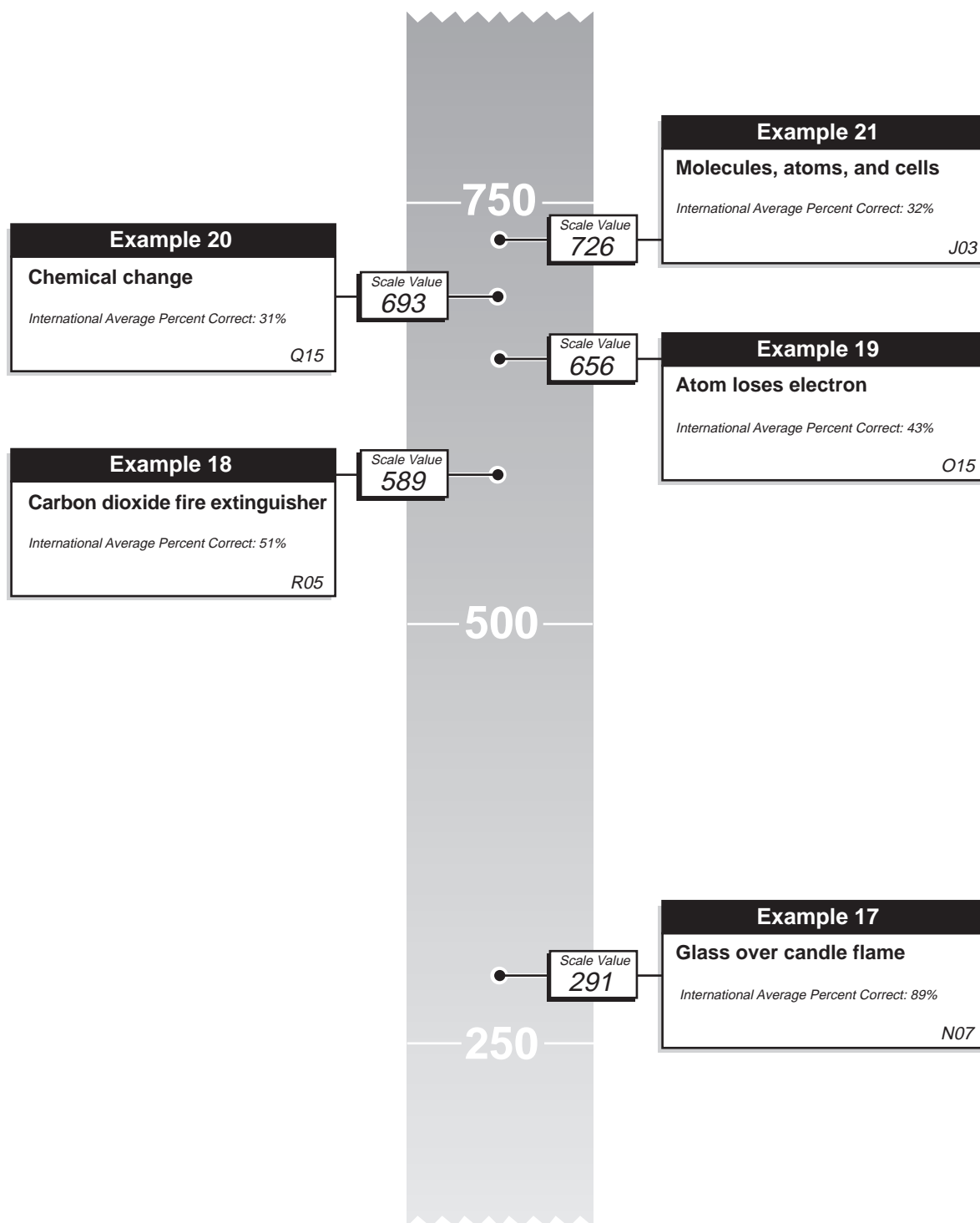
\*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡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 Chemistry**  
**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 science 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 Environmental Issues and the Nature of Science?

The fifth science category includes six items about environmental and resource issues, six items covering the nature of scientific knowledge, and two items involving the interaction of science and technology.

Example Items 22, 23, and 24 are all related to the nature of scientific knowledge. Item 22, requiring deductive reasoning to draw conclusions based on observations from a liquid evaporation experiment, was the easiest of the three. As shown in Table 3.22, on average, nearly two-thirds of the students answered this item correctly (62%). Performances on this item ranged from a low of 30% correct to more than 75% correct, with Missouri and Oregon on the high end of this range at 71% and 76%, respectively. In comparison to Example Item 22, Example Item 23 (Table 3.23), requiring knowledge of the precision of replicated scientific measurements, was slightly more difficult. On average, it was answered correctly by slightly more than half of the students (53% average correct). Students in Missouri performed at about the international average with 54% correct, while the Oregon students did better (68% providing correct responses). More difficult still was Example Item 24, which was related to experimental design and required students to identify an experimental condition necessary to test a particular hypothesis (Table 3.24). Fewer than half of the students, on average, chose the correct response (45%). Forty-six percent of the students in Missouri and Oregon responded correctly to this item.

Example Item 25, measuring knowledge of the principal cause of acid rain, was related to environmental issues (Table 3.25). About one-third or fewer students selected the correct response related to the burning of fossil fuels (on average, 35%). Missouri (36%) and Oregon (33%) performed near the international average on this item.

Figure 3.5 shows the international difficulty map for the four example items in environmental issues and the nature of science. The easiest example (Example Item 22) had a scale value of 526, compared with a value of 704 for the most difficult example (Example Item 25), which dealt with the causes of acid rain.

**Table 3.22: Environmental Issues and the Nature of Science**  
**Percent Correct for Example Item 22 - Eighth Grade\***

Country	Percent Correct	Example 22 Liquid evaporation experiment
‡ UNITED STATES	75 (2.0)	<p>A cupful of water and a similar cupful of gasoline were placed on a table near a window on a hot sunny day. A few hours later it was observed that both the cups had less liquid in them but that there was less gasoline left than water. What does this experiment show?</p> <p>A. All liquids evaporate.</p> <p>B. Gasoline gets hotter than water.</p> <p><input checked="" type="radio"/> C. Some liquids evaporate faster than others.</p> <p>D. Liquids will only evaporate in sunshine.</p> <p>E. Water gets hotter than gasoline</p>
‡ MISSOURI	71 (3.1)	
OREGON	76 (2.3)	
‡ Belgium (Fl)	76 (3.4)	
Canada	78 (1.8)	
Cyprus	65 (2.5)	
Czech Republic	59 (2.9)	
‡ England	72 (3.4)	
France	75 (2.3)	
Hong Kong	68 (2.6)	
Hungary	68 (2.7)	
Iceland	56 (2.8)	
Iran, Islamic Rep.	67 (2.7)	
Ireland	74 (2.3)	
Japan	30 (2.1)	
Korea	79 (2.4)	
‡ Latvia (LSS)	69 (3.0)	
‡ Lithuania	58 (3.4)	
New Zealand	68 (2.5)	
Norway	57 (2.8)	
Portugal	54 (2.9)	
Russian Federation	59 (2.7)	
Singapore	80 (1.8)	
Slovak Republic	50 (3.3)	
Spain	60 (2.8)	
Sweden	61 (2.3)	
‡ Switzerland	52 (2.7)	
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>		
Australia	70 (2.5)	
Austria	58 (2.8)	
Belgium (Fr)	77 (3.2)	
Bulgaria	84 (2.8)	
Netherlands	77 (3.0)	
Scotland	72 (2.8)	
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>		
Colombia	42 (3.7)	
‡ Germany	60 (3.1)	
Romania	53 (2.9)	
Slovenia	77 (2.7)	
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>		
Denmark	61 (3.4)	
Greece	57 (2.5)	
Thailand	45 (2.1)	
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>		
‡ Israel	64 (3.9)	
Kuwait	28 (3.3)	
South Africa	25 (3.1)	
<b>International Average Percent Correct</b>	<b>62 (0.4)</b>	

\*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 3.23: Environmental Issues and the Nature of Science**  
**Percent Correct for Example Item 23 - Eighth Grade\***

Country	Percent Correct	Example 23 Replication of measurements	
‡ UNITED STATES	61 (1.9)	<p>Whenever scientists carefully measure any quantity many times, they expect that</p> <p>A. all of the measurements will be exactly the same</p> <p>B. only two of the measurements will be exactly the same</p> <p>C. all but one of the measurements will be exactly the same</p> <p><input checked="" type="radio"/> D. most of the measurements will be close but not exactly the same</p>	
‡ MISSOURI	54 (2.3)		
OREGON	68 (2.3)		
* Belgium (Fl)	42 (3.4)		
Canada	58 (2.0)		
Cyprus	51 (3.3)		
Czech Republic	64 (2.7)		
* England	64 (3.5)		
France	51 (2.6)		
Hong Kong	70 (2.5)		
Hungary	39 (2.9)		
Iceland	59 (3.5)		
Iran, Islamic Rep.	39 (3.0)		
Ireland	54 (2.7)		
Japan	39 (2.0)		
Korea	85 (1.8)		
* Latvia (LSS)	49 (3.4)		
* Lithuania	50 (3.1)		
New Zealand	63 (2.8)		
Norway	53 (2.7)		
Portugal	35 (1.9)		
Russian Federation	61 (2.0)		
Singapore	65 (2.2)		
Slovak Republic	70 (2.6)		
Spain	28 (2.3)		
Sweden	68 (2.1)		
* Switzerland	25 (1.9)		
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>			
Australia	63 (1.9)		
Austria	36 (2.7)		
Belgium (Fr)	45 (2.9)		
Bulgaria	56 (4.4)		
Netherlands	58 (4.2)		
Scotland	63 (2.8)		
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>			
Colombia	39 (4.0)		
* Germany	33 (2.9)		
Romania	54 (2.7)		
Slovenia	73 (2.7)		
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>			
Denmark	58 (3.1)		
Greece	63 (3.3)		
Thailand	77 (2.1)		
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>			
* Israel	28 (3.8)		
Kuwait	60 (4.0)		
South Africa	23 (2.1)		
<b>International Average Percent Correct</b>	<b>53 (0.4)</b>		

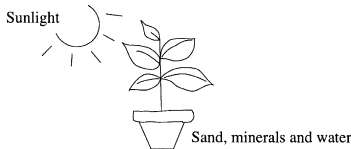
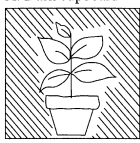
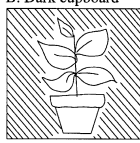
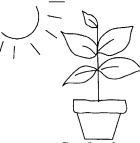
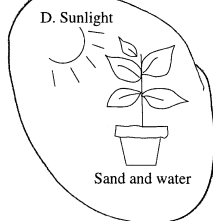

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

\*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 3.24: Environmental Issues and the Nature of Science**  
**Percent Correct for Example Item 24 - Eighth Grade\***

Country	Percent Correct	Example 24 Plant/mineral experiment				
‡ UNITED STATES	47 (2.5)	<p>A girl had an idea that plants needed minerals from the soil for healthy growth. She placed a plant in the Sun, as shown in the diagram below.</p>  <p>In order to check her idea she also needed to use another plant. Which of the following should she use?</p> <div> <p>A. Dark cupboard</p>  <p>B. Dark cupboard</p>  <p>C. Sunlight</p>  <p>D. Sunlight</p>  <p>E. Sunlight</p>  </div>				
‡ MISSOURI	46 (2.6)					
OREGON	46 (2.7)					
‡ Belgium (Fl)	47 (4.1)					
Canada	50 (2.1)					
Cyprus	31 (2.9)					
Czech Republic	42 (2.5)					
‡ England	44 (3.2)					
France	43 (2.6)					
Hong Kong	57 (2.7)					
Hungary	30 (2.6)					
Iceland	47 (4.1)					
Iran, Islamic Rep.	31 (3.5)					
Ireland	36 (2.4)					
Japan	57 (1.9)					
Korea	36 (2.8)					
‡ Latvia (LSS)	45 (3.3)					
‡ Lithuania	26 (3.1)					
New Zealand	47 (2.6)					
Norway	50 (2.7)					
Portugal	49 (2.2)					
Russian Federation	35 (4.0)					
Singapore	71 (1.8)					
Slovak Republic	43 (3.0)					
Spain	49 (2.7)					
Sweden	63 (2.1)					
‡ Switzerland	51 (3.0)					
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>						
Australia	48 (1.5)					
Austria	52 (3.1)					
Belgium (Fr)	40 (2.9)					
Bulgaria	71 (3.7)					
Netherlands	71 (2.9)					
Scotland	40 (2.8)					
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>						
Colombia	44 (4.4)					
‡ Germany	42 (2.8)					
Romania	35 (2.7)					
Slovenia	41 (2.9)					
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>						
Denmark	36 (3.6)					
Greece	44 (2.3)					
Thailand	29 (2.6)					
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>						
‡ Israel	52 (4.6)					
Kuwait	36 (2.7)					
South Africa	33 (2.2)					
<b>International Average Percent Correct</b>	45 (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.

**Table 3.25: Environmental Issues and the Nature of Science**  
**Percent Correct for Example Item 25 - Eighth Grade\***

Country	Percent Correct	Example 25 Acid rain	
‡ UNITED STATES	32 (1.7)	<p>One of the principal causes of acid rain is</p> <p>A. waste acid from chemical factories being pumped into rivers</p> <p>B. acid from chemical laboratories evaporating into the air</p> <p><input checked="" type="radio"/> C. gases from burning coal and oil dissolving in water in the atmosphere</p> <p>D. gases from air conditioners and refrigerators escaping into the atmosphere</p>	
‡ MISSOURI	36 (2.7)		
OREGON	33 (2.3)		
‡ Belgium (Fl)	30 (3.1)		
Canada	31 (2.3)		
Cyprus	23 (2.2)		
Czech Republic	45 (3.0)		
‡ England	44 (3.5)		
France	--		
Hong Kong	38 (2.6)		
Hungary	41 (2.7)		
Iceland	35 (4.5)		
Iran, Islamic Rep.	23 (2.7)		
Ireland	43 (2.6)		
Japan	46 (2.0)		
Korea	50 (3.0)		
‡ Latvia (LSS)	25 (2.8)		
‡ Lithuania	24 (2.8)		
New Zealand	31 (2.0)		
Norway	31 (2.3)		
Portugal	32 (2.2)		
Russian Federation	21 (2.5)		
Singapore	31 (2.3)		
Slovak Republic	14 (1.9)		
Spain	34 (2.5)		
Sweden	31 (1.9)		
‡ Switzerland	39 (2.6)		
<b>Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):</b>			
Australia	42 (2.0)		
Austria	55 (3.1)		
Belgium (Fr)	--		
Bulgaria	47 (4.5)		
Netherlands	44 (3.0)		
Scotland	32 (3.0)		
<b>Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):</b>			
Colombia	31 (3.9)		
‡ Germany	40 (2.8)		
Romania	26 (2.4)		
Slovenia	55 (3.4)		
<b>Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):</b>			
Denmark	27 (2.6)		
Greece	21 (1.9)		
Thailand	62 (2.2)		
<b>Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):</b>			
‡ Israel	30 (3.4)		
Kuwait	46 (4.8)		
South Africa	22 (2.1)		
<b>International Average Percent Correct</b>	<b>35 (0.5)</b>		

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

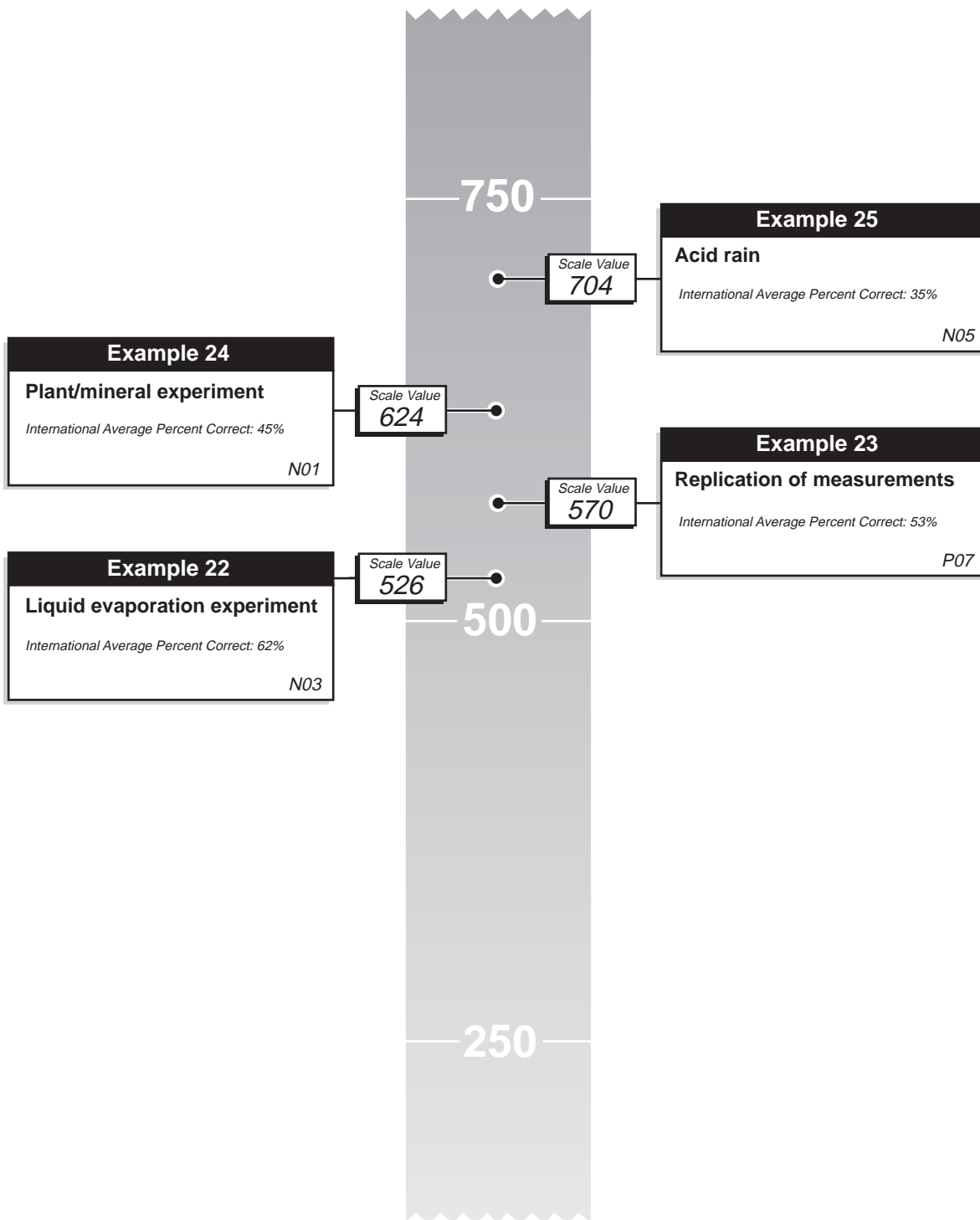
\*Eighth grade in most countries. See Table 2 for information about the grades tested in each country.

‡ 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 (–) indicates data are not available. Internationally comparable data are unavailable for Belgium (Fr) and France.

**Figure 3.5** International Difficulty Map for Environmental Issues and the Nature of Science 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 science 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 TOWARDS SCIENCE

To provide an educational context for interpreting the science 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 science reflect what happens in school and their perceptions of the value of science 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 science, provide information about what motivates them to do well in science, and indicate their attitudes towards science.

### 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 85% or more who so reported in England, the Netherlands, and Scotland.

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 science test. As in most countries, the more books students

**Table 4.1**  
**Students' Reports on Educational Aids in the Home: Dictionary, Study Desk/Table and Computer - Science - 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
<b>UNITED STATES</b>	56 (1.7)	559 (4.1)	44 (1.7)	505 (5.2)	97 (0.4)	90 (0.7)	59 (1.7)
<b>MISSOURI</b>	59 (1.9)	572 (7.0)	41 (1.9)	534 (7.1)	97 (0.5)	90 (0.8)	64 (1.9)
<b>OREGON</b>	70 (1.9)	579 (7.0)	30 (1.9)	529 (7.5)	97 (0.3)	89 (0.8)	76 (1.8)
<i>Australia</i>	66 (1.2)	557 (4.3)	34 (1.2)	524 (4.2)	88 (0.7)	97 (0.3)	73 (1.2)
<i>Austria</i>	56 (1.5)	566 (4.1)	44 (1.5)	547 (4.5)	98 (0.3)	93 (0.8)	59 (1.5)
<b>Belgium (Fl)</b>	64 (1.3)	559 (3.9)	36 (1.3)	536 (5.2)	99 (0.5)	96 (0.5)	67 (1.3)
<i>Belgium (Fr)</i>	58 (1.4)	483 (3.1)	42 (1.4)	456 (3.6)	97 (0.5)	96 (0.5)	60 (1.4)
<b>Canada</b>	57 (1.4)	545 (2.5)	43 (1.4)	514 (3.0)	97 (0.4)	89 (0.6)	61 (1.3)
<i>Colombia</i>	10 (1.2)	431 (10.3)	90 (1.2)	410 (3.9)	96 (0.5)	84 (1.0)	11 (1.2)
<b>Cyprus</b>	37 (0.9)	475 (3.0)	63 (0.9)	458 (2.5)	97 (0.3)	96 (0.5)	39 (0.9)
<b>Czech Republic</b>	33 (1.3)	596 (6.6)	67 (1.3)	563 (3.3)	94 (0.6)	90 (0.6)	36 (1.2)
<i>Denmark</i>	66 (1.5)	487 (3.2)	34 (1.5)	465 (4.4)	85 (1.1)	98 (0.3)	76 (1.2)
<b>England</b>	80 (1.0)	558 (3.8)	20 (1.0)	534 (5.3)	98 (0.4)	90 (0.8)	89 (0.8)
<b>France</b>	49 (1.3)	505 (2.9)	51 (1.3)	492 (3.1)	99 (0.2)	96 (0.4)	50 (1.3)
<i>Germany</i>	66 (1.1)	542 (4.3)	34 (1.1)	514 (6.5)	98 (0.4)	93 (0.6)	71 (1.0)
<i>Greece</i>	28 (1.0)	513 (4.3)	72 (1.0)	493 (2.2)	97 (0.3)	93 (0.5)	29 (1.0)
<b>Hong Kong</b>	33 (1.8)	540 (5.2)	67 (1.8)	516 (4.8)	99 (0.1)	80 (1.1)	39 (1.9)
<b>Hungary</b>	32 (1.2)	586 (3.3)	68 (1.2)	540 (3.1)	77 (1.2)	92 (0.7)	37 (1.2)
<b>Iceland</b>	72 (1.6)	495 (5.1)	28 (1.6)	488 (2.9)	95 (0.5)	96 (0.6)	77 (1.4)
<b>Iran, Islamic Rep.</b>	1 (0.3)	--	99 (0.3)	472 (2.3)	54 (1.5)	40 (2.0)	4 (0.4)
<b>Ireland</b>	67 (1.2)	548 (4.4)	33 (1.2)	522 (6.1)	99 (0.3)	86 (0.9)	78 (1.1)
<i>Israel</i>	75 (2.1)	540 (5.9)	25 (2.1)	495 (4.7)	100 (0.2)	98 (0.4)	76 (2.1)
<b>Japan</b>	--	--	--	--	--	--	--
<b>Korea</b>	38 (1.2)	585 (2.7)	62 (1.2)	553 (2.2)	98 (0.2)	95 (0.4)	39 (1.2)
<i>Kuwait</i>	38 (2.4)	434 (5.7)	62 (2.4)	429 (3.8)	84 (1.0)	73 (2.2)	53 (2.0)
<b>Latvia (LSS)</b>	13 (0.8)	487 (5.4)	87 (0.8)	486 (2.6)	94 (0.6)	98 (0.3)	13 (0.9)
<b>Lithuania</b>	35 (1.3)	481 (4.3)	65 (1.3)	474 (3.9)	88 (1.0)	95 (0.6)	42 (1.4)
<i>Netherlands</i>	83 (1.3)	563 (6.4)	17 (1.3)	548 (6.1)	100 (0.1)	99 (0.2)	85 (1.2)
<b>New Zealand</b>	56 (1.4)	541 (4.9)	44 (1.4)	509 (4.9)	99 (0.2)	91 (0.6)	60 (1.3)
<b>Norway</b>	63 (1.1)	535 (2.3)	37 (1.1)	516 (3.0)	97 (0.3)	98 (0.2)	64 (1.1)
<b>Portugal</b>	35 (1.8)	496 (3.1)	65 (1.8)	471 (2.1)	98 (0.4)	84 (0.9)	39 (1.8)
<i>Romania</i>	8 (1.0)	534 (9.5)	92 (1.0)	483 (4.7)	60 (1.6)	69 (1.3)	19 (1.2)
<b>Russian Federation</b>	30 (1.4)	545 (4.9)	70 (1.4)	536 (4.3)	88 (1.1)	95 (0.7)	35 (1.5)
<i>Scotland</i>	74 (1.2)	527 (5.4)	26 (1.2)	494 (6.5)	96 (0.5)	84 (1.2)	90 (0.6)
<b>Singapore</b>	47 (1.5)	627 (6.1)	53 (1.5)	591 (5.5)	99 (0.1)	92 (0.5)	49 (1.5)
<b>Slovak Republic</b>	27 (1.2)	567 (4.0)	73 (1.2)	536 (3.5)	96 (0.5)	86 (0.9)	31 (1.2)
<i>Slovenia</i>	43 (1.4)	581 (3.2)	57 (1.4)	544 (2.8)	94 (0.5)	93 (0.6)	47 (1.3)
<b>Spain</b>	40 (1.3)	529 (2.7)	60 (1.3)	509 (2.0)	99 (0.1)	93 (0.5)	42 (1.2)
<b>Sweden</b>	58 (1.3)	549 (2.9)	42 (1.3)	518 (3.7)	94 (0.4)	100 (0.1)	60 (1.3)
<b>Switzerland</b>	63 (1.2)	532 (2.8)	37 (1.2)	507 (3.1)	97 (0.4)	95 (0.4)	66 (1.2)
<i>Thailand</i>	4 (0.8)	545 (11.0)	96 (0.8)	525 (3.7)	68 (2.1)	66 (2.1)	4 (0.9)

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.

in Missouri and Oregon reported having in the home, the higher their science 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. The results for Missouri resembled those for the United States in general, whereas students in Oregon reported a higher level of book ownership. In Oregon, 38% of students reported having three or more bookcases, compared with 28% in Missouri, and 31% in the United States as a whole.

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' science 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' science achievement. In every country, the pattern was for those students whose parents had more education to also be those who have higher achievement in science. About one-third of the students (33%) in the United States reported that their parent(s) had graduated from college. In Missouri this figure was 29%, and in Oregon 37%. In both states, also, students whose parents had more education had higher achievement in science.

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 students' reports on the frequency with which they speak the language of the test at home. In the United States, 90% of students reported always or almost always speaking the language of the test, and their average science achievement was higher than those who speak the language less frequently. The results for Oregon (93%) and Missouri (96%) resembled those for the United States. In both states, also, these students had higher average science achievement than those who speak the test language less frequently.

**Table 4.2**  
**Students' Reports on the Number of Books in the Home - Science - 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
<b>UNITED STATES</b>	8 (0.8)	459 (6.2)	13 (0.8)	489 (5.0)	28 (0.9)	527 (4.2)	21 (0.6)	554 (4.3)	31 (1.5)	570 (5.2)
<b>MISSOURI</b>	9 (1.0)	494 (6.1)	13 (1.0)	508 (8.4)	30 (1.0)	552 (6.4)	21 (1.2)	574 (6.4)	28 (1.5)	588 (7.6)
<b>OREGON</b>	6 (0.7)	482 (10.1)	10 (0.9)	521 (7.8)	24 (1.1)	554 (7.3)	21 (1.1)	570 (7.5)	38 (2.0)	594 (8.0)
<i>Australia</i>	3 (0.3)	460 (7.8)	7 (0.6)	492 (7.5)	24 (0.8)	524 (4.3)	25 (0.6)	549 (3.8)	42 (1.4)	573 (4.2)
<i>Austria</i>	11 (1.0)	509 (6.5)	17 (1.1)	528 (7.5)	31 (1.2)	554 (5.1)	17 (0.9)	582 (4.9)	24 (1.4)	590 (4.7)
<b>Belgium (Fl)</b>	11 (1.2)	515 (6.5)	18 (0.8)	537 (6.0)	33 (1.0)	552 (5.2)	18 (1.0)	566 (4.9)	21 (0.9)	563 (5.0)
<i>Belgium (Fr)</i>	7 (0.7)	408 (11.0)	10 (0.7)	433 (4.5)	28 (1.1)	462 (4.7)	21 (0.9)	482 (4.0)	34 (1.5)	497 (3.3)
<b>Canada</b>	4 (0.3)	482 (8.0)	10 (0.7)	493 (4.0)	28 (1.0)	522 (3.5)	25 (0.8)	542 (3.5)	33 (1.4)	550 (3.6)
<i>Colombia</i>	26 (1.5)	397 (4.5)	31 (1.1)	404 (5.3)	27 (1.3)	424 (4.4)	9 (0.7)	426 (8.4)	7 (1.0)	434 (9.9)
<b>Cyprus</b>	6 (0.6)	425 (6.5)	18 (0.8)	438 (3.7)	34 (0.8)	465 (3.4)	23 (0.8)	486 (3.6)	20 (0.8)	480 (4.5)
<b>Czech Republic</b>	1 (0.2)	~ ~	4 (0.5)	520 (7.1)	30 (1.5)	552 (3.9)	32 (0.9)	577 (4.3)	34 (1.8)	597 (6.6)
<i>Denmark</i>	3 (0.6)	425 (12.6)	9 (0.8)	446 (8.6)	30 (1.2)	467 (4.1)	21 (0.9)	484 (3.9)	37 (1.5)	499 (4.0)
<b>England</b>	6 (0.6)	472 (8.9)	13 (1.0)	502 (4.4)	27 (1.3)	536 (5.3)	22 (0.8)	564 (6.2)	32 (1.5)	596 (4.6)
<b>France</b>	5 (0.5)	460 (8.6)	17 (1.0)	477 (4.0)	36 (1.1)	497 (3.8)	21 (1.0)	514 (3.9)	20 (1.2)	511 (4.5)
<i>Germany</i>	8 (0.8)	456 (7.4)	14 (1.1)	483 (6.9)	26 (1.0)	519 (4.4)	19 (0.9)	555 (6.8)	33 (1.7)	569 (5.1)
<i>Greece</i>	5 (0.4)	467 (6.1)	22 (0.9)	475 (2.9)	43 (0.9)	499 (2.5)	18 (0.7)	515 (4.8)	12 (0.7)	525 (4.8)
<b>Hong Kong</b>	21 (1.2)	500 (6.7)	29 (1.0)	525 (4.5)	29 (0.9)	529 (5.2)	10 (0.7)	542 (6.8)	10 (0.9)	536 (7.0)
<b>Hungary</b>	4 (0.6)	487 (12.8)	8 (0.7)	510 (5.8)	25 (1.0)	534 (3.8)	21 (1.0)	559 (4.2)	42 (1.4)	579 (3.0)
<b>Iceland</b>	1 (0.2)	~ ~	5 (0.8)	463 (10.9)	29 (1.4)	482 (4.8)	28 (1.2)	491 (5.1)	37 (1.7)	510 (6.7)
<b>Iran, Islamic Rep.</b>	37 (1.8)	457 (3.5)	32 (0.9)	475 (3.3)	17 (0.9)	478 (5.9)	6 (0.5)	481 (10.1)	7 (0.7)	487 (6.7)
<b>Ireland</b>	7 (0.6)	471 (7.4)	16 (0.8)	504 (5.2)	34 (1.0)	538 (4.5)	21 (0.7)	560 (4.5)	22 (1.2)	568 (5.9)
<i>Israel</i>	4 (0.6)	487 (12.5)	13 (1.6)	495 (8.3)	31 (1.9)	517 (7.2)	26 (1.4)	541 (6.4)	25 (2.0)	555 (7.7)
<b>Japan</b>	--	--	--	--	--	--	--	--	--	--
<b>Korea</b>	10 (0.6)	510 (5.2)	12 (0.8)	531 (3.9)	33 (0.9)	562 (2.9)	23 (0.8)	581 (2.8)	21 (0.9)	597 (4.1)
<i>Kuwait</i>	22 (1.5)	424 (5.4)	27 (1.4)	428 (4.5)	28 (1.3)	443 (3.7)	10 (0.8)	443 (6.9)	13 (1.2)	428 (7.3)
<b>Latvia (LSS)</b>	1 (0.3)	~ ~	4 (0.6)	434 (7.3)	17 (1.0)	474 (4.1)	21 (1.1)	477 (4.7)	57 (1.4)	496 (3.0)
<b>Lithuania</b>	3 (0.4)	429 (9.9)	17 (0.9)	451 (5.6)	35 (1.2)	469 (4.0)	21 (0.9)	491 (4.5)	24 (1.1)	501 (4.4)
<i>Netherlands</i>	8 (1.0)	523 (8.5)	16 (1.3)	533 (8.9)	34 (1.3)	553 (5.8)	19 (0.9)	580 (5.9)	22 (1.7)	591 (5.9)
<b>New Zealand</b>	3 (0.4)	441 (9.8)	7 (0.6)	466 (6.4)	24 (0.8)	506 (4.9)	25 (0.7)	533 (4.7)	41 (1.4)	551 (4.6)
<b>Norway</b>	2 (0.3)	~ ~	6 (0.4)	490 (7.7)	25 (0.9)	511 (2.9)	22 (0.7)	524 (3.4)	45 (1.2)	547 (2.4)
<b>Portugal</b>	10 (0.8)	456 (3.8)	26 (1.3)	464 (2.9)	32 (1.0)	479 (2.7)	15 (0.8)	493 (4.0)	17 (1.4)	508 (3.9)
<i>Romania</i>	24 (1.3)	467 (8.3)	22 (1.3)	476 (7.1)	19 (1.0)	483 (5.5)	11 (0.7)	503 (7.9)	24 (1.7)	518 (5.9)
<b>Russian Federation</b>	2 (0.3)	~ ~	11 (0.8)	508 (10.1)	36 (1.3)	527 (4.5)	24 (0.8)	550 (4.1)	26 (1.3)	561 (5.0)
<i>Scotland</i>	11 (1.2)	453 (5.5)	17 (1.1)	483 (4.2)	28 (1.0)	507 (4.2)	19 (1.0)	546 (4.7)	25 (2.0)	567 (7.8)
<b>Singapore</b>	11 (0.8)	567 (5.3)	22 (0.9)	583 (5.3)	41 (0.8)	610 (5.5)	14 (0.7)	640 (6.5)	12 (1.0)	648 (7.0)
<b>Slovak Republic</b>	2 (0.3)	~ ~	11 (0.6)	506 (5.3)	45 (1.1)	536 (3.5)	23 (0.9)	562 (3.9)	18 (1.0)	573 (5.1)
<i>Slovenia</i>	2 (0.4)	~ ~	15 (0.9)	522 (4.3)	38 (1.2)	555 (2.9)	22 (0.9)	574 (4.3)	22 (1.1)	587 (4.4)
<b>Spain</b>	4 (0.4)	487 (8.1)	18 (1.1)	490 (2.5)	33 (1.0)	511 (2.1)	20 (0.8)	528 (3.3)	26 (1.2)	540 (2.8)
<b>Sweden</b>	3 (0.3)	473 (9.9)	8 (0.7)	482 (5.6)	24 (1.0)	517 (4.3)	24 (0.8)	540 (3.6)	41 (1.5)	560 (3.5)
<b>Switzerland</b>	8 (1.0)	456 (8.1)	16 (0.9)	485 (6.1)	30 (1.0)	516 (3.4)	20 (0.9)	546 (3.7)	26 (1.2)	557 (4.2)
<i>Thailand</i>	19 (1.2)	514 (3.3)	30 (1.0)	519 (3.4)	33 (1.2)	529 (4.0)	9 (0.6)	538 (6.8)	9 (1.0)	546 (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.

**Table 4.3**  
**Students' Reports on the Highest Level of Education of Either Parent<sup>1</sup>**  
**Science - Eighth Grade\***

Country	Finished University <sup>2</sup>		Finished Upper Secondary School But Not University <sup>3</sup>		Finished Primary School But Not Upper Secondary School <sup>4</sup>		Do Not Know	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
<b>UNITED STATES</b>	33 (1.4)	562 (5.9)	54 (1.3)	530 (4.1)	7 (0.8)	483 (5.7)	5 (0.4)	512 (8.1)
<b>MISSOURI</b>	29 (2.1)	579 (8.6)	60 (1.8)	551 (6.3)	6 (0.7)	512 (11.3)	5 (0.6)	546 (14.7)
<b>OREGON</b>	37 (2.7)	595 (6.3)	55 (2.3)	556 (8.0)	4 (0.5)	493 (15.6)	4 (0.6)	520 (12.7)
<i>Australia</i>	28 (1.4)	587 (4.5)	37 (0.9)	544 (4.1)	24 (0.9)	527 (4.4)	11 (0.6)	499 (5.3)
<i>Austria</i>	10 (0.7)	588 (7.7)	70 (1.1)	566 (4.1)	8 (0.9)	508 (8.3)	12 (0.9)	530 (6.0)
<b>Belgium (Fl)</b>	20 (1.6)	574 (4.5)	34 (1.3)	554 (5.0)	21 (2.4)	532 (9.1)	25 (1.4)	535 (3.7)
<i>Belgium (Fr)</i>	27 (1.6)	497 (4.3)	34 (1.3)	481 (4.1)	11 (1.3)	434 (5.3)	27 (1.6)	450 (5.8)
<b>Canada</b>	37 (1.3)	549 (3.9)	39 (1.2)	532 (3.0)	13 (0.9)	501 (4.4)	10 (0.5)	517 (4.0)
<i>Colombia</i>	15 (1.6)	441 (7.9)	28 (1.6)	425 (4.2)	47 (2.3)	402 (3.7)	10 (0.9)	393 (6.3)
<b>Cyprus</b>	r 15 (0.9)	504 (6.3)	29 (1.1)	486 (3.6)	52 (1.4)	448 (2.7)	4 (0.5)	438 (10.5)
<b>Czech Republic</b>	21 (1.7)	606 (7.2)	47 (1.5)	579 (4.1)	25 (1.5)	550 (3.9)	7 (0.8)	536 (7.3)
<i>Denmark</i>	13 (1.0)	509 (6.0)	46 (1.5)	489 (3.8)	8 (0.7)	458 (8.6)	33 (1.7)	470 (4.6)
<b>England</b>	--	--	--	--	--	--	--	--
<b>France</b>	r 13 (1.2)	524 (6.6)	36 (1.3)	505 (3.5)	19 (1.2)	493 (3.3)	31 (1.3)	488 (3.5)
<i>Germany</i>	11 (1.0)	573 (8.6)	32 (1.3)	550 (4.7)	38 (1.6)	529 (4.2)	19 (1.3)	502 (7.7)
<i>Greece</i>	18 (1.1)	536 (4.8)	39 (1.3)	506 (3.1)	40 (1.8)	479 (2.3)	3 (0.3)	463 (7.8)
<b>Hong Kong</b>	7 (1.0)	547 (8.6)	30 (1.2)	537 (5.1)	55 (1.8)	519 (4.7)	7 (0.7)	498 (8.5)
<b>Hungary</b>	r 24 (1.8)	603 (4.1)	66 (1.7)	554 (3.0)	11 (0.9)	505 (6.0)	--	--
<b>Iceland</b>	25 (2.8)	513 (8.4)	44 (2.0)	499 (3.9)	15 (1.4)	477 (8.1)	15 (1.0)	475 (8.1)
<b>Iran, Islamic Rep.</b>	r 3 (0.6)	505 (8.4)	21 (1.8)	488 (4.4)	68 (2.2)	469 (3.0)	7 (1.0)	453 (6.7)
<b>Ireland</b>	17 (1.3)	573 (6.3)	46 (1.0)	546 (4.4)	26 (1.2)	522 (5.2)	10 (0.7)	506 (6.1)
<i>Israel</i>	37 (2.5)	560 (7.9)	45 (2.2)	523 (5.5)	10 (1.3)	485 (7.4)	8 (0.9)	508 (8.4)
<b>Japan</b>	--	--	--	--	--	--	--	--
<b>Korea</b>	22 (1.3)	593 (3.9)	47 (1.3)	566 (2.4)	26 (1.1)	546 (3.4)	5 (0.5)	529 (7.1)
<i>Kuwait</i>	s 3 (1.3)	459 (10.8)	3 (0.9)	425 (12.9)	92 (2.2)	427 (4.7)	1 (0.7)	--
<b>Latvia (LSS)</b>	r 27 (1.5)	515 (5.0)	49 (1.4)	488 (3.0)	13 (1.0)	466 (5.7)	11 (1.0)	463 (6.8)
<b>Lithuania</b>	s 37 (1.6)	500 (4.7)	44 (1.6)	474 (4.4)	7 (1.0)	449 (8.6)	12 (1.2)	475 (6.5)
<i>Netherlands</i>	12 (1.4)	586 (8.2)	55 (1.8)	567 (6.4)	10 (0.7)	547 (8.0)	23 (1.4)	542 (5.6)
<b>New Zealand</b>	25 (1.3)	560 (5.5)	38 (1.1)	530 (4.4)	15 (0.8)	503 (6.0)	21 (1.1)	505 (5.8)
<b>Norway</b>	25 (1.2)	544 (4.2)	38 (1.1)	532 (2.4)	9 (0.6)	505 (4.5)	27 (1.2)	520 (3.3)
<b>Portugal</b>	9 (1.2)	525 (4.6)	13 (1.0)	498 (4.1)	73 (2.0)	472 (2.1)	5 (0.4)	469 (5.6)
<i>Romania</i>	10 (1.3)	522 (9.7)	47 (1.5)	498 (5.0)	33 (1.9)	477 (7.7)	10 (0.9)	463 (10.0)
<b>Russian Federation</b>	34 (1.8)	567 (3.7)	54 (1.6)	528 (4.9)	5 (0.5)	493 (8.7)	6 (0.8)	522 (11.3)
<i>Scotland</i>	14 (1.4)	579 (7.1)	33 (1.4)	521 (5.4)	14 (0.8)	501 (5.1)	39 (1.3)	507 (6.2)
<b>Singapore</b>	8 (1.0)	661 (8.4)	69 (1.0)	612 (5.5)	23 (1.2)	578 (5.1)	--	--
<b>Slovak Republic</b>	20 (1.4)	580 (4.9)	50 (1.1)	549 (3.2)	23 (1.2)	519 (4.8)	6 (0.5)	513 (7.5)
<i>Slovenia</i>	19 (1.1)	600 (4.2)	59 (1.4)	558 (2.6)	18 (1.3)	533 (3.7)	4 (0.4)	545 (8.9)
<b>Spain</b>	15 (1.2)	547 (3.9)	21 (0.9)	531 (2.9)	54 (1.8)	509 (2.1)	10 (0.8)	504 (3.9)
<b>Sweden</b>	22 (1.2)	561 (4.2)	34 (1.1)	541 (3.3)	9 (0.6)	517 (5.0)	35 (1.1)	527 (3.4)
<b>Switzerland</b>	11 (0.8)	559 (6.4)	61 (1.3)	531 (2.7)	13 (0.9)	493 (3.9)	15 (1.0)	506 (4.5)
<i>Thailand</i>	9 (1.4)	557 (6.7)	14 (1.4)	540 (5.9)	73 (2.6)	519 (2.9)	3 (0.5)	522 (10.2)

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.

<sup>1</sup>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.<sup>2</sup>In most countries, defined as completion of at least a 4-year degree program at a university or an equivalent institute of higher education.<sup>3</sup>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.<sup>4</sup>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<sup>†</sup>**

Finished Primary School But Not Upper Secondary School	
<b>Internationally-Defined Levels:</b> <i>Finished Primary School or Finished Some Secondary School</i>	
<b>Countries with Modified Nationally-Defined Levels:</b> Austria: <i>Compulsory (Pflichtschulabschluss; 9 grades)</i> Denmark: <i>Basic school (Folkeskolen, Realeksamen; 9 or 10 grades)</i> France: <i>Lower secondary (Collège, CAP)</i> Germany: <i>Lower secondary (Hauptschulabschluss; 9 or 10 grades) or Medium secondary (Fachoberschulreife, Realschulabschluss or Polytechnische Oberschule; 10 grades)</i> Hungary: <i>Some or all of general school (8 grades)</i> Norway: <i>Compulsory (9 grades) or some upper secondary</i> Scotland: <i>Some secondary School</i> Singapore: <i>Primary school</i> Sweden: <i>Compulsory (9 grades) or started upper secondary</i> Switzerland: <i>Compulsory (9 grades)</i>	
Finished Upper Secondary School <sup>1</sup> But Not University	
<b>Internationally-Defined Levels:</b> <i>Finished Secondary School or Some Vocational/Technical Education After Secondary School or Some University</i>	
<b>Countries with Modified Nationally-Defined Levels:</b> Austria: <i>Upper secondary tracks: apprenticeship (Berufsschul-/Lehrabschluss), medium vocational (Handelsschule, Fachschule), higher vocational (HAK, HTL, etc.), or higher academic (Gymnasium, Realgymnasium)</i> Cyprus: <i>Upper secondary tracks: academic or technical/vocational or Postsecondary: finished college.</i> Denmark: <i>Upper secondary tracks: academic or general/vocational (gymnasium, hf, htx, hhx) or vocational training (erhvervsfaglig uddannelse) Postsecondary: medium-cycle higher education (mellemlang uddannelse)</i> France: <i>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)</i> Germany: <i>Upper secondary tracks: general/academic or apprenticeship/vocational training (Lehrabschluss, Berufsfachschule, Postsecondary: Higher vocational schools (Fachhochschulabschluss)</i> Hungary: <i>Upper secondary tracks: apprenticeship (general + 3 years) or final exam in secondary (general + 4 years)</i> Sweden: <i>Upper secondary tracks: academic or vocational (gymnasieutbildning or yrkesinriktad utbildning) Postsecondary: less than 3 years of university studies</i> Switzerland: <i>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)</i>	
Finished University	
<b>Internationally-Defined Levels:</b> <i>Finished University</i>	
<b>Countries with Modified Nationally-Defined Levels:</b> Austria: <i>University (master's degree)</i> Canada: <i>University or college</i> Cyprus: <i>University degree or post-graduate studies</i> France: <i>4 years university study after baccalauréat</i> Germany: <i>University, technical university, teacher college or pedagogic institute</i> Hungary: <i>University or college diploma</i> New Zealand: <i>University or teachers' college</i> Norway: <i>University or college</i> Portugal: <i>University or polytechnic</i> Sweden: <i>3 years university studies or more</i> Switzerland: <i>University or institute of technology</i> United States: <i>Bachelor's degree at college or university</i>	

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

<sup>†</sup> 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.

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

**Table 4.4**  
**Students' Reports on Frequency with Which They Speak the Language  
of the Test at Home - Science - Eighth Grade\***

Country	Always or Almost Always		Sometimes		Never	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
<b>UNITED STATES</b>	90 (1.4)	543 (4.3)	9 (1.3)	474 (7.6)	1 (0.2)	--
<b>MISSOURI</b>	96 (0.5)	558 (6.3)	3 (0.4)	516 (16.2)	1 (0.2)	--
<b>OREGON</b>	93 (0.8)	569 (7.0)	6 (0.7)	503 (12.1)	1 (0.3)	--
<i>Australia</i>	91 (1.0)	553 (3.9)	7 (0.9)	500 (9.6)	1 (0.2)	--
<i>Austria</i>	89 (1.2)	565 (3.0)	8 (1.0)	474 (12.4)	3 (0.5)	513 (12.9)
<b>Belgium (Fl)</b>	87 (1.3)	554 (4.5)	9 (0.8)	527 (6.8)	4 (0.7)	519 (13.1)
<i>Belgium (Fr)</i>	90 (1.3)	476 (3.1)	8 (1.0)	420 (7.2)	2 (0.5)	--
<b>Canada</b>	90 (0.9)	537 (2.5)	9 (0.8)	485 (7.4)	1 (0.2)	--
<i>Colombia</i>	96 (0.5)	412 (3.8)	3 (0.5)	392 (9.7)	1 (0.2)	--
<b>Cyprus</b>	91 (0.7)	469 (2.1)	7 (0.6)	442 (8.0)	2 (0.4)	--
<b>Czech Republic</b>	99 (0.2)	575 (4.3)	1 (0.2)	--	0 (0.1)	--
<i>Denmark</i>	r 95 (1.0)	484 (3.0)	4 (0.9)	405 (12.6)	1 (0.3)	--
<b>England</b>	96 (0.7)	556 (3.7)	3 (0.7)	522 (14.1)	0 (0.1)	--
<b>France</b>	94 (0.6)	500 (2.6)	5 (0.6)	462 (8.2)	1 (0.2)	--
<i>Germany</i>	r 87 (1.2)	539 (4.5)	10 (1.0)	460 (8.8)	3 (0.4)	472 (15.9)
<i>Greece</i>	96 (0.5)	501 (2.3)	3 (0.3)	452 (7.4)	1 (0.3)	--
<b>Hong Kong</b>	r 2 (0.3)	--	65 (1.5)	531 (4.6)	33 (1.5)	525 (5.6)
<b>Hungary</b>	r 99 (0.3)	557 (2.9)	1 (0.2)	--	1 (0.2)	--
<b>Iceland</b>	96 (0.7)	494 (3.6)	3 (0.6)	516 (23.9)	1 (0.3)	--
<b>Iran, Islamic Rep.</b>	53 (2.8)	478 (2.9)	33 (2.2)	458 (4.8)	13 (1.3)	462 (5.5)
<b>Ireland</b>	98 (0.7)	540 (4.4)	2 (0.6)	--	1 (0.2)	--
<i>Israel</i>	87 (1.9)	529 (6.0)	10 (1.5)	510 (9.2)	3 (0.6)	540 (15.0)
<b>Japan</b>	--	--	--	--	--	--
<b>Korea</b>	96 (0.4)	567 (1.9)	3 (0.4)	523 (9.3)	0 (0.1)	--
<i>Kuwait</i>	52 (2.9)	429 (5.1)	34 (1.7)	429 (4.8)	14 (2.4)	440 (4.2)
<b>Latvia (LSS)</b>	98 (0.6)	486 (2.8)	2 (0.5)	--	0 (0.1)	--
<b>Lithuania</b>	98 (0.5)	477 (3.4)	1 (0.4)	--	0 (0.2)	--
<i>Netherlands</i>	91 (1.3)	563 (5.6)	7 (1.0)	534 (10.2)	2 (0.6)	--
<b>New Zealand</b>	91 (0.7)	532 (4.2)	8 (0.7)	477 (8.1)	1 (0.2)	--
<b>Norway</b>	r 94 (0.8)	533 (2.1)	4 (0.6)	468 (9.6)	2 (0.4)	--
<b>Portugal</b>	98 (0.3)	482 (2.5)	2 (0.3)	--	0 (0.1)	--
<i>Romania</i>	82 (2.0)	488 (4.9)	13 (1.0)	486 (10.2)	5 (1.7)	471 (15.5)
<b>Russian Federation</b>	97 (0.6)	540 (4.0)	2 (0.4)	--	1 (0.3)	--
<i>Scotland</i>	94 (0.6)	524 (5.3)	3 (0.4)	472 (9.7)	3 (0.4)	452 (11.6)
<b>Singapore</b>	20 (1.3)	636 (8.0)	71 (1.1)	601 (5.4)	9 (0.5)	594 (7.1)
<b>Slovak Republic</b>	89 (1.8)	547 (3.5)	9 (1.4)	523 (8.5)	2 (0.5)	--
<i>Slovenia</i>	93 (0.8)	563 (2.6)	5 (0.7)	518 (8.1)	1 (0.3)	--
<b>Spain</b>	79 (1.5)	519 (1.9)	9 (0.7)	520 (4.4)	12 (1.1)	506 (4.9)
<b>Sweden</b>	r 91 (1.1)	544 (3.0)	7 (0.9)	485 (8.6)	2 (0.3)	--
<b>Switzerland</b>	81 (1.4)	536 (2.5)	14 (0.9)	467 (4.5)	5 (0.9)	458 (10.2)
<i>Thailand</i>	75 (2.5)	528 (4.3)	19 (1.9)	519 (4.2)	6 (0.8)	518 (5.8)

\*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 for their beliefs about the importance of doing well in the academic subjects of science, mathematics, and language, respectively. For most of the countries, and for Missouri and Oregon, more than 80% of the students agreed or strongly agreed that it was important to do well in science. Compared to science, somewhat more students in some countries agreed or strongly agreed that it was important to do well in mathematics and language, although in Missouri and Oregon the figures were very similar.

For the most part, students indicated that their mothers' opinions about the importance of these academic activities corresponded very closely to their own feelings (Table 4.6). For example, in Missouri and Oregon, almost all students reported that their mothers agreed that it is important to do well in science, mathematics, and language. In contrast, however, students reported that their friends did not value academic success as highly as they themselves (Table 4.7).

For purposes of comparison, students also were asked about the importance of two non-academic activities – having time to have fun and being good at sports. In most countries, very high percentages of the students (more than 95%) felt it was important to have time to have fun (Table 4.5). In Missouri and Oregon the figure was 99%. 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 (86% in Missouri and 83% in Oregon).

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). In Missouri and Oregon the figure was 94%. According to students, their mothers considered being good at sports to be somewhat less important, although the level of agreement was still quite high.

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, and in Missouri and Oregon (Table 4.7). Internationally, students reported that their friends generally agreed that it was important to do well in sports (87% in Missouri and 86% in Oregon).



**Table 4.5**  
**Students' Reports on Whether They Agree or Strongly Agree That It Is Important to Do Various Activities - Science - Eighth Grade\***

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

\*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.

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

**Table 4.6**  
**Students' Reports on Whether Their Mothers Agree or Strongly Agree That It Is Important to Do Various Activities - Science - Eighth Grade\***

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

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

\*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.

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

## 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 students' reports about the average number of hours per day they spend studying or doing homework in science, mathematics, and other subjects. Students in most countries reported spending between half an hour and an hour per day studying science. Students in Missouri and Oregon both reported spending half an hour on science homework. On average, students in nearly all countries reported spending somewhat more time studying mathematics, roughly an hour per day in many countries. Students in Missouri reported .7 hours per day on average, and those in Oregon .8 hours.

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. Students in Oregon reported spending a little more time on homework on average, than the Missouri students (2.2 hours versus 1.9 hours), although both were below the average for the United States (2.3 hours).

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. 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<sup>1</sup>**  
**Science - Eighth Grade\***

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

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

<sup>1</sup>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.

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

**Table 4.9**  
**Students' Reports on How They Spend Their Daily Leisure Time<sup>1</sup>**  
**Science - 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
<b>UNITED STATES</b>	2.6 (0.07)	0.7 (0.03)	2.5 (0.06)	1.2 (0.04)	2.2 (0.05)	0.7 (0.02)
<b>MISSOURI</b>	2.6 (0.07)	0.7 (0.03)	2.6 (0.10)	1.3 (0.05)	2.0 (0.05)	0.6 (0.02)
<b>OREGON</b>	2.0 (0.08)	0.7 (0.04)	2.4 (0.07)	1.2 (0.05)	1.9 (0.06)	0.8 (0.03)
<i>Australia</i>	2.4 (0.05)	0.6 (0.02)	1.4 (0.03)	0.9 (0.02)	1.6 (0.03)	0.6 (0.02)
<i>Austria</i>	1.9 (0.06)	0.6 (0.03)	2.9 (0.08)	0.8 (0.03)	1.9 (0.07)	0.8 (0.03)
<b>Belgium (Fl)</b>	2.0 (0.05)	0.5 (0.06)	1.6 (0.05)	1.1 (0.03)	1.8 (0.07)	0.7 (0.03)
<i>Belgium (Fr)</i>	1.9 (0.08)	0.7 (0.03)	1.7 (0.10)	0.8 (0.03)	1.8 (0.04)	0.8 (0.03)
<b>Canada</b>	2.3 (0.04)	0.5 (0.02)	2.2 (0.05)	1.0 (0.02)	1.9 (0.03)	0.8 (0.02)
<i>Colombia</i>	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)
<b>Cyprus</b>	2.3 (0.04)	0.8 (0.03)	1.7 (0.04)	1.0 (0.03)	1.4 (0.04)	0.8 (0.02)
<b>Czech Republic</b>	2.6 (0.05)	0.6 (0.03)	2.9 (0.09)	1.3 (0.04)	1.9 (0.06)	1.0 (0.03)
<i>Denmark</i>	2.2 (0.06)	0.7 (0.03)	2.8 (0.07)	1.1 (0.04)	1.7 (0.06)	0.7 (0.03)
<b>England</b>	2.7 (0.07)	0.9 (0.05)	2.5 (0.06)	0.8 (0.03)	1.5 (0.05)	0.7 (0.03)
<b>France</b>	1.5 (0.04)	0.5 (0.02)	1.5 (0.05)	0.9 (0.03)	1.7 (0.04)	0.8 (0.03)
<i>Germany</i>	1.9 (0.04)	0.8 (0.04)	3.5 (0.07)	0.9 (0.02)	1.7 (0.04)	0.7 (0.02)
<i>Greece</i>	2.1 (0.04)	0.7 (0.03)	1.5 (0.04)	0.9 (0.03)	1.8 (0.04)	1.0 (0.03)
<b>Hong Kong</b>	2.6 (0.05)	0.8 (0.03)	1.2 (0.04)	0.7 (0.02)	0.9 (0.03)	0.9 (0.02)
<b>Hungary</b>	3.0 (0.06)	0.7 (0.03)	2.3 (0.05)	2.0 (0.04)	1.7 (0.04)	1.2 (0.04)
<b>Iceland</b>	2.2 (0.05)	r 0.7 (0.06)	3.1 (0.06)	0.8 (0.03)	1.8 (0.06)	0.9 (0.06)
<b>Iran, Islamic Rep.</b>	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)
<b>Ireland</b>	2.1 (0.03)	0.5 (0.03)	1.5 (0.06)	0.9 (0.03)	1.4 (0.05)	0.6 (0.02)
<i>Israel</i>	3.3 (0.10)	0.9 (0.04)	2.4 (0.08)	1.2 (0.05)	1.9 (0.09)	1.0 (0.04)
<b>Japan</b>	2.6 (0.04)	0.6 (0.02)	1.9 (0.04)	0.6 (0.01)	1.3 (0.03)	0.9 (0.02)
<b>Korea</b>	2.0 (0.04)	0.3 (0.02)	0.9 (0.03)	0.5 (0.02)	0.5 (0.02)	0.8 (0.03)
<i>Kuwait</i>	1.9 (0.09)	0.7 (0.04)	1.5 (0.06)	1.2 (0.06)	1.5 (0.06)	1.0 (0.04)
<b>Latvia (LSS)</b>	2.6 (0.05)	0.7 (0.04)	2.1 (0.06)	1.5 (0.04)	1.2 (0.04)	1.1 (0.03)
<b>Lithuania</b>	2.8 (0.05)	0.9 (0.04)	2.7 (0.06)	1.2 (0.03)	1.2 (0.04)	1.0 (0.03)
<i>Netherlands</i>	2.5 (0.09)	0.7 (0.04)	2.8 (0.08)	0.9 (0.04)	1.8 (0.06)	0.6 (0.03)
<b>New Zealand</b>	2.5 (0.05)	0.7 (0.03)	1.5 (0.04)	0.9 (0.02)	1.5 (0.04)	0.8 (0.02)
<b>Norway</b>	2.5 (0.04)	0.8 (0.03)	3.2 (0.06)	1.1 (0.03)	1.9 (0.05)	0.7 (0.02)
<b>Portugal</b>	2.0 (0.04)	0.7 (0.03)	1.7 (0.05)	1.0 (0.04)	1.7 (0.04)	0.7 (0.02)
<i>Romania</i>	1.9 (0.06)	0.6 (0.05)	1.5 (0.06)	1.9 (0.08)	1.3 (0.05)	1.3 (0.07)
<b>Russian Federation</b>	2.9 (0.05)	1.0 (0.04)	2.9 (0.05)	1.5 (0.03)	1.0 (0.03)	1.3 (0.04)
<i>Scotland</i>	2.7 (0.05)	1.0 (0.04)	2.8 (0.08)	0.7 (0.02)	1.9 (0.05)	0.7 (0.02)
<b>Singapore</b>	2.7 (0.05)	0.6 (0.03)	1.5 (0.04)	1.0 (0.03)	0.7 (0.03)	1.1 (0.02)
<b>Slovak Republic</b>	2.7 (0.05)	0.6 (0.03)	2.9 (0.07)	1.5 (0.05)	1.8 (0.04)	1.0 (0.03)
<i>Slovenia</i>	2.0 (0.04)	0.6 (0.02)	1.7 (0.05)	1.6 (0.05)	1.6 (0.03)	0.9 (0.02)
<b>Spain</b>	1.8 (0.05)	0.3 (0.02)	1.8 (0.06)	1.1 (0.03)	1.7 (0.04)	0.6 (0.02)
<b>Sweden</b>	2.3 (0.04)	0.6 (0.02)	2.3 (0.05)	0.9 (0.02)	1.6 (0.04)	0.7 (0.02)
<b>Switzerland</b>	1.3 (0.03)	0.4 (0.02)	2.4 (0.05)	1.0 (0.03)	1.8 (0.03)	0.8 (0.02)
<i>Thailand</i>	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.

<sup>1</sup>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 studying science on a normal school day and students' average science achievement. The relationship was curvilinear in many countries, including the United States, and Missouri and Oregon, with the highest achievement being associated with a moderate amount of homework per day (less than one hour). This 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. Only in Korea was a direct positive relationship between time spent doing homework and science achievement found. The only inverse relationship was noted for Denmark. Clearly, different countries have different policies and practices about assigning homework.

The relationship between science achievement and amount of time spent watching television each day was more consistent across countries than that spent doing homework (Table 4.11). In about half the TIMSS countries, including the United States, the highest science 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%). The extent of television viewing reported by students in Missouri was very similar to that reported by students in the United States in general, and the relationship with science achievement was also quite similar. Students in Oregon reported watching less television, and the relationship between viewing time and science achievement was more linear - higher achievement was associated with less television viewing.

That watching less than one hour of television per day generally was associated with lower average science achievement than watching one to two hours in many countries most likely has little to do with the influence of television viewing on science 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.

In general, beyond one to two hours of television viewing per day, the more television eighth graders reported watching, the lower their science achievement. In all countries students watching more than five hours of television per day had the lowest average science 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% of students reported watching more than five hours each day, and in Oregon 8% did.

**Table 4.10**  
**Students' Reports on Total Amount of Out-of-School Time Spent Studying Science or Doing Science Homework on a Normal School Day - Eighth Grade\***

Country	No Time		Less Than 1 Hour		One Hour or More		Average Hours <sup>1</sup>
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	
<b>UNITED STATES</b>	25 (1.3)	510 (8.6)	57 (1.3)	551 (3.8)	18 (0.7)	527 (5.5)	0.6 (0.01)
<b>MISSOURI</b>	30 (1.6)	547 (7.3)	57 (1.6)	566 (7.1)	14 (1.0)	538 (7.5)	0.5 (0.02)
<b>OREGON</b>	29 (2.2)	546 (7.6)	58 (1.7)	577 (7.4)	13 (1.0)	555 (13.0)	0.5 (0.03)
<i>Australia</i>	26 (1.3)	512 (5.2)	62 (1.1)	562 (3.7)	12 (0.6)	541 (6.4)	0.5 (0.01)
<i>Austria</i>	21 (1.4)	559 (6.8)	54 (1.4)	567 (3.7)	24 (1.3)	542 (5.0)	0.7 (0.03)
<b>Belgium (Fl)</b>	10 (1.0)	557 (5.9)	59 (1.4)	554 (5.3)	31 (1.4)	542 (4.2)	0.8 (0.02)
<i>Belgium (Fr)</i>	10 (0.8)	433 (5.5)	58 (1.4)	483 (3.1)	32 (1.4)	464 (4.3)	0.8 (0.02)
<b>Canada</b>	26 (1.6)	523 (4.7)	58 (1.5)	540 (2.5)	16 (1.0)	518 (4.3)	0.6 (0.02)
<i>Colombia</i>	6 (0.8)	401 (8.2)	45 (1.8)	421 (3.5)	49 (1.7)	413 (6.1)	1.2 (0.06)
<b>Cyprus</b>	20 (0.8)	438 (4.2)	50 (1.2)	475 (3.0)	30 (1.1)	469 (3.4)	0.9 (0.02)
<b>Czech Republic</b>	21 (1.5)	558 (5.0)	62 (1.1)	580 (4.3)	16 (1.0)	574 (6.2)	0.6 (0.02)
<i>Denmark</i>	57 (2.0)	488 (3.6)	34 (1.8)	476 (4.4)	9 (0.9)	446 (7.4)	0.3 (0.02)
<b>England</b>	--	--	--	--	--	--	--
<b>France</b>	19 (1.0)	481 (4.3)	64 (1.1)	504 (2.8)	17 (0.8)	499 (4.3)	0.6 (0.01)
<i>Germany</i>	19 (1.2)	508 (7.3)	65 (1.2)	546 (4.4)	16 (0.9)	516 (6.5)	0.6 (0.02)
<i>Greece</i>	16 (1.1)	474 (3.5)	35 (0.9)	507 (3.0)	49 (1.3)	502 (2.6)	1.2 (0.03)
<b>Hong Kong</b>	26 (1.5)	501 (6.2)	59 (1.4)	531 (4.2)	15 (0.7)	531 (6.9)	0.6 (0.02)
<b>Hungary</b>	8 (0.7)	516 (7.2)	48 (1.3)	555 (3.8)	45 (1.3)	560 (3.0)	1.1 (0.02)
<b>Iceland</b>	19 (2.2)	478 (6.0)	67 (1.9)	502 (4.5)	14 (1.3)	494 (9.1)	0.6 (0.03)
<b>Iran, Islamic Rep.</b>	1 (0.3)	~ ~	23 (1.5)	479 (3.6)	76 (1.6)	471 (2.6)	1.9 (0.05)
<b>Ireland</b>	17 (1.6)	490 (6.7)	67 (1.7)	552 (4.3)	16 (0.8)	545 (6.2)	0.6 (0.01)
<i>Israel</i>	23 (1.3)	511 (7.3)	60 (1.4)	541 (6.3)	17 (1.7)	515 (5.9)	0.6 (0.03)
<b>Japan</b>	25 (1.2)	555 (3.2)	56 (1.0)	577 (2.1)	18 (0.9)	575 (3.0)	0.6 (0.01)
<b>Korea</b>	30 (1.3)	548 (3.3)	52 (1.1)	569 (2.4)	18 (0.9)	584 (4.2)	0.6 (0.02)
<i>Kuwait</i>	4 (0.7)	406 (10.4)	41 (1.3)	433 (5.4)	55 (1.5)	431 (3.8)	1.5 (0.05)
<b>Latvia (LSS)</b>	17 (1.3)	477 (4.7)	66 (1.5)	492 (3.0)	16 (1.1)	484 (4.5)	0.6 (0.02)
<b>Lithuania</b>	13 (1.0)	465 (6.2)	66 (1.3)	484 (3.4)	21 (1.4)	473 (4.8)	0.7 (0.02)
<i>Netherlands</i>	6 (1.0)	532 (9.4)	81 (1.1)	566 (5.6)	13 (0.8)	537 (5.2)	0.6 (0.01)
<b>New Zealand</b>	19 (1.1)	502 (5.9)	68 (1.2)	537 (4.4)	13 (0.8)	515 (5.6)	0.6 (0.01)
<b>Norway</b>	11 (0.7)	511 (6.3)	76 (1.0)	533 (2.0)	14 (0.8)	515 (4.0)	0.6 (0.01)
<b>Portugal</b>	5 (0.5)	466 (6.4)	61 (1.1)	486 (2.7)	33 (1.2)	473 (3.0)	0.9 (0.02)
<i>Romania</i>	14 (0.9)	470 (8.5)	31 (1.1)	486 (5.7)	55 (1.6)	496 (5.2)	1.6 (0.06)
<b>Russian Federation</b>	8 (0.6)	515 (6.9)	49 (1.3)	542 (5.0)	43 (1.3)	542 (3.8)	1 (0.02)
<i>Scotland</i>	25 (1.6)	484 (5.5)	65 (1.5)	531 (5.9)	11 (0.8)	531 (6.0)	0.5 (0.01)
<b>Singapore</b>	6 (0.5)	576 (8.4)	21 (0.9)	625 (6.8)	73 (1.0)	605 (5.4)	1.3 (0.02)
<b>Slovak Republic</b>	11 (0.8)	543 (5.0)	63 (1.1)	547 (3.3)	26 (1.2)	542 (4.9)	0.8 (0.02)
<i>Slovenia</i>	8 (0.6)	559 (7.2)	50 (0.9)	571 (3.0)	42 (1.1)	548 (3.3)	1 (0.02)
<b>Spain</b>	6 (0.6)	489 (6.6)	48 (1.3)	524 (2.2)	46 (1.4)	514 (2.5)	1 (0.02)
<b>Sweden</b>	12 (0.9)	519 (5.7)	70 (1.0)	544 (2.9)	19 (0.8)	524 (5.0)	0.7 (0.01)
<b>Switzerland</b>	12 (0.6)	515 (5.0)	63 (1.3)	530 (3.2)	25 (1.1)	510 (3.8)	0.7 (0.01)
<i>Thailand</i>	7 (0.6)	510 (7.1)	48 (1.1)	525 (3.7)	45 (1.4)	530 (4.0)	1 (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.

<sup>1</sup>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**  
**Science - 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
<b>UNITED STATES</b>	22 (0.8)	542 (6.0)	40 (0.9)	548 (4.3)	25 (0.6)	533 (5.4)	13 (1.0)	493 (5.9)
<b>MISSOURI</b>	22 (1.1)	556 (7.9)	40 (1.6)	571 (6.0)	26 (1.1)	553 (7.4)	12 (0.9)	514 (8.4)
<b>OREGON</b>	32 (1.4)	575 (9.0)	42 (1.0)	569 (7.4)	19 (1.1)	560 (7.3)	8 (1.0)	519 (15.0)
<i>Australia</i>	24 (0.9)	556 (5.3)	41 (0.8)	554 (3.7)	27 (0.8)	541 (4.5)	9 (0.6)	502 (5.7)
<i>Austria</i>	25 (1.4)	562 (5.7)	53 (1.1)	561 (4.8)	17 (1.0)	558 (4.7)	5 (0.6)	522 (9.7)
<b>Belgium (Fl)</b>	24 (1.2)	563 (4.5)	52 (1.2)	556 (4.8)	19 (1.0)	526 (6.3)	5 (0.5)	517 (8.8)
<i>Belgium (Fr)</i>	33 (1.3)	480 (3.6)	44 (1.8)	476 (4.3)	17 (1.3)	467 (5.2)	6 (1.0)	413 (8.7)
<b>Canada</b>	22 (0.7)	528 (3.5)	46 (0.8)	536 (3.2)	25 (0.7)	535 (3.2)	7 (0.6)	508 (6.1)
<i>Colombia</i>	31 (1.5)	411 (4.3)	39 (1.2)	419 (4.5)	20 (1.2)	417 (7.3)	11 (1.0)	412 (6.2)
<b>Cyprus</b>	25 (1.1)	453 (3.6)	45 (1.1)	474 (2.4)	21 (0.8)	469 (4.0)	9 (0.7)	440 (5.1)
<b>Czech Republic</b>	15 (0.8)	578 (6.2)	45 (1.2)	581 (4.7)	31 (1.2)	571 (4.8)	9 (0.8)	546 (8.7)
<i>Denmark</i>	28 (1.1)	476 (3.9)	42 (1.2)	484 (4.3)	22 (1.0)	484 (4.9)	8 (0.7)	464 (7.8)
<b>England</b>	20 (1.3)	545 (9.8)	37 (1.2)	565 (4.9)	31 (1.2)	558 (4.2)	11 (0.9)	530 (7.5)
<b>France</b>	42 (1.3)	503 (3.6)	45 (1.1)	498 (2.9)	9 (0.7)	493 (4.9)	4 (0.5)	467 (7.3)
<i>Germany</i>	31 (1.0)	533 (6.0)	47 (1.1)	542 (4.9)	16 (0.8)	530 (6.5)	6 (0.6)	477 (9.2)
<i>Greece</i>	32 (0.9)	499 (2.7)	42 (0.7)	502 (3.1)	17 (0.7)	496 (3.6)	9 (0.5)	488 (4.9)
<b>Hong Kong</b>	22 (0.9)	520 (5.3)	39 (0.9)	529 (5.5)	28 (1.0)	526 (4.7)	11 (0.8)	506 (7.0)
<b>Hungary</b>	11 (0.7)	569 (5.9)	41 (1.1)	564 (3.6)	33 (0.9)	552 (3.7)	15 (1.0)	522 (5.0)
<b>Iceland</b>	24 (1.3)	485 (8.9)	47 (1.3)	496 (3.5)	22 (1.2)	504 (5.0)	7 (0.8)	492 (8.4)
<b>Iran, Islamic Rep.</b>	32 (1.3)	463 (3.4)	46 (0.9)	473 (2.9)	17 (0.9)	485 (6.1)	5 (0.6)	474 (6.7)
<b>Ireland</b>	20 (0.8)	530 (5.6)	51 (1.1)	546 (4.3)	23 (0.8)	546 (5.2)	5 (0.5)	501 (9.0)
<i>Israel</i>	9 (1.4)	507 (19.9)	33 (2.1)	538 (6.8)	44 (1.7)	532 (5.0)	14 (1.2)	513 (9.4)
<b>Japan</b>	9 (0.5)	579 (4.9)	53 (0.9)	578 (2.3)	30 (0.8)	564 (2.3)	9 (0.5)	547 (4.8)
<b>Korea</b>	32 (1.0)	574 (3.2)	40 (1.0)	569 (2.6)	20 (0.8)	555 (4.5)	7 (0.6)	534 (6.1)
<i>Kuwait</i>	39 (2.1)	425 (4.0)	38 (1.3)	435 (4.9)	14 (1.2)	441 (6.1)	9 (1.0)	420 (7.6)
<b>Latvia (LSS)</b>	16 (1.0)	473 (5.0)	44 (1.1)	487 (3.4)	29 (1.2)	497 (3.9)	10 (0.7)	477 (5.0)
<b>Lithuania</b>	12 (0.7)	469 (7.2)	44 (1.3)	485 (3.8)	32 (1.2)	476 (4.1)	12 (0.9)	467 (5.8)
<i>Netherlands</i>	17 (1.8)	562 (11.5)	47 (1.7)	572 (4.7)	27 (1.5)	550 (6.2)	9 (0.9)	527 (6.1)
<b>New Zealand</b>	24 (1.0)	530 (5.8)	38 (0.9)	538 (4.8)	26 (0.9)	525 (5.1)	12 (0.8)	489 (5.5)
<b>Norway</b>	15 (0.7)	536 (4.7)	48 (1.0)	534 (2.2)	30 (1.0)	523 (3.5)	7 (0.4)	496 (6.1)
<b>Portugal</b>	27 (1.0)	474 (3.6)	48 (0.9)	481 (2.8)	20 (0.8)	488 (3.0)	5 (0.5)	471 (5.8)
<i>Romania</i>	38 (1.4)	479 (7.2)	39 (1.2)	493 (5.6)	16 (0.9)	503 (6.0)	8 (0.7)	475 (7.3)
<b>Russian Federation</b>	12 (1.0)	526 (6.7)	42 (1.4)	540 (4.4)	32 (1.0)	544 (4.2)	14 (0.9)	538 (6.2)
<i>Scotland</i>	15 (0.7)	509 (8.1)	43 (1.0)	525 (6.4)	31 (1.0)	525 (5.4)	11 (0.7)	491 (5.4)
<b>Singapore</b>	7 (0.6)	633 (8.5)	50 (1.1)	615 (6.2)	37 (1.2)	597 (5.4)	6 (0.5)	582 (6.5)
<b>Slovak Republic</b>	14 (0.7)	558 (6.4)	47 (1.0)	548 (3.5)	28 (0.9)	545 (4.5)	11 (0.8)	521 (5.5)
<i>Slovenia</i>	23 (1.1)	568 (3.9)	54 (1.1)	559 (2.9)	19 (0.9)	558 (3.5)	4 (0.4)	547 (8.7)
<b>Spain</b>	33 (1.2)	514 (2.8)	46 (1.0)	522 (2.2)	17 (0.8)	517 (3.6)	4 (0.5)	496 (6.0)
<b>Sweden</b>	16 (0.7)	540 (5.2)	51 (0.9)	543 (3.1)	27 (0.8)	531 (4.1)	6 (0.5)	490 (5.5)
<b>Switzerland</b>	45 (1.5)	534 (3.9)	44 (1.3)	518 (3.2)	9 (0.7)	502 (5.2)	2 (0.2)	~ ~
<i>Thailand</i>	28 (1.4)	518 (3.8)	46 (1.0)	527 (4.0)	19 (1.1)	534 (4.8)	8 (0.7)	524 (5.9)

\*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.

## How Do Students Perceive Success in the Sciences?

Table 4.12 presents eighth-grade students' perceptions about doing well in the sciences. The results for each country are reported for either integrated science or separately for the science subject areas of biological science, earth science and physical science, depending on the form of the student questionnaire used (the integrated science version was used in the United States, and in Missouri and Oregon). In all but three countries (Hong Kong, Japan, and Korea), the majority of students agreed or strongly agreed that they did well in either integrated science or in all of the science subject areas. Interestingly, two of these three countries where fewer than half of students thought they did well in science, Japan (45%) and Korea (35%), were among the highest performing countries on the TIMSS science test. In the United States, 86% of eighth-grade students reported doing well in science. Missouri and Oregon both had very similar results (87%).

Figure 4.2 indicates that for most countries, both boys and girls tended to agree that they did well in the sciences – a perception that did not always coincide with their achievement on the TIMSS science test. Among the countries that administered the integrated science form of the questionnaire, girls in England, Hong Kong, Japan, New Zealand, Norway, Scotland, Singapore, and Switzerland reported significantly lower self-perceptions than boys about doing well in science. There was no difference in the self-perceptions of boys and girls in the United States in general, or in Missouri or Oregon.

**Table 4.12**  
**Students' Reports on Their Self-Perceptions About Usually Doing Well**  
**in the Sciences<sup>1</sup> - Eighth Grade\***

Country	Percent of Students Responding Agree or Strongly Agree			
	Science (Integrated)	Science Subject Areas		
		Biological Science	Earth Science	Physical Science
<b>UNITED STATES</b>	86 (0.7)	..	..	..
<b>MISSOURI</b>	87 (1.2)	..	..	..
<b>OREGON</b>	87 (1.3)	..	..	..
<i>Australia</i>	77 (1.0)	..	..	..
<i>Austria</i>	..	84 (1.2)	76 (1.4)	70 (1.5)
<b>Belgium (Fl)</b>	..	71 (2.4)	65 (2.7)	56 (3.8)
<i>Belgium (Fr)</i>	s 85 (1.9)	..	..	..
<b>Canada</b>	82 (1.2)	..	..	..
<i>Colombia</i>	91 (0.8)	..	..	..
<b>Cyprus</b>	76 (1.2)	..	..	..
<b>Czech Republic</b>	..	82 (2.0)	84 (1.1)	69 (2.0)
<i>Denmark</i>	..	79 (1.0)	78 (1.3)	72 (1.3)
<b>England</b>	88 (1.0)	..	..	..
<sup>2</sup> <b>France</b>	..	71 (1.5)	..	74 (1.7)
<i>Germany</i>	..	79 (1.1)	70 (1.3)	63 (1.6)
<i>Greece</i>	..	..	..	81 (0.9)
<b>Hong Kong</b>	43 (1.6)	..	..	..
<b>Hungary</b>	..	82 (1.2)	76 (1.3)	63 (1.5)
<b>Iceland</b>	..	81 (1.6)	s 60 (1.8)	72 (1.5)
<b>Iran, Islamic Rep.</b>	95 (0.5)	..	..	..
<b>Ireland</b>	74 (1.6)	..	..	..
<i>Israel</i>	84 (1.3)	..	..	..
<b>Japan</b>	45 (0.9)	..	..	..
<b>Korea</b>	35 (1.1)	..	..	..
<i>Kuwait</i>	89 (1.0)	..	..	..
<b>Latvia (LSS)</b>	..	74 (1.2)	..	72 (1.4)
<b>Lithuania</b>	..	85 (1.0)	61 (1.7)	60 (1.8)
<i>Netherlands</i>	..	r 83 (1.4)	81 (1.7)	83 (1.6)
<b>New Zealand</b>	80 (0.9)	..	..	..
<b>Norway</b>	80 (1.1)	..	..	..
<sup>3</sup> <b>Portugal</b>	..	72 (1.3)	..	68 (1.5)
<i>Romania</i>	..	77 (1.1)	77 (1.3)	69 (1.3)
<b>Russian Federation</b>	..	84 (1.4)	74 (1.6)	70 (1.3)
<i>Scotland</i>	84 (0.9)	..	..	..
<b>Singapore</b>	73 (1.2)	..	..	..
<b>Slovak Republic</b>	..	89 (0.8)	91 (0.7)	78 (1.2)
<i>Slovenia</i>	..	86 (1.2)	..	82 (1.1)
<b>Spain</b>	80 (1.2)	..	..	..
<b>Sweden</b>	..	82 (0.9)	83 (0.8)	77 (1.1)
<b>Switzerland</b>	76 (1.2)	..	..	..
<i>Thailand</i>	67 (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 more information about the grades tested in each country.

<sup>1</sup>Countries administered either an integrated science or separate subject area form of the questionnaire. A dot (.) denotes questions not administered by design. Percentages for separate science subject areas are based only on those students taking each subject.

<sup>2</sup>Biological science data for France are for students taking biology/geology classes.

<sup>3</sup>Biological science data for Portugal are for students taking natural science classes.

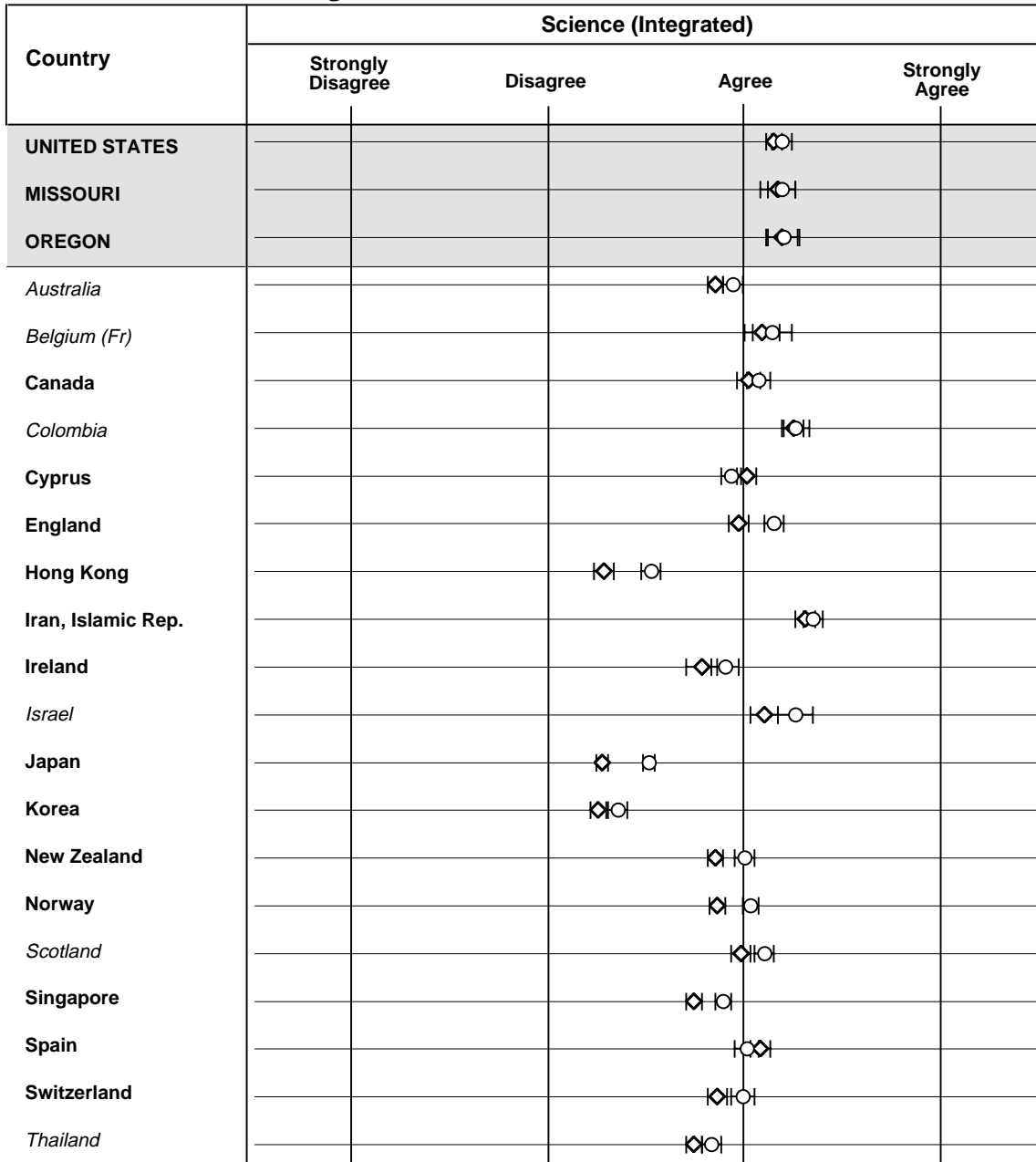
Countries shown in italics did not satisfy one or more guidelines for sample participation rates or student sampling (see Figure 1).

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

**Figure 4.2**  
**Gender Differences in Students' Self-Perceptions About Usually Doing Well in the Sciences<sup>1</sup> - Eighth Grade\***



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

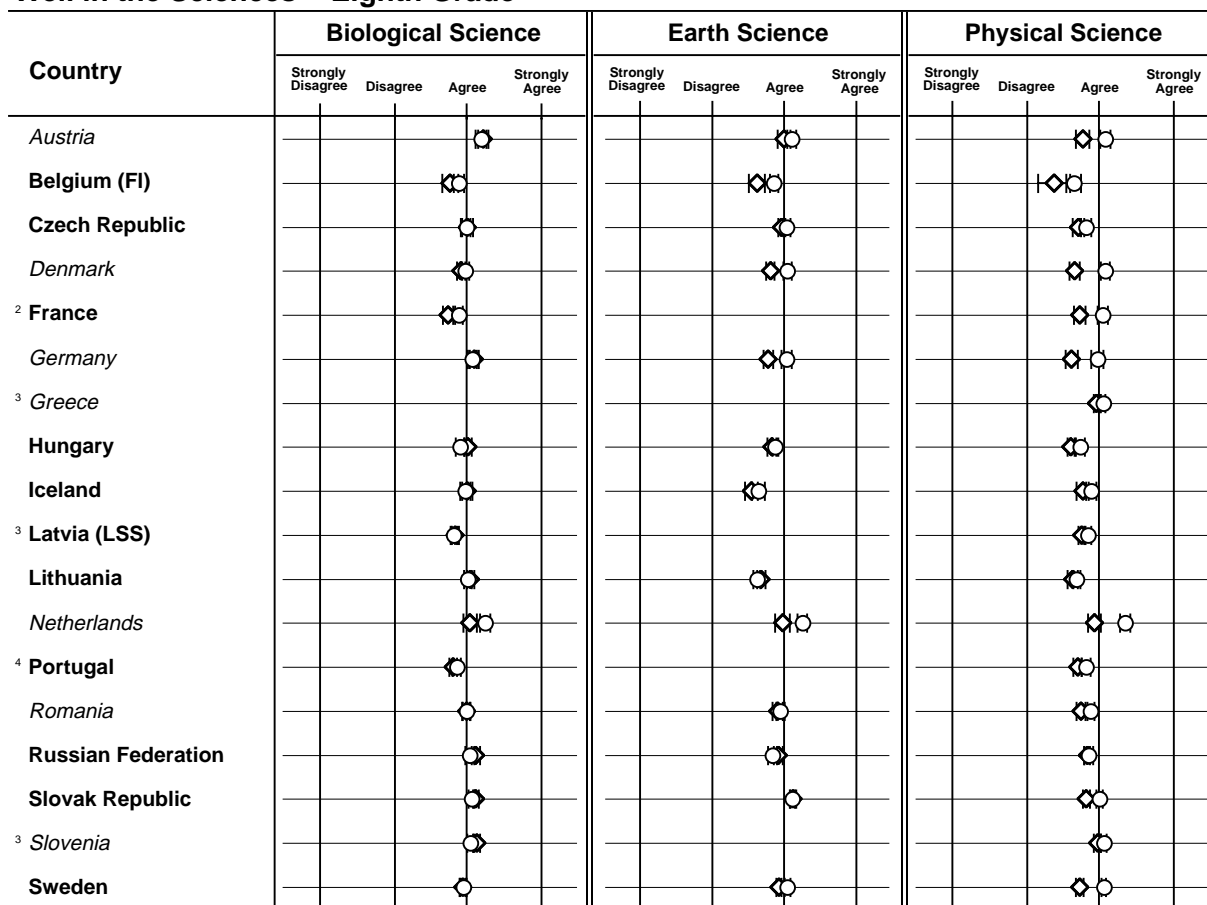
⊠ = Average for Girls (±2SE)  
 ⊠ = Average for Boys (±2SE)

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

<sup>1</sup>Countries administered either an integrated science or separate subject area form of the questionnaire. Percentages for separate science subject areas are based only on those students taking each subject.

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 4.2 (Continued)**  
**Gender Differences in Students' Self-Perceptions About Usually Doing Well in the Sciences<sup>1</sup> - Eighth Grade\***



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

○ = Average for Girls (±2SE)  
 ○ = Average for Boys (±2SE)

\*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.  
<sup>1</sup>Countries administered either an integrated science or separate subject area form of the questionnaire. Percentages for separate science subject areas are based only on those students taking each subject.  
<sup>2</sup>Biological science data for France are for students taking biology/geology classes.  
<sup>3</sup>Greece, Latvia, and Slovenia did not ask about all three science subjects.  
<sup>4</sup>Biological science data for Portugal are for students taking natural science classes.  
 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.

Students were asked about the necessity of various attributes or activities to do well in science (see Table 4.13). These included attributes outside of students' control, such as natural talent and ability, and good luck, and attributes within their control, such as lots of hard work studying, and memorization of textbooks or notes. There was enormous variation from country to country in the percentage of students agreeing that natural talent or ability were important to do well in science. Fewer than 50% of the students agreed in the Czech Republic, England, France, Iceland, the Netherlands, and Sweden compared to 90% or more in Colombia, Iran, and Kuwait. In Missouri and Oregon, and in the United States generally, about half of the students agreed that talent and ability were important. Internationally, relatively few students agreed that good luck was important to do well. The countries where more than 50% of the students agreed that good luck was needed to do well in science included Colombia, the Czech Republic, Hungary, Iran, Japan, Korea, Kuwait, Latvia (LSS), Lithuania, Romania, the Russian Federation, and the Slovak Republic. About one third of the students in Missouri, Oregon, and the United States generally agreed that good luck was important.

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 science. Percentages of agreement were in the 80s and 90s for most countries, including the United States, and Missouri and Oregon, and in the 70s for Austria, Hungary, Lithuania, and Switzerland. 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, Iran, Japan, Korea, Kuwait, and Thailand, 90% or more of the eighth-grade students agreed or strongly agreed that memorization was important to doing well in science. In contrast, fewer than 50% agreed in Latvia (LSS), Lithuania, and Sweden. About two-thirds of students in the United States and Missouri agreed that memorization was important, and in Oregon 56% so agreed. These results suggest that a greater percentage of students in Missouri and Oregon, and in the United States generally, believe that doing well in science is more related to factors within their control (such as studying or memorizing) and less to factors outside of their control, such as natural talent or good luck.

**Table 4.13**  
**Students' Reports on Things Necessary to Do Well in the Sciences**  
**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
<b>UNITED STATES</b>	51 (0.8)	34 (1.3)	90 (0.6)	66 (1.0)
<b>MISSOURI</b>	52 (1.5)	32 (1.7)	88 (0.8)	63 (1.2)
<b>OREGON</b>	47 (1.4)	29 (1.6)	86 (1.1)	56 (1.3)
<i>Australia</i>	66 (0.8)	33 (0.8)	91 (0.5)	71 (0.9)
<i>Austria</i>	61 (1.5)	31 (1.3)	78 (1.4)	65 (1.2)
<b>Belgium (Fl)</b>	53 (1.5)	24 (1.8)	85 (0.9)	63 (1.9)
<i>Belgium (Fr)</i>	67 (1.2)	25 (1.1)	94 (0.7)	94 (0.6)
<b>Canada</b>	61 (1.0)	30 (1.0)	89 (0.7)	52 (1.0)
<i>Colombia</i>	91 (0.7)	64 (1.5)	97 (0.4)	79 (1.2)
<b>Cyprus</b>	51 (1.0)	34 (0.9)	93 (0.6)	76 (0.9)
<b>Czech Republic</b>	45 (1.0)	55 (1.2)	82 (1.2)	59 (1.4)
<i>Denmark</i>	89 (0.6)	35 (1.3)	82 (1.2)	65 (1.4)
<b>England</b>	47 (1.4)	25 (1.0)	93 (0.6)	56 (1.0)
<b>France</b>	38 (1.3)	23 (1.1)	88 (0.8)	95 (0.8)
<i>Germany</i>	57 (1.5)	28 (1.2)	82 (1.1)	70 (1.0)
<i>Greece</i>	58 (1.0)	27 (0.9)	96 (0.4)	87 (0.6)
<b>Hong Kong</b>	74 (0.9)	38 (1.0)	96 (0.5)	84 (0.7)
<b>Hungary</b>	88 (0.7)	56 (1.1)	79 (0.9)	57 (1.3)
<b>Iceland</b>	36 (1.4)	26 (1.6)	90 (0.9)	95 (0.8)
<b>Iran, Islamic Rep.</b>	95 (0.7)	51 (2.3)	97 (0.4)	91 (0.7)
<b>Ireland</b>	70 (1.0)	32 (1.1)	95 (0.6)	78 (0.9)
<i>Israel</i>	53 (1.9)	19 (1.8)	95 (0.9)	54 (2.1)
<b>Japan</b>	82 (0.6)	60 (1.0)	97 (0.3)	97 (0.3)
<b>Korea</b>	85 (0.7)	62 (1.0)	98 (0.2)	94 (0.4)
<i>Kuwait</i>	90 (1.3)	78 (1.5)	83 (1.0)	92 (0.6)
<b>Latvia (LSS)</b>	50 (1.2)	61 (1.2)	87 (0.8)	42 (1.3)
<b>Lithuania</b>	76 (1.0)	68 (1.1)	76 (1.1)	31 (1.2)
<i>Netherlands</i>	46 (1.4)	25 (1.6)	93 (0.8)	67 (1.2)
<b>New Zealand</b>	63 (1.1)	29 (1.2)	92 (0.5)	75 (1.0)
<b>Norway</b>	84 (0.7)	22 (0.9)	92 (0.6)	81 (0.9)
<b>Portugal</b>	72 (1.1)	39 (1.3)	98 (0.2)	66 (1.3)
<i>Romania</i>	64 (1.1)	59 (1.3)	86 (0.9)	78 (1.1)
<b>Russian Federation</b>	77 (0.7)	53 (1.7)	87 (0.9)	66 (1.8)
<i>Scotland</i>	--	--	--	--
<b>Singapore</b>	86 (0.7)	40 (0.9)	98 (0.3)	87 (0.8)
<b>Slovak Republic</b>	61 (1.1)	52 (1.1)	92 (0.6)	55 (1.2)
<i>Slovenia</i>	75 (1.0)	41 (1.4)	90 (0.6)	--
<b>Spain</b>	66 (1.1)	35 (1.0)	96 (0.4)	79 (1.0)
<b>Sweden</b>	45 (1.0)	26 (1.1)	87 (0.6)	42 (1.0)
<b>Switzerland</b>	56 (1.2)	25 (0.7)	75 (1.1)	58 (1.5)
<i>Thailand</i>	69 (1.1)	35 (1.3)	80 (0.8)	97 (0.3)

\*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.

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

Students also were asked about why they need to do well in the sciences. Depending on which questionnaire each country used, the results are reported for either integrated science or the separate science subject areas of biology, chemistry, earth science, and physics. Students could agree with any or all of three areas of possible motivation presented in Table 4.14 (to get their desired job), in Table 4.15 (to get into their preferred university or secondary school) and in Table 4.16 (to please their parents). There were substantial differences from country to country in students' responses for the three motivational factors.

As indicated in Table 4.14, the majority of eighth-grade students in many countries asked about integrated science either agreed or strongly agreed that getting their desired job was a motivating factor, although there were several countries where only slightly more than half of the students agreed. Eighty-five percent or more of students agreed in Iran (90%), Kuwait (85%), and Thailand (94%), compared to fewer than half of the students in Austria (38%), Japan (40%), Korea (44%), Norway (47%), and Switzerland (33%). About two-thirds of students in Missouri and Oregon, and in the United States generally, agreed or strongly agreed that they need to do well in the sciences to get their desired job.

Compared to the integrated-science students, in general, fewer students in the countries asking about separate science subject areas agreed with the need to do well to get their desired job. Fewer than 60% of students in nearly all of these countries (primarily in Europe) agreed for any of the science subject areas that this was a reason to do well. In particular, fewer than 30% of students in Belgium (Flemish) and Hungary agreed for any subject, and only in Greece, Latvia (LSS), Lithuania, and Romania, did 50% or more of students agree for all subject areas. At the eighth grade, it appears that many students in these countries do not make a connection between getting a job they want and their performance in specific science subject areas. While this may be due to fewer students in these countries desiring jobs that use a particular science, it is also very likely that many students in this age group do not yet have a clear conception of either the type of job they want to pursue or the specific science education requirements for different jobs.

In the majority of countries, pleasing their parents and getting into their preferred university or secondary school were both stronger motivators than getting their desired job for eighth-grade students in either integrated science or separate science subject areas (Table 4.16). However, 40% or fewer students in Denmark, Iceland, Japan, Lithuania (biology and chemistry), and Slovenia agreed that doing well was important in order to please their parents.

For eighth-grade students in Missouri and Oregon, as well as for students in the United States in general, the most important reason for doing well in science was to get into their preferred university or secondary school (Table 4.15). Almost 90% of these students reported that this was an important reason for doing well. Most U.S. students also agreed that pleasing their parents was an important reason (79% in the United States and in Missouri, and 80% in Oregon). Students in the United States were less in agreement with the need to do well in science to get their desired job, with about only about two-thirds agreeing that this was important.



**Table 4.14**  
**Students' Perceptions About the Need To Do Well in the Sciences To Get Their Desired Job<sup>1</sup> - Eighth Grade\***

Country	Percent of Students Responding Agree or Strongly Agree							
	Science (Integrated)	Science Subject Areas						
		Biology	Chemistry	Earth Science	Physics			
<b>UNITED STATES</b>	65 (0.9)	..	..	..	..			
<b>MISSOURI</b>	66 (1.4)	..	..	..	..			
<b>OREGON</b>	63 (1.3)	..	..	..	..			
<i>Australia</i>	52 (1.0)	..	..	..	..			
<i>Austria</i>	38 (1.4)	..	..	..	..			
<b>Belgium (Fl)</b>	..	28 (1.4)	..	18 (0.8)	x x			
<sup>2</sup> <i>Belgium (Fr)</i>	53 (2.3)	x x	..	..	x x			
<b>Canada</b>	63 (1.2)	..	..	..	..			
<i>Colombia</i>	74 (1.3)	..	..	..	..			
<b>Cyprus</b>	57 (1.3)	..	..	..	..			
<b>Czech Republic</b>	..	36 (1.0)	40 (1.3)	42 (1.2)	48 (1.5)			
<sup>3</sup> <i>Denmark</i>	..	31 (1.3)	..	32 (1.4)	37 (1.1)			
<b>England</b>	62 (1.5)	..	..	..	..			
<sup>4</sup> <b>France</b>	..	36 (1.1)	..	..	39 (1.3)			
<i>Germany</i>	..	33 (1.1)	s	32 (1.9)	34 (1.2)			
<i>Greece</i>	..	..	60 (0.8)	54 (0.9)	70 (0.8)			
<b>Hong Kong</b>	55 (1.0)	..	..	..	..			
<b>Hungary</b>	..	26 (1.1)	20 (0.9)	19 (0.9)	25 (0.9)			
<b>Iceland</b>	..	44 (1.6)	x x	x x	s	46 (1.7)		
<b>Iran, Islamic Rep.</b>	90 (1.0)	..	..	..	..			
<b>Ireland</b>	50 (1.2)	..	..	..	..			
<i>Israel</i>	51 (1.9)	..	..	..	..			
<b>Japan</b>	40 (0.7)	..	..	..	..			
<b>Korea</b>	44 (1.0)	..	..	..	..			
<i>Kuwait</i>	85 (1.3)	..	..	..	..			
<b>Latvia (LSS)</b>	..	50 (1.3)	54 (1.2)	..	61 (1.3)			
<b>Lithuania</b>	..	52 (1.5)	53 (1.3)	55 (1.3)	59 (1.2)			
<sup>5</sup> <i>Netherlands</i>	..	r	39 (1.9)	..	22 (1.4)	36 (1.7)		
<b>New Zealand</b>	55 (1.1)	..	..	..	..			
<b>Norway</b>	47 (1.1)	..	..	..	..			
<sup>6</sup> <b>Portugal</b>	..	55 (1.2)	..	..	49 (1.1)			
<i>Romania</i>	..	59 (1.3)	55 (1.4)	57 (1.4)	57 (1.2)			
<b>Russian Federation</b>	..	45 (1.1)	46 (0.9)	44 (1.2)	55 (0.9)			
<i>Scotland</i>	65 (1.1)	..	..	..	..			
<b>Singapore</b>	71 (1.4)	..	..	..	..			
<b>Slovak Republic</b>	..	36 (1.2)	31 (1.0)	34 (1.0)	42 (1.2)			
<i>Slovenia</i>	..	37 (1.4)	38 (1.4)	..	45 (1.4)			
<b>Spain</b>	65 (1.0)	..	..	..	..			
<b>Sweden</b>	..	36 (1.2)	s	38 (1.5)	r	47 (1.1)	r	45 (1.1)
<b>Switzerland</b>	33 (0.9)	..	..	..	..			
<i>Thailand</i>	94 (0.5)	..	..	..	..			

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

<sup>1</sup>Countries administered either an integrated science or separate subject area form of the questionnaire. A dot (.) denotes questions not administered by design. Percentages for separate science subject areas are based only on those students taking each subject.

<sup>2</sup>Data for Belgium (Fr) are reported for students in both integrated science classes and separate biology and physics classes.

<sup>3</sup>Physics data for Denmark are for students taking physics/chemistry classes.

<sup>4</sup>Biology data for France are for students taking biology/geology classes; physics data are for students taking physics/chemistry classes.

<sup>5</sup>Physics data for the Netherlands include students in both physics classes and physics/chemistry classes.

<sup>6</sup>Biology data for Portugal are for students taking natural science classes; physics data are for students taking physical science classes.

( ) 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. An "s" indicates a 50-69% student response rate.

An "x" indicates a <50% student response rate.

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

**Table 4.15**  
**Students' Perceptions About the Need To Do Well in the Sciences To Get Into Their Preferred University or Secondary School<sup>1</sup> - Eighth Grade\***

Country	Percent of Students Responding Agree or Strongly Agree				
	Science (Integrated)	Science Subject Areas			
		Biology	Chemistry	Earth Science	Physics
<b>UNITED STATES</b>	89 (0.6)	..	..	..	..
<b>MISSOURI</b>	88 (1.0)	..	..	..	..
<b>OREGON</b>	88 (1.0)	..	..	..	..
<i>Australia</i>	59 (1.0)	..	..	..	..
<i>Austria</i>	48 (1.5)	..	..	..	..
<b>Belgium (Fl)</b>	..	38 (1.5)	..	28 (1.2)	x x
<sup>2</sup> <i>Belgium (Fr)</i>	s 59 (2.6)	x x	..	..	x x
<b>Canada</b>	81 (0.9)	..	..	..	..
<i>Colombia</i>	87 (0.8)	..	..	..	..
<b>Cyprus</b>	68 (1.1)	..	..	..	..
<b>Czech Republic</b>	..	57 (1.1)	57 (1.3)	55 (1.2)	61 (1.5)
<sup>3</sup> <i>Denmark</i>	..	49 (1.4)	..	r 55 (1.5)	59 (1.5)
<b>England</b>	75 (1.2)	..	..	..	..
<sup>4</sup> <b>France</b>	..	57 (1.1)	..	..	59 (1.1)
<i>Germany</i>	..	36 (1.4)	s 35 (1.8)	..	35 (1.3)
<i>Greece</i>	..	..	77 (1.1)	67 (0.9)	77 (0.6)
<b>Hong Kong</b>	74 (0.9)	..	..	..	..
<b>Hungary</b>	..	63 (1.2)	61 (1.3)	61 (1.2)	63 (1.4)
<b>Iceland</b>	..	76 (1.6)	x x	x x	s 70 (1.6)
<b>Iran, Islamic Rep.</b>	93 (0.5)	..	..	..	..
<b>Ireland</b>	66 (1.3)	..	..	..	..
<i>Israel</i>	83 (1.2)	..	..	..	..
<b>Japan</b>	86 (0.8)	..	..	..	..
<b>Korea</b>	80 (0.8)	..	..	..	..
<i>Kuwait</i>	86 (1.3)	..	..	..	..
<b>Latvia (LSS)</b>	..	69 (1.2)	70 (1.2)	..	71 (1.1)
<b>Lithuania</b>	..	57 (1.2)	57 (1.3)	59 (1.0)	61 (1.3)
<sup>5</sup> <i>Netherlands</i>	..	r 47 (1.5)	..	29 (1.4)	42 (1.9)
<b>New Zealand</b>	60 (1.0)	..	..	..	..
<b>Norway</b>	64 (1.0)	..	..	..	..
<sup>6</sup> <b>Portugal</b>	..	71 (1.0)	..	..	65 (1.2)
<i>Romania</i>	..	64 (1.2)	61 (1.2)	61 (1.3)	60 (1.2)
<b>Russian Federation</b>	..	62 (1.1)	64 (1.0)	59 (1.1)	67 (0.9)
<i>Scotland</i>	71 (1.2)	..	..	..	..
<b>Singapore</b>	93 (0.5)	..	..	..	..
<b>Slovak Republic</b>	..	49 (1.2)	44 (1.2)	43 (1.1)	52 (1.0)
<i>Slovenia</i>	..	55 (1.3)	54 (1.5)	..	58 (1.3)
<b>Spain</b>	78 (0.8)	..	..	..	..
<b>Sweden</b>	..	54 (1.1)	s 53 (1.1)	r 58 (0.9)	r 56 (0.9)
<b>Switzerland</b>	43 (0.9)	..	..	..	..
<i>Thailand</i>	97 (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.

<sup>1</sup>Countries administered either an integrated science or separate subject area form of the questionnaire. A dot (.) denotes questions not administered by design. Percentages for separate science subject areas are based only on those students taking each subject.<sup>2</sup>Data for Belgium (Fr) are reported for students in both integrated science classes and separate biology and physics classes.<sup>3</sup>Physics data for Denmark are for students taking physics/chemistry classes.<sup>4</sup>Biology data for France are for students taking biology/geology classes; physics data are for students taking physics/chemistry classes.<sup>5</sup>Physics data for the Netherlands include students in both physics classes and physics/chemistry classes.<sup>6</sup>Biology data for Portugal are for students taking natural science classes; physics data are for students taking physical science classes.

() 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. An "s" indicates a 50-69% student response rate.

An "x" indicates a &lt;50% student response rate.

**Table 4.16**  
**Students' Perceptions About the Need To Do Well in the Sciences To Please**  
**Their Parents<sup>1</sup> - Eighth Grade\***

Country	Percent of Students Responding Agree or Strongly Agree				
	Science (Integrated)	Science Subject Areas			
		Biology	Chemistry	Earth Science	Physics
<b>UNITED STATES</b>	79 (0.7)	..	..	..	..
<b>MISSOURI</b>	79 (0.9)	..	..	..	..
<b>OREGON</b>	80 (0.9)	..	..	..	..
<i>Australia</i>	66 (0.8)	..	..	..	..
<i>Austria</i>	48 (1.3)	..	..	..	..
<b>Belgium (Fl)</b>	..	66 (1.0)	..	67 (1.1)	x x
<sup>2</sup> <i>Belgium (Fr)</i>	s 73 (2.1)	x x	..	..	x x
<b>Canada</b>	63 (1.3)	..	..	..	..
<i>Colombia</i>	75 (1.4)	..	..	..	..
<b>Cyprus</b>	65 (1.1)	..	..	..	..
<b>Czech Republic</b>	..	80 (1.1)	81 (1.1)	82 (1.1)	83 (1.0)
<sup>3</sup> <i>Denmark</i>	..	27 (1.4)	..	30 (1.5)	30 (1.4)
<b>England</b>	63 (1.4)	..	..	..	..
<sup>4</sup> <b>France</b>	..	48 (1.3)	..	..	52 (1.3)
<i>Germany</i>	..	41 (1.3)	s 48 (1.5)	..	46 (1.2)
<i>Greece</i>	..	..	73 (0.9)	74 (0.9)	76 (0.8)
<b>Hong Kong</b>	56 (1.0)	..	..	..	..
<b>Hungary</b>	..	41 (1.1)	41 (1.1)	43 (1.2)	46 (1.2)
<b>Iceland</b>	..	37 (1.7)	x x	x x	s 38 (1.9)
<b>Iran, Islamic Rep.</b>	95 (0.6)	..	..	..	..
<b>Ireland</b>	56 (1.0)	..	..	..	..
<i>Israel</i>	47 (2.1)	..	..	..	..
<b>Japan</b>	33 (0.8)	..	..	..	..
<b>Korea</b>	53 (1.2)	..	..	..	..
<i>Kuwait</i>	93 (1.0)	..	..	..	..
<b>Latvia (LSS)</b>	..	71 (1.3)	77 (1.1)	..	77 (1.2)
<b>Lithuania</b>	..	36 (1.4)	39 (1.3)	41 (1.2)	45 (1.4)
<sup>5</sup> <i>Netherlands</i>	..	r 49 (2.0)	..	50 (1.7)	52 (1.8)
<b>New Zealand</b>	61 (0.9)	..	..	..	..
<b>Norway</b>	48 (1.1)	..	..	..	..
<sup>6</sup> <b>Portugal</b>	..	64 (1.2)	..	..	63 (1.2)
<i>Romania</i>	..	61 (1.4)	62 (1.4)	62 (1.3)	63 (1.2)
<b>Russian Federation</b>	..	62 (1.1)	63 (1.3)	64 (1.3)	67 (1.4)
<i>Scotland</i>	60 (1.2)	..	..	..	..
<b>Singapore</b>	68 (1.0)	..	..	..	..
<b>Slovak Republic</b>	..	64 (1.2)	64 (1.1)	68 (1.2)	68 (1.2)
<i>Slovenia</i>	..	33 (1.3)	33 (1.4)	..	37 (1.3)
<b>Spain</b>	83 (0.9)	..	..	..	..
<b>Sweden</b>	..	40 (1.2)	s 42 (1.4)	r 46 (1.3)	r 44 (1.2)
<b>Switzerland</b>	42 (1.1)	..	..	..	..
<i>Thailand</i>	98 (0.2)	..	..	..	..

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

<sup>1</sup>Countries administered either an integrated science or separate subject area form of the questionnaire. A dot (.) denotes questions not administered by design. Percentages for separate science subject areas are based only on those students taking each subject.

<sup>2</sup>Data for Belgium (Fr) are reported for students in both integrated science classes and separate biology and physics classes.

<sup>3</sup>Physics data for Denmark are for students taking physics/chemistry classes.

<sup>4</sup>Biology data for France are for students taking biology/geology classes; physics data are for students taking physics/chemistry classes.

<sup>5</sup>Physics data for the Netherlands include students in both physics classes and physics/chemistry classes.

<sup>6</sup>Biology data for Portugal are for students taking natural science classes; physics data are for students taking physical science classes.

( ) 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. An "s" indicates a 50-69% student response rate.

An "x" indicates a <50% student response rate.

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

## What Are Students' Attitudes Towards the Sciences?

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

Table 4.17 summarizes students' responses to the questions about how much they like or dislike science or the separate science subject areas of biological science, earth science, and physical science. Even though the majority of students in nearly every country indicated they liked science or liked science a lot, clearly not all students feel equally positive about these subject areas. For example, 60% or fewer of students reported that they liked integrated science in Australia (60%), Israel (59%), Japan (56%), and Korea (59%). About 70% of students in the United States, and in Missouri and Oregon, reported that they liked science

More students internationally reported liking biological science than either earth science or physical science. For example, the percentage of students agreeing or strongly agreeing that they liked biological science ranged from 52% in Denmark to 90% in Portugal, whereas the range in physical science was from 44% in the Czech Republic to 81% in Portugal. In Denmark, fewer than 60% of students reported liking any of the three science subject areas.

The data in Figure 4.3 reveal that, on average, in the majority of countries eighth graders of both genders were relatively neutral about liking the sciences. There was, however, more variation in the average response across countries asking about integrated science than across those asking about the separate science subject areas. Boys reported liking science (integrated) more than did girls in England, Hong Kong, Japan, New Zealand, Norway, and Singapore. There was no significant gender difference in liking science in Missouri, Oregon, or the United States in general.

Across the separate science subject areas, the greatest number of statistically significant gender differences were found in physical science, with boys liking physical science more than girls did. In contrast, in all countries, girls reported liking biological science at least as much as did boys. In fact, the only statistically significant gender differences in liking biological science favored girls in Austria, Hungary, and Slovenia. These differences in students' reports of liking science subjects correspond with the relative performance of boys and girls on the life science and physical science content areas on the TIMSS test, with the majority of statistically significant gender differences in performance favoring boys on the physics and chemistry items (Table 2.2).

**Table 4.17**  
**Students' Reports on Liking the Sciences<sup>1</sup> - Eighth Grade\***

Country	Percent of Students Responding Like or Like a Lot			
	Science (Integrated)	Science Subject Areas		
		Biological Science	Earth Science	Physical Science
<b>UNITED STATES</b>	71 (1.1)	..	..	..
<b>MISSOURI</b>	72 (1.9)	..	..	..
<b>OREGON</b>	70 (1.8)	..	..	..
<i>Australia</i>	60 (1.2)	..	..	..
<i>Austria</i>	..	70 (1.7)	55 (2.0)	49 (2.0)
<b>Belgium (FI)</b>	..	68 (2.0)	53 (2.2)	s 54 (2.3)
<i>Belgium (Fr)</i>	s 71 (2.2)	..	..	..
<b>Canada</b>	68 (1.3)	..	..	..
<i>Colombia</i>	87 (0.9)	..	..	..
<b>Cyprus</b>	70 (1.3)	..	..	..
<b>Czech Republic</b>	..	65 (2.4)	65 (2.3)	44 (1.6)
<i>Denmark</i>	..	52 (2.1)	51 (1.9)	56 (1.7)
<b>England</b>	78 (1.1)	..	..	..
<sup>2</sup> <b>France</b>	..	67 (1.7)	..	65 (2.1)
<i>Germany</i>	..	65 (1.5)	55 (1.5)	49 (1.5)
<i>Greece</i>	..	..	..	76 (1.0)
<b>Hong Kong</b>	69 (1.5)	..	..	..
<b>Hungary</b>	..	73 (1.4)	63 (1.5)	49 (1.3)
<b>Iceland</b>	..	72 (2.8)	r 53 (2.2)	59 (2.3)
<b>Iran, Islamic Rep.</b>	93 (0.8)	..	..	..
<b>Ireland</b>	67 (1.6)	..	..	..
<i>Israel</i>	59 (2.0)	..	..	..
<b>Japan</b>	56 (1.1)	..	..	..
<b>Korea</b>	59 (1.5)	..	..	..
<i>Kuwait</i>	89 (1.2)	..	..	..
<b>Latvia (LSS)</b>	..	81 (1.3)	..	74 (1.3)
<b>Lithuania</b>	..	77 (1.2)	56 (1.4)	55 (1.6)
<i>Netherlands</i>	..	r 72 (1.9)	55 (2.6)	57 (2.2)
<b>New Zealand</b>	68 (1.2)	..	..	..
<b>Norway</b>	67 (1.6)	..	..	..
<sup>3</sup> <b>Portugal</b>	..	90 (0.8)	..	81 (1.3)
<i>Romania</i>	..	76 (1.2)	75 (1.1)	65 (1.4)
<b>Russian Federation</b>	..	85 (1.0)	70 (1.3)	71 (1.4)
<i>Scotland</i>	78 (1.3)	..	..	..
<b>Singapore</b>	92 (0.6)	..	..	..
<b>Slovak Republic</b>	..	69 (1.4)	72 (1.4)	51 (1.7)
<i>Slovenia</i>	..	74 (1.7)	..	66 (1.4)
<b>Spain</b>	73 (1.3)	..	..	..
<b>Sweden</b>	..	61 (1.4)	66 (1.3)	63 (1.3)
<b>Switzerland</b>	67 (1.5)	..	..	..
<i>Thailand</i>	90 (0.7)	..	..	..

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.

<sup>1</sup>Countries administered either an integrated science or separate subject area form of the questionnaire. A dot (.) denotes questions not administered by design. Percentages for separate science subject areas are based only on those students taking each subject.

<sup>2</sup>Biological science data for France are for students taking biology/geology classes.

<sup>3</sup>Biological science data for Portugal are for students taking natural science classes.

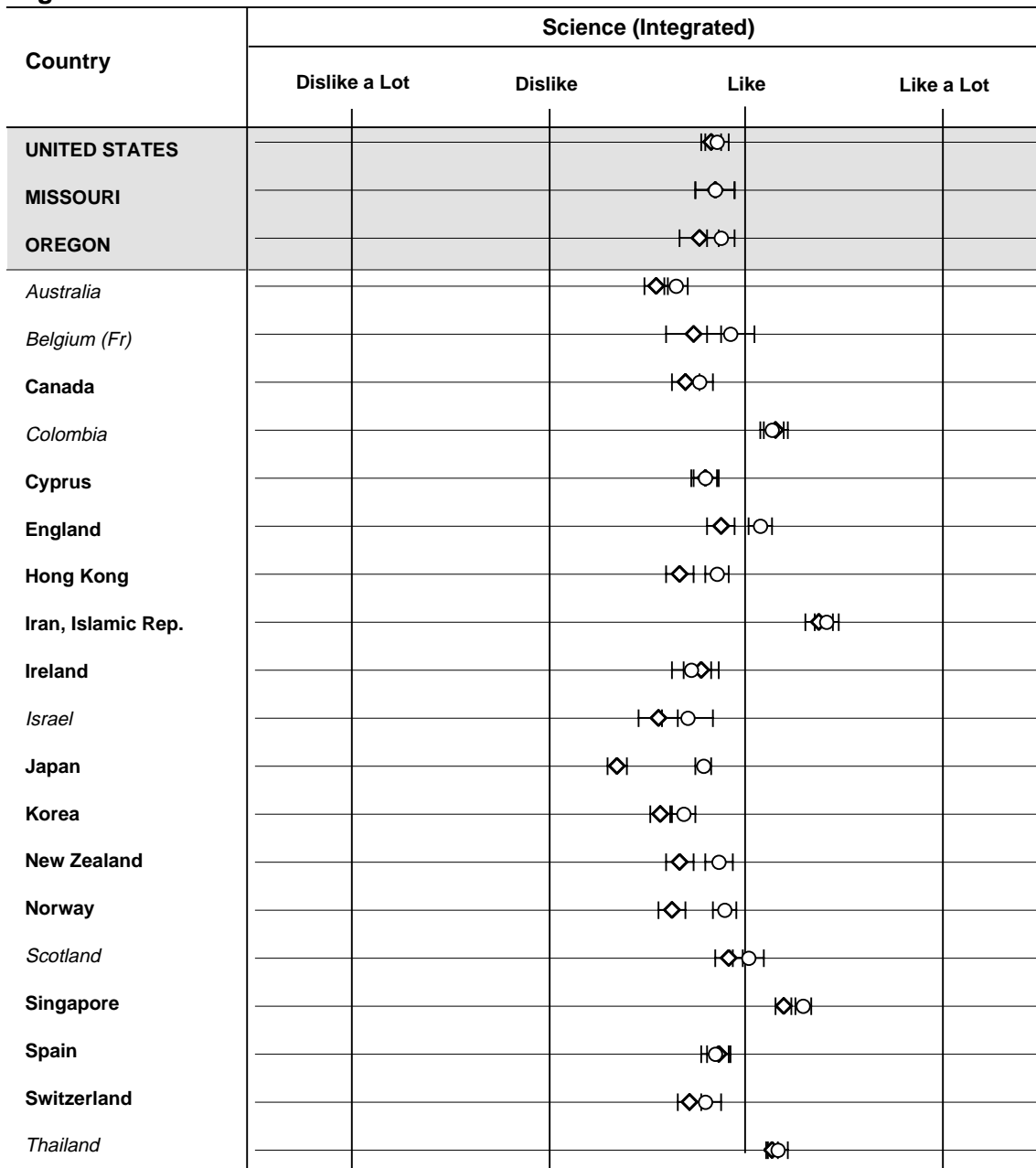
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

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

**Figure 4.3**  
**Gender Differences in Liking the Sciences<sup>1</sup>**  
**Eighth Grade\***

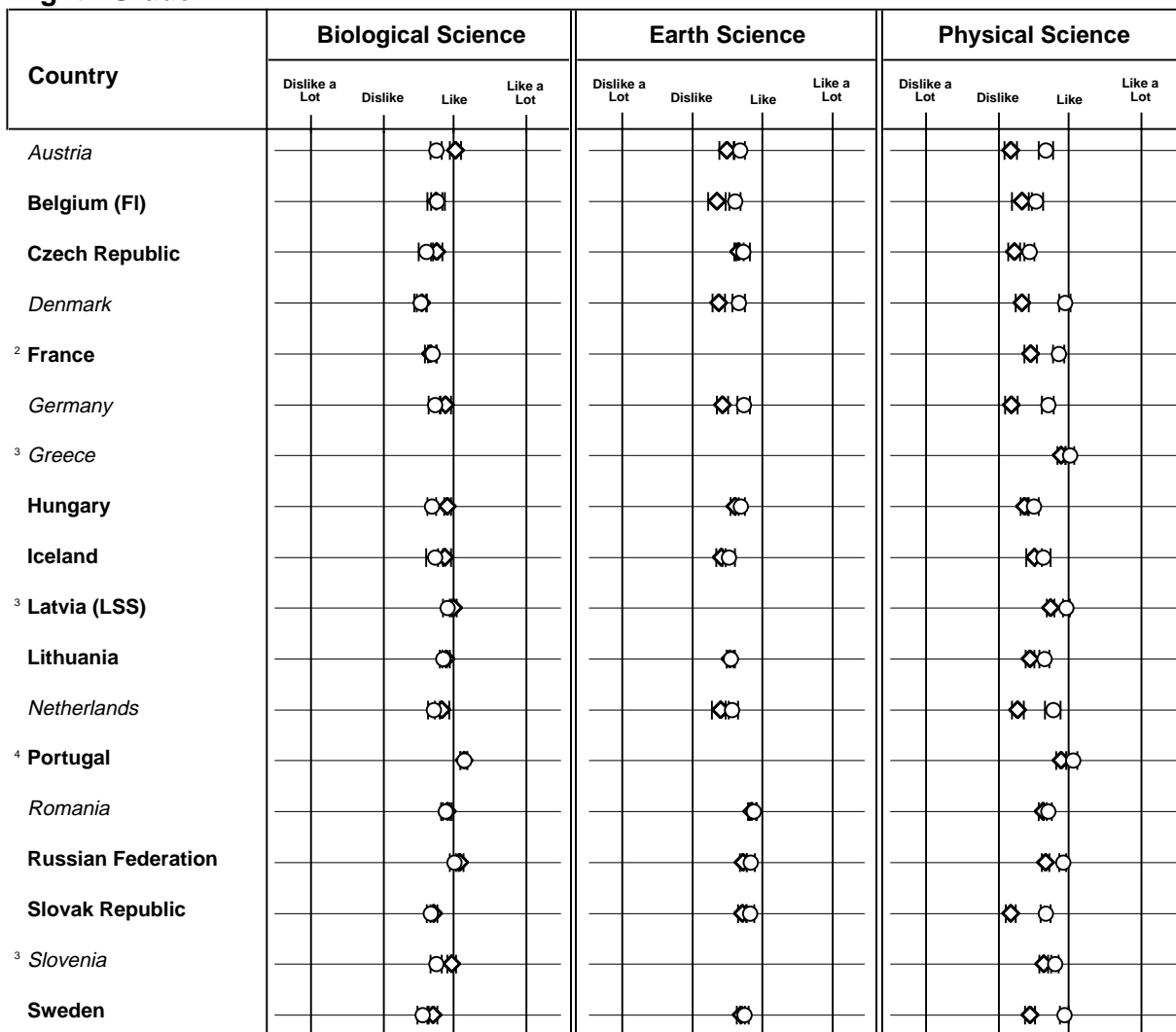


SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

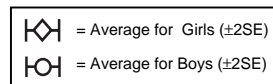
	= Average for Girls (±2SE)
	= Average for Boys (±2SE)

\*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.  
<sup>1</sup>Countries administered either an integrated science or separate subject area form of the questionnaire. Percentages for separate science subject areas are based only on those students taking each subject.  
 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 (Continued)**  
**Gender Differences in Liking the Sciences<sup>1</sup>**  
**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.

<sup>1</sup>Countries administered either an integrated science or separate subject area form of the questionnaire. Percentages for separate science subject areas are based only on those students taking each subject.

<sup>2</sup>Biological science data for France are for students taking biology/geology classes.

<sup>3</sup>Greece, Latvia, and Slovenia did not ask about all three science subjects.

<sup>4</sup>Biological science data for Portugal are for students taking natural science classes.

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 SCIENCE INSTRUCTION

Teachers and the instructional approaches they use are fundamental in building students' understanding of science. 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 scientific tasks, and help deepen students' grasp of the science being studied. Teachers may help students use technology and laboratory equipment to investigate scientific ideas, develop their understanding of scientific approaches to problem solving, and promote positive attitudes towards science. 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 science teaching is a complex endeavor requiring knowledge of the subject matter of science, understanding of student learning, and appreciation of the pedagogy of science. 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 scientific concepts, and developing sequences that move students from concrete tasks to the ability to think for themselves and explore scientific theories.

TIMSS administered a questionnaire to teachers to gather information about their backgrounds, training, and how they think about science. The questionnaire also asked how teachers 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 science lessons, the role of homework, and the reliance on different types of assessment approaches.

This chapter presents the results of teacher's responses to some of these questions. Because the sampling for the teacher questionnaires was based on participating students, the responses to the science teacher questionnaire do not necessarily represent all of the eighth-grade science teachers in each of the TIMSS countries. 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 response rates. For a country where teacher responses were available for 70% to 84% of the students, an "r" is included next to the data for that country. When teacher responses were available for 50% to 69% of the students, an "s" is included next to the data for that country. When teacher responses were available for less than 50% of the students, an "x" replaces the data.

## Who Delivers Science Instruction?

This section provides information about the science teaching force in each of the participating countries, in terms of certification, degrees, age, gender, and years of teaching experience.

Table 5.1 contains teachers' reports on their age and gender. In most countries, the majority of the eighth-grade students were taught science by teachers in their 30s or 40s. Very few countries seemed to have a comparatively younger teaching force, with only Iran having 40% or more of the students with science teachers in their 20s or younger, and just six countries (Hong Kong, Iran, Israel, Korea, Kuwait, and Portugal) having 70% or more students with teachers in their 30s or younger. The age distribution of teachers in Missouri resembled that of the United States fairly closely, with approximately equal percentages of students taught by teachers from each of the age groups. In contrast, relatively more students in Oregon were taught by teachers aged 30 to 49, and relatively fewer by teachers aged 50 or over. Very few Oregonian students (4%) were taught by younger teachers (29 or younger).

In a number of countries, approximately equivalent percentages of eighth-grade students were taught science by male teachers and female teachers. However, at least 70% of the students had female science teachers in the Czech Republic, Hungary, Israel, Latvia (LSS), Lithuania, Portugal, Romania, the Russian Federation, and Slovenia. In contrast, at least 70% of the students had male teachers in Denmark, Japan, the Netherlands, and Switzerland. In Missouri and in the United States generally, just over half of the students had female science teachers and just under half had male teachers, whereas in Oregon approximately two thirds of the students were taught science by male teachers.

As might be expected from the differences in teachers' ages from country to country, the TIMSS data indicate differences in teacher experience across countries (see Table 5.2). Those countries with younger teaching forces tended to have more students taught by less experienced teachers. For eight countries, at least half the eighth-grade students had science teachers with 10 or fewer years of experience. Fewer countries had relatively experienced teaching forces. Only in the Czech Republic, France, and Romania did more than half the students have science teachers with more than 20 years of experience. Just under half of the students in Missouri and the United States were taught science by teachers with 10 or fewer years of experience, while in Oregon this figure was about one third.

The relationship between years of teaching experience and science achievement is not clear in many countries. In about one-fourth of the countries, the students with the most experienced teachers (more than 20 years) had higher science 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. However, there were also several countries where the students with less experienced teachers had higher achievement than did those with the most experienced teachers. There was no consistent relationship between teacher experience and student achievement in science in the United States or in Missouri or Oregon.

**Table 5.1**  
**Teachers' Reports on Their Age and Gender - Science - 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
<b>UNITED STATES</b>	r 17 (2.9)	27 (2.5)	34 (3.5)	23 (3.4)	r 54 (4.1)	46 (4.1)
<b>MISSOURI</b>	20 (3.1)	19 (3.1)	33 (4.7)	28 (4.6)	r 53 (4.5)	47 (4.5)
<b>OREGON</b>	4 (1.4)	29 (4.2)	49 (4.8)	19 (4.5)	35 (4.4)	65 (4.4)
<i>Australia</i>	r 17 (2.2)	31 (3.2)	37 (3.3)	16 (2.2)	r 39 (3.5)	61 (3.5)
<i>Austria</i>	r 6 (1.8)	41 (4.0)	43 (3.6)	10 (2.0)	r 52 (3.4)	48 (3.4)
<b>Belgium (Fl)</b>	13 (2.5)	30 (3.9)	32 (4.3)	25 (3.4)	55 (4.2)	45 (4.2)
<i>Belgium (Fr)</i>	s 15 (3.5)	33 (5.8)	31 (4.6)	20 (3.7)	s 56 (5.8)	44 (5.8)
<b>Canada</b>	21 (3.5)	27 (2.9)	33 (4.0)	19 (3.1)	37 (3.6)	63 (3.6)
<i>Colombia</i>	18 (4.6)	31 (4.2)	36 (4.5)	14 (3.6)	39 (5.0)	61 (5.0)
<b>Cyprus</b>	r 0 (0.0)	28 (3.1)	53 (3.7)	19 (3.3)	r 52 (4.0)	48 (4.0)
<b>Czech Republic</b>	8 (2.1)	18 (2.9)	32 (2.8)	42 (3.0)	76 (2.5)	24 (2.5)
<i>Denmark</i>	s 8 (3.5)	23 (5.7)	39 (6.1)	30 (5.8)	s 23 (4.4)	77 (4.4)
<b>England</b>	s 15 (2.0)	25 (2.5)	41 (2.9)	19 (2.6)	s 39 (3.2)	61 (3.2)
<b>France</b>	13 (1.9)	19 (2.7)	41 (3.5)	27 (3.3)	51 (3.9)	49 (3.9)
<i>Germany</i>	s 0 (0.0)	15 (3.7)	37 (4.0)	47 (3.9)	s 39 (4.8)	61 (4.8)
<i>Greece</i>	2 (0.4)	43 (3.4)	43 (3.4)	12 (2.1)	43 (3.9)	57 (3.9)
<b>Hong Kong</b>	34 (5.8)	38 (6.1)	20 (4.3)	8 (3.1)	32 (5.4)	68 (5.4)
<b>Hungary</b>	14 (1.7)	27 (2.3)	39 (2.2)	20 (2.1)	74 (2.2)	26 (2.2)
<b>Iceland</b>	r 22 (4.2)	46 (4.9)	24 (3.4)	8 (2.9)	r 44 (7.4)	56 (7.4)
<b>Iran, Islamic Rep.</b>	45 (5.5)	39 (5.7)	15 (3.9)	1 (0.9)	40 (4.7)	60 (4.7)
<b>Ireland</b>	r 18 (2.7)	39 (3.8)	29 (4.0)	13 (2.7)	r 54 (4.7)	46 (4.7)
<i>Israel</i>	s 26 (7.8)	49 (8.8)	11 (5.4)	14 (6.8)	s 91 (5.4)	9 (5.4)
<b>Japan</b>	19 (3.6)	48 (4.4)	20 (3.8)	13 (3.2)	20 (3.6)	80 (3.6)
<b>Korea</b>	24 (3.2)	46 (4.1)	21 (3.4)	10 (2.2)	48 (4.0)	52 (4.0)
<i>Kuwait</i>	r 33 (8.0)	48 (8.3)	19 (5.1)	1 (0.6)	r 50 (3.4)	50 (3.4)
<b>Latvia (LSS)</b>	r 13 (1.5)	34 (2.8)	25 (2.2)	28 (2.4)	r 75 (2.1)	25 (2.1)
<b>Lithuania</b>	17 (2.0)	32 (2.3)	26 (2.2)	24 (2.2)	78 (1.8)	22 (1.8)
<i>Netherlands</i>	11 (2.3)	27 (3.4)	35 (3.7)	27 (3.4)	20 (3.1)	80 (3.1)
<b>New Zealand</b>	11 (2.6)	28 (3.8)	39 (4.2)	22 (3.3)	40 (4.3)	60 (4.3)
<b>Norway</b>	12 (2.9)	19 (3.6)	41 (3.9)	28 (3.8)	31 (3.9)	69 (3.9)
<b>Portugal</b>	37 (3.0)	44 (3.2)	13 (2.4)	6 (1.5)	78 (3.0)	22 (3.0)
<i>Romania</i>	11 (1.6)	21 (2.0)	38 (2.2)	30 (2.3)	74 (1.9)	26 (1.9)
<b>Russian Federation</b>	18 (3.7)	26 (3.0)	31 (2.5)	25 (2.4)	86 (2.0)	14 (2.0)
<i>Scotland</i>	s 9 (1.7)	26 (4.3)	43 (4.8)	22 (3.9)	s 37 (3.8)	63 (3.8)
<b>Singapore</b>	30 (4.3)	23 (4.0)	28 (4.9)	19 (3.6)	69 (4.6)	31 (4.6)
<b>Slovak Republic</b>	13 (2.7)	25 (3.9)	40 (4.4)	21 (3.5)	63 (4.2)	37 (4.2)
<i>Slovenia</i>	r 13 (2.4)	45 (3.2)	24 (2.8)	18 (2.9)	r 77 (2.6)	23 (2.6)
<b>Spain</b>	3 (1.5)	31 (3.8)	50 (4.1)	16 (3.1)	44 (4.2)	56 (4.2)
<b>Sweden</b>	11 (1.9)	23 (2.6)	28 (2.7)	39 (3.0)	37 (2.9)	63 (2.9)
<b>Switzerland</b>	r 15 (4.1)	26 (4.1)	39 (4.6)	19 (3.3)	r 14 (2.5)	86 (2.5)
<i>Thailand</i>	r 23 (5.0)	43 (5.7)	33 (6.2)	2 (2.2)	r 63 (5.7)	37 (5.7)

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.

**Table 5.2**  
**Teachers' Reports on Their Years of Teaching Experience - Science - 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
<b>UNITED STATES</b>	r 30 (3.8)	538 (8.0)	15 (3.0)	549 (10.5)	26 (3.7)	534 (7.0)	29 (3.8)	542 (7.4)
<b>MISSOURI</b>	31 (4.4)	553 (7.6)	18 (4.5)	551 (9.8)	19 (3.5)	571 (4.9)	33 (4.3)	555 (9.2)
<b>OREGON</b>	7 (1.9)	581 (14.1)	24 (3.9)	562 (6.6)	34 (4.2)	559 (7.9)	36 (4.0)	574 (7.8)
<i>Australia</i>	r 19 (2.3)	537 (8.4)	20 (2.9)	539 (10.4)	38 (3.5)	555 (7.9)	23 (2.7)	548 (7.9)
<i>Austria</i>	r 5 (1.1)	553 (11.5)	17 (2.3)	567 (5.0)	49 (3.5)	560 (4.9)	30 (3.3)	562 (4.7)
<b>Belgium (Fl)</b>	11 (2.3)	548 (8.0)	11 (2.8)	574 (6.2)	38 (5.3)	548 (8.8)	40 (4.8)	549 (7.7)
<i>Belgium (Fr)</i>	s 13 (3.6)	482 (8.7)	8 (2.7)	492 (8.1)	43 (5.7)	485 (4.8)	36 (4.9)	477 (6.0)
<b>Canada</b>	25 (3.3)	535 (7.2)	18 (2.5)	542 (6.7)	23 (3.0)	521 (4.4)	33 (3.6)	529 (5.6)
<i>Colombia</i>	r 18 (3.4)	404 (9.5)	10 (2.8)	410 (9.7)	36 (3.7)	415 (5.5)	36 (4.6)	421 (4.5)
<b>Cyprus</b>	s 34 (5.1)	457 (5.0)	10 (2.9)	461 (11.7)	24 (3.1)	454 (4.8)	32 (4.1)	463 (3.4)
<b>Czech Republic</b>	11 (1.8)	566 (8.1)	12 (1.9)	589 (14.2)	13 (2.0)	573 (5.9)	64 (2.5)	572 (4.1)
<i>Denmark</i>	s 14 (4.2)	482 (8.0)	15 (4.6)	461 (7.2)	32 (5.9)	477 (4.6)	40 (6.3)	484 (6.2)
<b>England</b>	s 21 (2.2)	559 (11.5)	14 (2.2)	559 (10.7)	33 (3.2)	566 (8.3)	32 (3.0)	569 (8.3)
<b>France</b>	16 (2.2)	498 (4.3)	9 (2.2)	489 (7.1)	19 (2.5)	492 (4.3)	55 (4.0)	501 (3.8)
<i>Germany</i>	s 5 (2.0)	557 (30.0)	13 (3.2)	529 (14.0)	39 (4.3)	546 (7.4)	43 (4.4)	526 (10.2)
<i>Greece</i>	19 (3.0)	485 (4.4)	26 (4.2)	481 (3.3)	42 (4.0)	508 (3.6)	14 (2.3)	512 (4.5)
<b>Hong Kong</b>	38 (6.3)	532 (7.6)	23 (4.8)	516 (11.3)	25 (5.4)	504 (10.4)	14 (4.1)	536 (13.5)
<b>Hungary</b>	15 (1.9)	545 (5.6)	12 (1.8)	552 (4.9)	32 (2.7)	556 (4.6)	41 (2.7)	552 (3.9)
<b>Iceland</b>	r 34 (4.6)	489 (8.9)	21 (5.6)	492 (6.1)	31 (6.5)	485 (5.1)	14 (3.5)	483 (5.3)
<b>Iran, Islamic Rep.</b>	37 (4.7)	456 (4.2)	20 (5.7)	473 (5.6)	34 (4.7)	478 (4.8)	9 (3.3)	487 (6.2)
<b>Ireland</b>	r 18 (3.2)	563 (11.3)	16 (2.9)	532 (12.4)	38 (4.1)	547 (7.0)	27 (3.9)	527 (10.2)
<i>Israel</i>	r 28 (7.8)	501 (15.7)	27 (7.6)	512 (12.8)	31 (7.4)	553 (13.4)	14 (6.3)	552 (23.0)
<b>Japan</b>	19 (3.4)	563 (4.1)	21 (3.4)	573 (3.4)	36 (4.2)	574 (3.9)	23 (3.5)	573 (3.2)
<b>Korea</b>	23 (3.5)	562 (4.9)	31 (3.3)	568 (4.0)	32 (3.7)	562 (3.8)	13 (2.7)	567 (5.9)
<i>Kuwait</i>	s 37 (10.8)	433 (4.6)	25 (9.0)	445 (7.6)	33 (8.5)	413 (10.9)	5 (3.9)	421 (6.2)
<b>Latvia (LSS)</b>	r 13 (1.8)	485 (3.6)	20 (2.3)	482 (3.9)	28 (2.7)	486 (4.2)	39 (2.6)	485 (3.6)
<b>Lithuania</b>	r 19 (2.2)	483 (4.7)	14 (1.7)	479 (5.4)	28 (2.0)	474 (5.1)	39 (2.8)	474 (5.0)
<i>Netherlands</i>	20 (2.9)	556 (9.2)	11 (2.4)	558 (7.0)	32 (2.8)	562 (7.5)	37 (3.6)	567 (11.6)
<b>New Zealand</b>	16 (3.1)	525 (9.1)	21 (3.6)	531 (10.7)	38 (3.7)	528 (7.0)	25 (3.3)	523 (9.5)
<b>Norway</b>	16 (3.4)	533 (5.1)	8 (2.4)	528 (5.6)	36 (4.2)	527 (3.1)	40 (4.5)	528 (3.9)
<b>Portugal</b>	46 (3.4)	473 (3.0)	25 (2.7)	482 (3.2)	21 (2.6)	484 (4.3)	7 (1.7)	502 (6.3)
<i>Romania</i>	12 (1.6)	465 (9.4)	11 (1.4)	484 (8.7)	22 (2.0)	488 (6.5)	55 (2.5)	492 (6.1)
<b>Russian Federation</b>	17 (3.9)	541 (8.7)	13 (1.8)	531 (7.2)	28 (3.4)	536 (6.1)	43 (3.4)	538 (5.6)
<i>Scotland</i>	s 19 (3.0)	499 (7.3)	15 (3.1)	510 (11.6)	36 (4.7)	533 (10.1)	31 (4.5)	523 (7.6)
<b>Singapore</b>	30 (4.4)	615 (11.4)	13 (3.0)	591 (18.0)	21 (4.0)	599 (9.8)	36 (4.4)	610 (9.7)
<b>Slovak Republic</b>	15 (2.8)	546 (7.4)	18 (3.5)	548 (6.7)	18 (3.2)	540 (8.7)	49 (4.7)	545 (4.4)
<i>Slovenia</i>	r 11 (2.3)	569 (5.6)	17 (2.2)	560 (4.9)	38 (3.5)	553 (3.5)	33 (3.3)	560 (3.6)
<b>Spain</b>	9 (2.1)	527 (9.4)	13 (2.9)	516 (5.1)	40 (4.2)	516 (3.7)	39 (4.3)	514 (3.2)
<b>Sweden</b>	19 (2.3)	538 (4.1)	12 (2.0)	539 (6.9)	27 (2.3)	534 (5.0)	42 (3.0)	538 (3.4)
<b>Switzerland</b>	r 17 (3.7)	516 (9.4)	10 (2.5)	540 (11.6)	37 (4.4)	520 (6.9)	35 (4.1)	521 (6.7)
<i>Thailand</i>	r 41 (7.0)	522 (6.1)	20 (5.1)	537 (10.2)	36 (6.8)	535 (7.7)	3 (1.9)	529 (47.6)

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.

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 Are Teachers' Perceptions About Science?

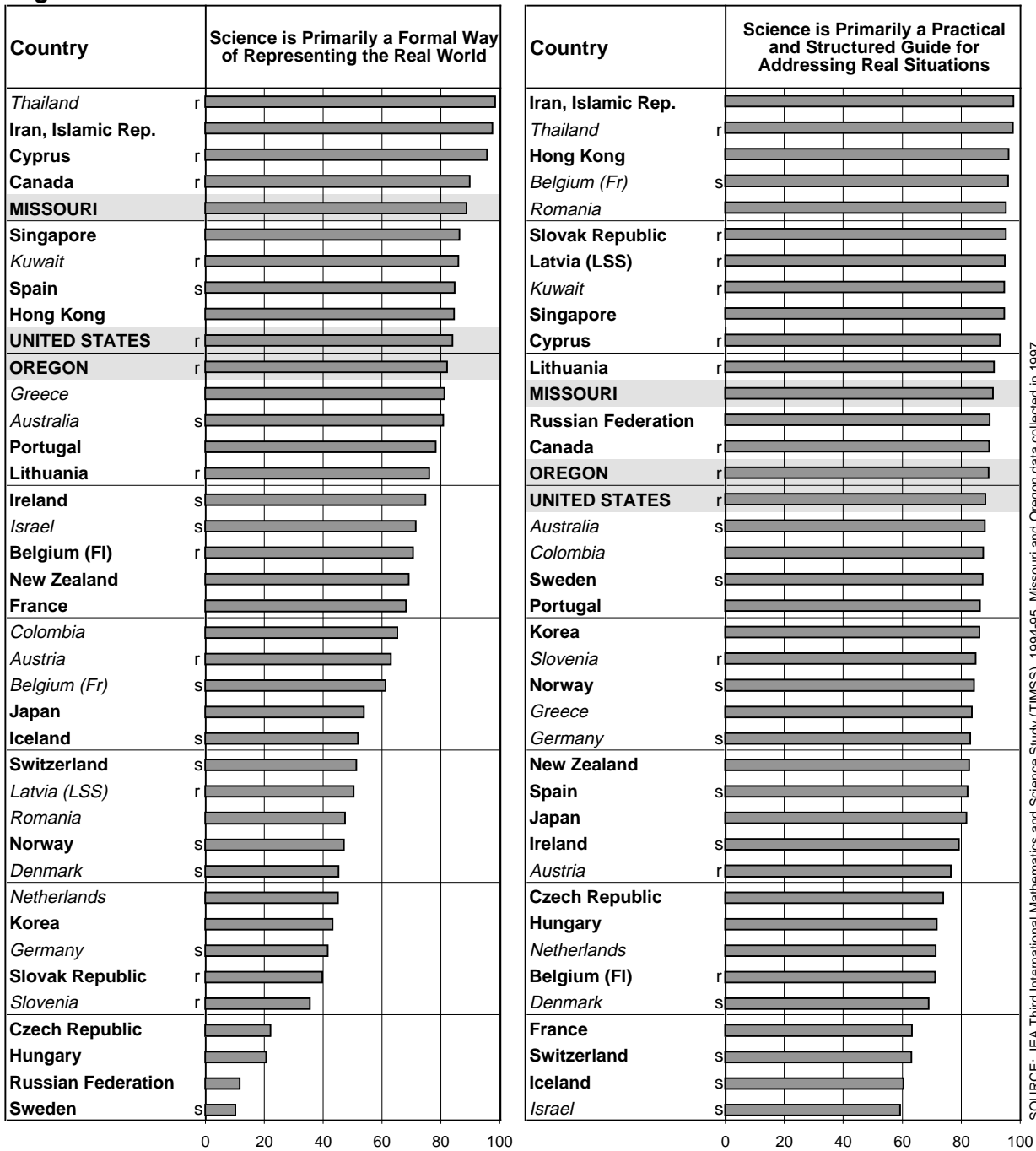
Figure 5.1 depicts the percentages of eighth-grade students whose science teachers reported certain beliefs about science and the way science should be taught. Teacher views about the nature of science varied considerably across countries. In many countries, most notably Thailand, Iran, Cyprus, Canada, and Singapore, teachers agreed that science is primarily a formal way of representing the real world. Teachers in the United States and in Missouri and Oregon also largely agreed with this statement. In contrast, less than 40% of students had teachers holding this view in the Slovak Republic, Slovenia, the Czech Republic, Hungary, the Russian Federation, and Sweden. However, teachers in most countries indicated a fairly practical view of science, agreeing that it is primarily a practical and structured guide for addressing real situations. In most countries also, the majority of students had teachers who agreed that some students have a natural talent for science, although there was quite a range across countries. Relatively low percentages of students in Missouri, Oregon, and the United States (between 55% and 60%) were taught by science teachers holding these views.

Regarding perceptions about how to teach science, there seemed to be widespread agreement that it is important to give students prescriptive and sequential directions for doing science experiments. Only in the Slovak Republic, New Zealand, Iceland, Denmark, and Korea did fewer than 60% of the eighth-grade students have teachers who agreed with this approach.

TIMSS also queried teachers about the cognitive demands of science, 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. Internationally, most science teachers felt it was very important for students to be able to think in a sequential and procedural manner, to be able to think creatively, to understand how science is used in the real world, and to be able to provide reasons to support their conclusions. In Missouri and Oregon, and in the United States generally, the majority of students were taught by science teachers who agreed with these statements.

However, there was some variation across countries. In every country except Slovenia and Israel, the majority of students were taught by teachers who considered it very important that students be able to think in a sequential and procedural manner. Fewer than half of the eighth-grade students in Austria, Singapore, the Netherlands, Switzerland, Israel, Belgium (Flemish), Ireland, and France had teachers who felt it was very important to think creatively, and fewer than half in Switzerland, France, Austria and Belgium (Flemish) had teachers who felt it was very important to understand how science is used in the real world. With the current calls from business and industry on helping students improve their ability to apply scientific 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 two aspects of science. In all countries except Korea, Switzerland, the Slovak Republic, Kuwait, and Austria, the majority of students had teachers who felt it was very important to be able to provide reasons to support their conclusions. Over 80% of the students in Missouri and Oregon and in the United States in general, were taught by teachers who thought this was very important.

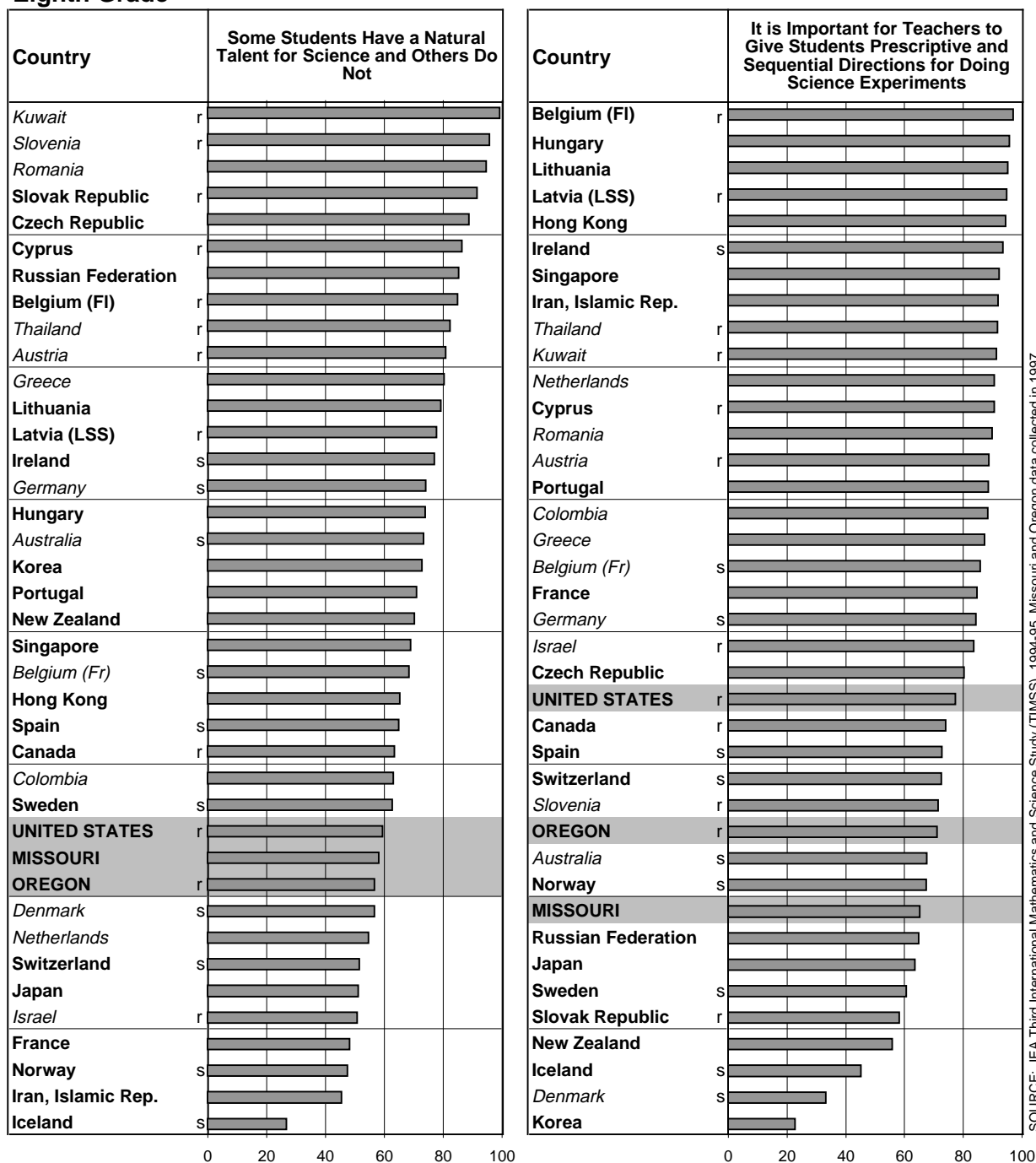
**Figure 5.1**  
**Percent of Students Whose Science Teachers Agree or Strongly Agree with Statements About the Nature of Science and Science Teaching Eighth Grade\***



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.  
 Countries where data were not available or where teacher response data were available for <50% of students are omitted from the figure (England).  
 Scotland did not ask these questions.

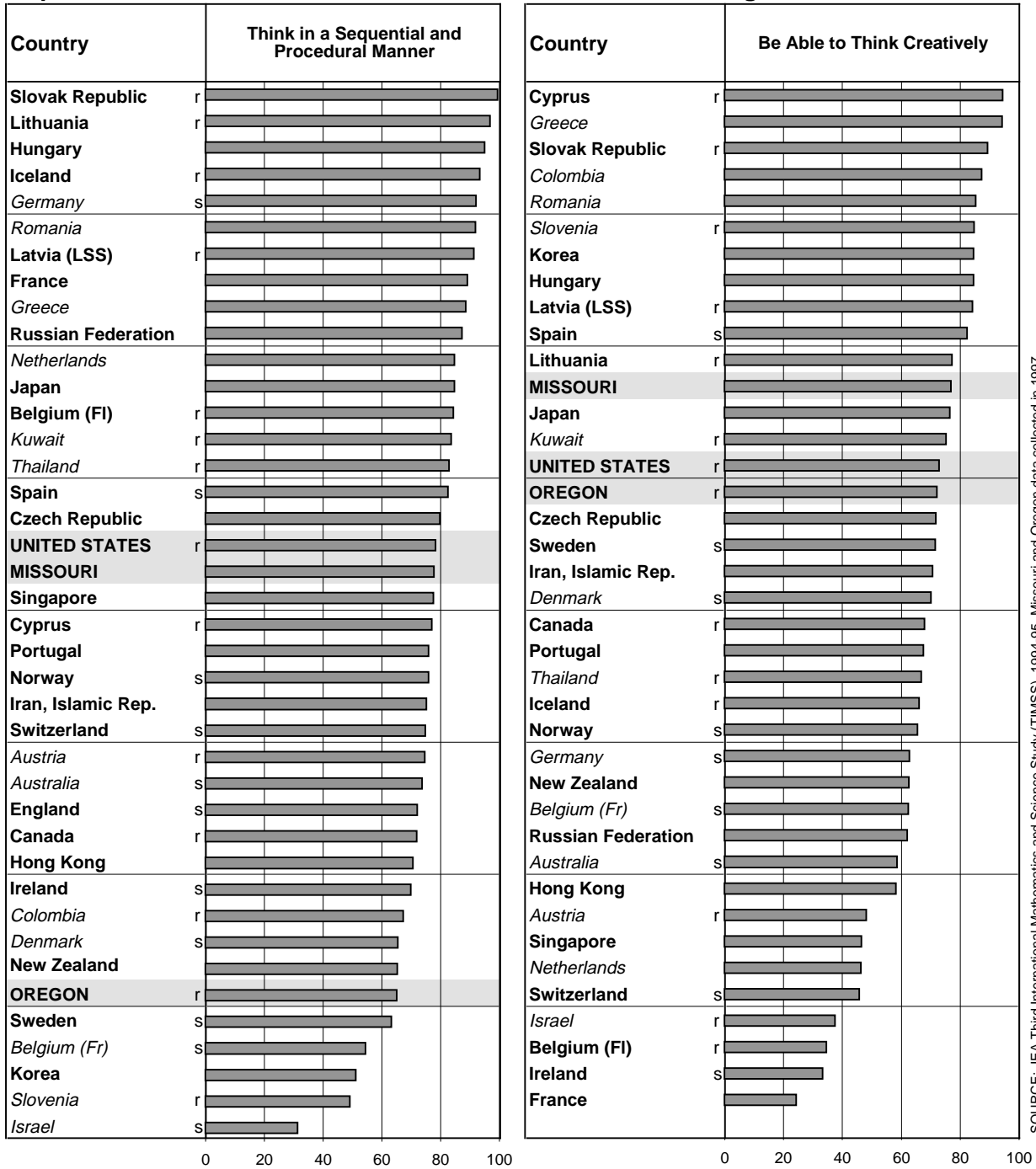
**Figure 5.1 (Continued)**  
**Percent of Students Whose Science Teachers Agree or Strongly Agree**  
**with Statements About the Nature of Science and Science Teaching**  
**Eighth Grade\***



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.  
 Countries where data were not available or where teacher response data were available for <50% of students are omitted from the figure (England).  
 Scotland did not ask these questions.

**Figure 5.2** Percent of Students Whose Science Teachers Think Particular Abilities Are Very Important for Students' Success in the Sciences in School - Eighth Grade\*

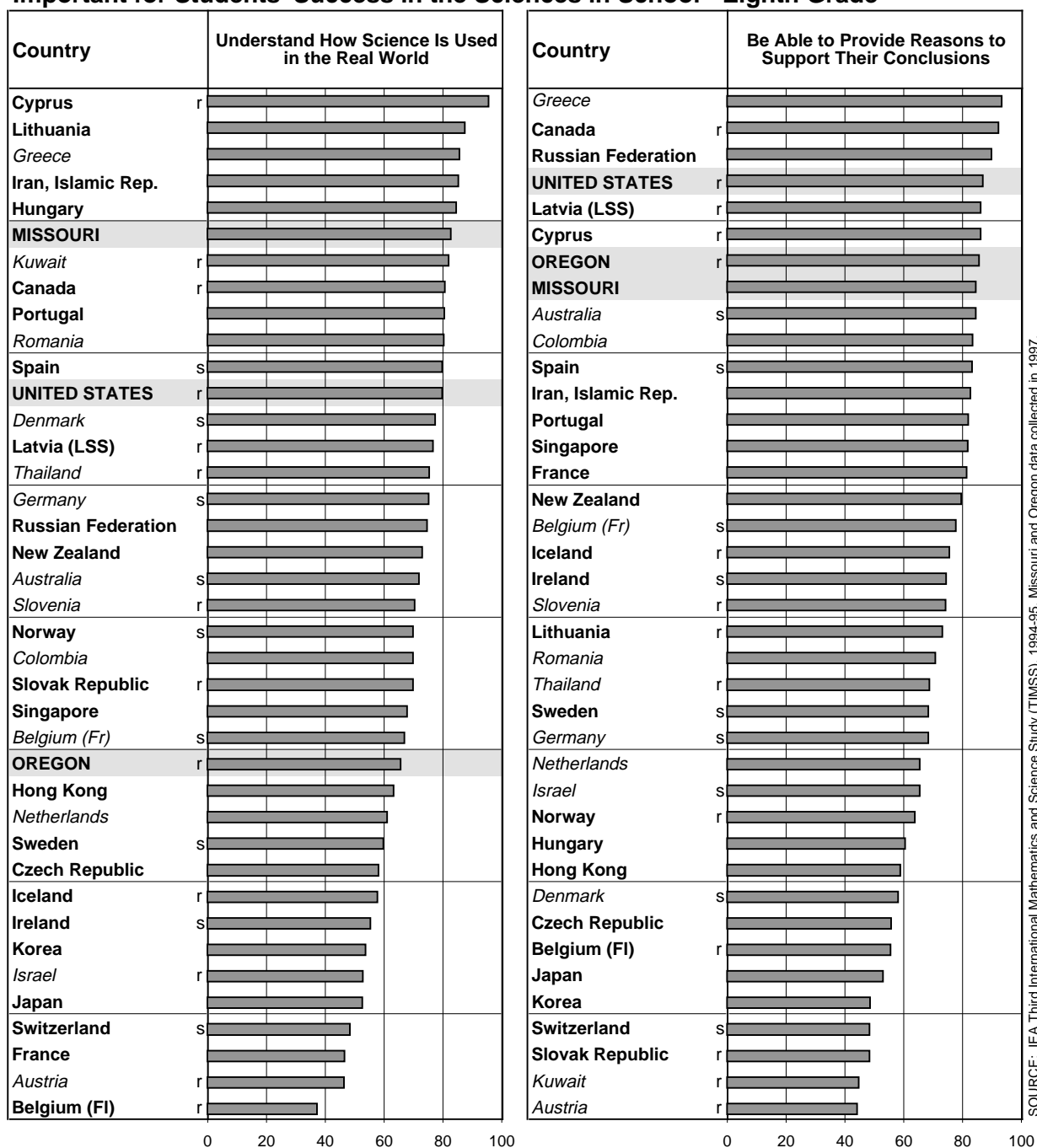


SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Missouri and Oregon data collected in 1997.

\*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. Countries where data were not available or where teacher response data were available for <50% of students are omitted from the figure (England in the second, third, and fourth panels). Scotland did not ask these questions.



**Figure 5.2 (Continued)**  
**Percent of Students Whose Science Teachers Think Particular Abilities Are Very Important for Students' Success in the Sciences 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.  
 Countries where data were not available or where teacher response data were available for <50% of students are omitted from the figure (England).  
 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 science teachers are specialists. In Belgium (Flemish), Cyprus, France, Kuwait, Latvia (LSS), Lithuania, the Netherlands, New Zealand, Portugal, the Russian Federation, and Scotland, the majority of eighth-grade students had teachers who spent at least 75% of their formally scheduled school time teaching science. In the United States and in Oregon, only about one quarter of students were taught by such teachers, and about one third in Missouri. For most participating countries, and for U.S. students, there was little difference in students' achievement according to whether they were taught by specialist teachers.

As shown in Table 5.4, teachers in most countries where science is taught as an integrated subject reported that science classes typically meet for less than 3.5 hours per week, although 3.5 to nearly 5 hours was reported for more than three-quarters of the eighth-grade students in Singapore and almost half of those in New Zealand. The data reveal no clear pattern between the number of in-class instructional hours and achievement either across or between countries. Common sense and research both support the idea that increased time on task can yield commensurate increases in achievement, yet this time also can be spent outside of school on homework or in special tutoring. The ability to use straightforward analyses such as these to disentangle complicated relationships also is made difficult by the practice of providing additional in-school instruction for lower-performing students. About three quarters of the eighth-grade students in Missouri were in science class for at least 3.5 hours per week (there were insufficient data for Oregon, and for the United States). The data reveal no clear pattern between the number of in-class instructional hours and achievement either within 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 science teachers who spent 2.1 hours per week preparing or grading tests, and another 2.4 hours per week reading and grading student work. Their teachers spent 2.2 hours per week on lesson planning and 1.9 hours combined on meeting students and parents. They spent 1.0 hours on professional reading and development, and 3.5 hours on record-keeping and administrative tasks combined. Teachers of eighth graders in Missouri and Oregon reported spending similar amounts of time in these activities. Across countries, teachers reported that grading tests, grading student work, and lesson planning were the most time-consuming activities, averaging as much as 10.4 hours per week in Singapore. Missouri teachers reported spending 7.4 hours on these tasks, and Oregon teachers 7.0 hours. 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 the Sciences<sup>1</sup> - 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
<b>UNITED STATES</b>	r 40 (3.5)	546 (4.5)	36 (3.9)	541 (7.1)	25 (3.5)	526 (9.8)
<b>MISSOURI</b>	41 (4.6)	561 (5.9)	27 (4.9)	548 (13.1)	32 (4.3)	562 (2.9)
<b>OREGON</b>	r 50 (4.7)	567 (6.0)	26 (3.4)	562 (6.1)	24 (4.3)	562 (11.6)
<i>Australia</i>	r 34 (2.7)	539 (6.3)	25 (3.1)	551 (7.0)	42 (3.2)	554 (8.4)
<i>Austria</i>	r 66 (2.8)	550 (4.1)	16 (2.5)	566 (6.1)	17 (1.9)	602 (4.3)
<b>Belgium (Fl)</b>	20 (3.2)	548 (6.7)	18 (3.1)	569 (4.5)	61 (4.0)	548 (6.2)
<i>Belgium (Fr)</i>	s 24 (4.5)	477 (6.1)	33 (4.6)	486 (5.4)	43 (5.2)	484 (4.3)
<b>Canada</b>	55 (3.5)	523 (3.0)	24 (3.5)	549 (6.2)	22 (2.7)	534 (5.8)
<i>Colombia</i>	27 (4.2)	399 (11.1)	39 (4.8)	415 (4.5)	34 (4.0)	419 (4.8)
<b>Cyprus</b>	r 12 (2.0)	448 (4.9)	22 (3.8)	455 (4.6)	66 (4.0)	463 (2.6)
<b>Czech Republic</b>	69 (2.9)	569 (3.7)	18 (2.7)	574 (6.7)	13 (2.5)	597 (8.2)
<i>Denmark</i>	s 66 (5.2)	481 (4.0)	20 (3.8)	481 (8.3)	15 (4.1)	463 (8.6)
<b>England</b>	x x	x x	x x	x x	x x	x x
<b>France</b>	15 (2.1)	489 (4.3)	8 (1.7)	495 (10.1)	77 (2.5)	501 (2.6)
<i>Germany</i>	s 47 (3.8)	524 (10.0)	22 (3.4)	534 (8.8)	31 (3.7)	556 (7.0)
<i>Greece</i>	--	--	--	--	--	--
<b>Hong Kong</b>	32 (6.1)	506 (11.0)	26 (5.2)	530 (8.7)	42 (5.3)	530 (7.5)
<i>Hungary</i>	--	--	--	--	--	--
<b>Iceland</b>	r 64 (6.5)	487 (5.0)	14 (6.1)	490 (5.5)	21 (7.1)	486 (8.3)
<b>Iran, Islamic Rep.</b>	--	--	--	--	--	--
<b>Ireland</b>	r 25 (3.7)	541 (10.2)	36 (4.5)	546 (7.6)	40 (4.2)	538 (8.7)
<i>Israel</i>	s 32 (9.3)	549 (17.0)	22 (6.4)	548 (10.6)	46 (9.5)	507 (10.1)
<b>Japan</b>	28 (3.8)	571 (3.5)	38 (3.9)	574 (3.6)	34 (4.4)	568 (3.2)
<b>Korea</b>	51 (3.4)	565 (3.0)	41 (3.4)	563 (3.2)	8 (1.9)	576 (6.7)
<i>Kuwait</i>	r 23 (6.1)	422 (10.2)	26 (4.6)	432 (4.2)	51 (7.4)	425 (6.0)
<b>Latvia (LSS)</b>	r 25 (2.5)	484 (5.0)	18 (2.0)	484 (3.6)	57 (3.0)	484 (3.0)
<b>Lithuania</b>	20 (2.0)	481 (6.9)	15 (1.8)	472 (5.9)	65 (2.3)	476 (4.0)
<i>Netherlands</i>	16 (2.5)	539 (12.3)	15 (2.5)	556 (12.3)	68 (3.7)	569 (5.8)
<b>New Zealand</b>	19 (3.0)	514 (9.9)	24 (2.9)	527 (7.4)	57 (4.0)	532 (5.9)
<b>Norway</b>	81 (3.5)	532 (2.2)	7 (2.2)	513 (6.2)	12 (3.0)	512 (5.7)
<b>Portugal</b>	15 (2.2)	477 (3.5)	22 (2.5)	478 (3.6)	63 (2.9)	481 (3.0)
<i>Romania</i>	81 (2.3)	489 (5.0)	14 (2.1)	472 (9.3)	4 (1.0)	489 (13.1)
<b>Russian Federation</b>	5 (1.2)	537 (12.6)	5 (1.3)	529 (10.8)	90 (2.0)	538 (4.1)
<i>Scotland</i>	s 0 (0.0)	~ ~	3 (1.5)	499 (16.9)	97 (1.5)	521 (5.6)
<b>Singapore</b>	10 (2.3)	577 (12.6)	56 (5.3)	608 (7.8)	34 (4.9)	613 (10.4)
<b>Slovak Republic</b>	83 (2.9)	543 (3.7)	14 (2.6)	549 (6.7)	3 (1.6)	572 (17.2)
<i>Slovenia</i>	r 29 (2.5)	558 (3.8)	30 (3.6)	554 (4.5)	41 (3.4)	561 (3.2)
<b>Spain</b>	85 (3.3)	515 (1.9)	14 (3.2)	524 (7.0)	1 (0.9)	~ ~
<b>Sweden</b>	62 (2.6)	538 (3.1)	28 (2.5)	533 (5.0)	9 (1.7)	540 (5.8)
<b>Switzerland</b>	r 70 (3.4)	520 (4.1)	14 (3.1)	507 (9.6)	16 (2.2)	544 (7.3)
<i>Thailand</i>	r 27 (5.7)	526 (9.5)	27 (5.3)	528 (7.8)	45 (6.2)	531 (6.2)

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

<sup>1</sup>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.

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 5.4**  
**Teachers' Reports<sup>1</sup> on Average Number of Hours Integrated Science Is Taught Weekly to Their Science 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
<b>UNITED STATES</b>	x x	x x	x x	x x	x x	x x	x x	x x
<b>MISSOURI</b>	r 6 (1.9)	583 (14.7)	19 (3.1)	561 (2.7)	42 (5.1)	562 (9.2)	33 (6.0)	525 (7.8)
<b>OREGON</b>	x x	x x	x x	x x	x x	x x	x x	x x
<i>Australia</i>	x x	x x	x x	x x	x x	x x	x x	x x
<b>Canada</b>	r 11 (2.1)	512 (8.9)	69 (3.9)	540 (3.8)	11 (2.5)	528 (5.5)	8 (2.1)	517 (10.3)
<i>Colombia</i>	r 6 (2.3)	416 (4.5)	75 (4.2)	415 (5.6)	13 (3.2)	404 (5.5)	6 (2.4)	403 (18.6)
<b>Cyprus</b>	x x	x x	x x	x x	x x	x x	x x	x x
<b>England</b>	--	--	--	--	--	--	--	--
<b>Hong Kong</b>	6 (2.3)	492 (29.9)	82 (3.9)	526 (5.3)	9 (3.3)	518 (8.6)	2 (1.6)	~ ~
<b>Iran, Islamic Rep.</b>	--	--	--	--	--	--	--	--
<b>Ireland</b>	s 4 (1.9)	578 (16.6)	94 (2.1)	540 (6.2)	2 (0.8)	~ ~	0 (0.0)	~ ~
<i>Israel</i>	s 19 (7.9)	547 (19.6)	77 (7.2)	520 (9.1)	4 (3.5)	529 (0.0)	0 (0.0)	~ ~
<b>Japan</b>	5 (1.6)	618 (15.2)	94 (1.7)	569 (1.5)	0 (0.0)	~ ~	1 (0.6)	~ ~
<b>Korea</b>	43 (2.9)	569 (3.3)	51 (3.2)	561 (3.1)	1 (0.8)	~ ~	5 (2.3)	568 (12.7)
<i>Kuwait</i>	r 3 (2.6)	409 (1.9)	97 (2.7)	426 (4.1)	0 (0.5)	~ ~	0 (0.0)	~ ~
<b>New Zealand</b>	1 (0.9)	~ ~	52 (4.1)	527 (6.3)	47 (4.2)	525 (6.6)	0 (0.0)	~ ~
<b>Norway</b>	s 27 (4.9)	526 (3.0)	73 (4.9)	524 (2.6)	1 (0.6)	~ ~	0 (0.0)	~ ~
<i>Scotland</i>	s 14 (3.1)	538 (23.4)	83 (3.6)	519 (4.8)	3 (1.7)	488 (22.5)	0 (0.0)	~ ~
<b>Singapore</b>	0 (0.0)	~ ~	24 (4.4)	618 (14.6)	76 (4.4)	603 (6.0)	0 (0.0)	~ ~
<b>Spain</b>	r 5 (2.6)	532 (2.5)	84 (3.9)	518 (2.1)	11 (3.0)	502 (9.4)	1 (0.7)	~ ~
<b>Switzerland</b>	s 41 (4.7)	532 (6.6)	37 (4.4)	524 (8.4)	9 (3.1)	486 (13.7)	13 (3.5)	519 (15.6)
<i>Thailand</i>	x x	x x	x x	x x	x x	x x	x x	x x

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.

<sup>1</sup>Reported for countries using integrated science form of student questionnaire.

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 &lt;50% of students.

**Table 5.5** **Average Number of Hours<sup>1</sup> Students' Teachers Spend on Various School-Related Activities Outside the Formal School Day During the School Week - Science - 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
<b>UNITED STATES</b>	r 2.1 (0.1)	r 2.4 (0.1)	r 2.2 (0.1)	r 1.2 (0.1)	r 0.7 (0.1)	r 1.0 (0.1)	r 1.5 (0.1)	r 2.0 (0.1)
<b>MISSOURI</b>	2.0 (0.1)	2.7 (0.2)	2.7 (0.1)	1.3 (0.1)	0.6 (0.0)	1.2 (0.1)	1.8 (0.1)	1.8 (0.1)
<b>OREGON</b>	1.8 (0.1)	2.8 (0.1)	2.4 (0.1)	1.1 (0.1)	0.6 (0.0)	1.0 (0.1)	2.0 (0.1)	1.6 (0.1)
<i>Australia</i>	r 2.1 (0.1)	s 2.3 (0.1)	r 2.8 (0.1)	s 1.1 (0.1)	s 0.5 (0.0)	r 1.2 (0.1)	s 1.1 (0.1)	r 2.1 (0.1)
<i>Austria</i>	r 1.7 (0.1)	r 2.6 (0.1)	r 3.6 (0.1)	r 0.5 (0.0)	r 0.6 (0.0)	r 1.9 (0.1)	r 0.9 (0.1)	r 1.1 (0.1)
<b>Belgium (Fl)</b>	3.5 (0.1)	1.5 (0.1)	3.6 (0.1)	0.7 (0.1)	r 0.6 (0.1)	1.2 (0.1)	r 0.5 (0.1)	1.4 (0.1)
<i>Belgium (Fr)</i>	s 3.2 (0.2)	s 1.7 (0.1)	s 3.5 (0.2)	s 0.7 (0.1)	s 0.5 (0.1)	s 1.4 (0.1)	s 0.8 (0.1)	s 1.1 (0.1)
<b>Canada</b>	2.2 (0.1)	2.5 (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)
<i>Colombia</i>	2.9 (0.1)	r 2.5 (0.2)	3.1 (0.1)	r 1.5 (0.2)	r 0.9 (0.1)	r 2.4 (0.2)	r 0.8 (0.1)	r 1.4 (0.2)
<b>Cyprus</b>	r 3.4 (0.1)	r 1.6 (0.1)	r 3.5 (0.1)	s 0.3 (0.0)	r 1.0 (0.1)	r 1.0 (0.1)	s 0.5 (0.1)	r 1.3 (0.1)
<b>Czech Republic</b>	2.5 (0.1)	1.2 (0.1)	4.0 (0.1)	1.1 (0.1)	0.5 (0.0)	1.0 (0.1)	0.9 (0.0)	1.3 (0.1)
<i>Denmark</i>	--	--	--	--	--	--	--	--
<b>England</b>	x x	x x	x x	x x	x x	x x	x x	x x
<b>France</b>	3.8 (0.1)	r 1.0 (0.1)	3.6 (0.1)	0.6 (0.0)	0.5 (0.0)	1.4 (0.1)	0.9 (0.0)	1.3 (0.1)
<i>Germany</i>	s 2.7 (0.1)	s 2.3 (0.1)	s 4.1 (0.1)	s 0.7 (0.1)	s 0.7 (0.1)	s 1.9 (0.1)	s 1.0 (0.1)	s 1.7 (0.1)
<i>Greece</i>	2.8 (0.1)	1.2 (0.1)	2.4 (0.1)	0.6 (0.1)	0.9 (0.1)	2.6 (0.1)	0.4 (0.0)	1.3 (0.2)
<b>Hong Kong</b>	2.3 (0.2)	3.1 (0.2)	2.8 (0.2)	1.9 (0.1)	0.4 (0.1)	1.0 (0.1)	0.8 (0.1)	1.8 (0.2)
<b>Hungary</b>	2.7 (0.1)	2.2 (0.1)	3.7 (0.1)	1.8 (0.1)	0.8 (0.0)	2.1 (0.1)	0.7 (0.0)	2.3 (0.1)
<b>Iceland</b>	s 1.8 (0.2)	s 2.8 (0.2)	s 4.0 (0.2)	r 0.6 (0.1)	s 0.5 (0.0)	r 1.3 (0.2)	s 1.3 (0.1)	r 2.0 (0.2)
<b>Iran, Islamic Rep.</b>	2.5 (0.2)	1.8 (0.2)	2.0 (0.1)	0.9 (0.1)	0.7 (0.1)	0.5 (0.1)	0.9 (0.1)	0.8 (0.1)
<b>Ireland</b>	r 2.1 (0.1)	s 1.7 (0.1)	r 2.3 (0.1)	r 0.8 (0.1)	r 0.3 (0.1)	r 0.8 (0.1)	r 0.8 (0.1)	r 1.1 (0.1)
<i>Israel</i>	r 3.4 (0.3)	s 2.1 (0.2)	r 3.5 (0.3)	s 1.1 (0.2)	s 0.7 (0.1)	s 3.3 (0.3)	s 1.2 (0.2)	r 1.6 (0.2)
<b>Japan</b>	1.8 (0.1)	1.7 (0.1)	3.0 (0.1)	2.0 (0.1)	0.5 (0.0)	1.7 (0.1)	1.3 (0.1)	2.4 (0.1)
<b>Korea</b>	1.9 (0.1)	1.7 (0.1)	2.4 (0.1)	1.9 (0.1)	0.4 (0.0)	1.7 (0.1)	1.1 (0.1)	1.9 (0.1)
<i>Kuwait</i>	r 2.8 (0.2)	r 2.1 (0.2)	r 2.1 (0.2)	s 0.4 (0.1)	r 0.5 (0.1)	s 0.9 (0.2)	r 1.3 (0.1)	r 0.8 (0.1)
<b>Latvia (LSS)</b>	r 2.3 (0.1)	r 1.6 (0.1)	r 3.1 (0.1)	r 1.5 (0.1)	r 0.6 (0.0)	r 1.2 (0.1)	r 0.4 (0.0)	r 1.4 (0.1)
<b>Lithuania</b>	r 1.5 (0.1)	r 2.0 (0.1)	r 2.6 (0.1)	r 1.6 (0.1)	r 0.8 (0.0)	r 2.3 (0.1)	r 0.8 (0.0)	r 0.7 (0.1)
<i>Netherlands</i>	3.8 (0.1)	r 1.1 (0.1)	3.0 (0.1)	r 1.3 (0.1)	0.6 (0.0)	1.2 (0.1)	r 0.5 (0.0)	1.4 (0.1)
<b>New Zealand</b>	2.3 (0.1)	2.1 (0.1)	3.0 (0.1)	1.2 (0.1)	0.4 (0.1)	1.3 (0.1)	1.0 (0.1)	2.6 (0.1)
<b>Norway</b>	2.1 (0.1)	1.6 (0.1)	3.4 (0.1)	0.7 (0.1)	0.6 (0.0)	0.5 (0.1)	0.8 (0.1)	1.7 (0.1)
<b>Portugal</b>	3.0 (0.1)	2.2 (0.1)	3.7 (0.1)	0.7 (0.1)	0.6 (0.0)	1.5 (0.1)	0.9 (0.1)	1.5 (0.1)
<i>Romania</i>	2.1 (0.1)	1.7 (0.1)	3.3 (0.1)	1.4 (0.1)	1.1 (0.0)	1.4 (0.1)	1.5 (0.1)	2.2 (0.1)
<b>Russian Federation</b>	2.1 (0.1)	2.0 (0.1)	3.1 (0.1)	1.9 (0.1)	1.0 (0.0)	2.8 (0.1)	0.9 (0.0)	1.9 (0.1)
<i>Scotland</i>	s 1.5 (0.1)	s 1.7 (0.1)	s 2.0 (0.1)	s 0.9 (0.1)	s 0.6 (0.1)	s 1.1 (0.1)	s 1.1 (0.1)	s 1.6 (0.1)
<b>Singapore</b>	3.3 (0.2)	4.0 (0.1)	3.1 (0.1)	1.4 (0.1)	0.4 (0.0)	1.3 (0.1)	1.2 (0.1)	2.3 (0.1)
<b>Slovak Republic</b>	2.3 (0.1)	1.6 (0.1)	3.5 (0.1)	1.2 (0.1)	0.6 (0.0)	0.9 (0.1)	1.1 (0.1)	1.1 (0.1)
<i>Slovenia</i>	r 2.2 (0.1)	r 1.2 (0.1)	r 3.4 (0.1)	r 1.2 (0.1)	r 1.1 (0.1)	r 2.2 (0.1)	r 0.6 (0.0)	r 1.6 (0.1)
<b>Spain</b>	2.2 (0.1)	1.5 (0.1)	1.8 (0.1)	0.9 (0.1)	1.1 (0.1)	1.6 (0.1)	0.8 (0.1)	1.7 (0.1)
<b>Sweden</b>	2.3 (0.1)	1.5 (0.1)	4.0 (0.1)	0.6 (0.0)	0.8 (0.0)	1.5 (0.1)	0.9 (0.0)	2.4 (0.1)
<b>Switzerland</b>	r 3.0 (0.1)	r 2.1 (0.1)	r 3.8 (0.1)	r 0.9 (0.1)	r 0.7 (0.1)	r 1.9 (0.1)	r 0.7 (0.0)	r 2.3 (0.1)
<i>Thailand</i>	s 2.7 (0.2)	s 2.4 (0.2)	s 2.3 (0.2)	s 1.3 (0.1)	s 0.6 (0.1)	s 1.6 (0.2)	s 1.4 (0.1)	s 1.8 (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.

<sup>1</sup>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.

An "x" indicates teacher response data available for &lt;50% of students.

Opportunities to meet with colleagues to plan curriculum or teaching approaches enable teachers to expand their views of science, 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 Cyprus, the Czech Republic, England, Hungary, Korea, Kuwait, Norway, Scotland, the Slovak Republic, and Sweden. In the remaining countries, however, most students had science teachers who reported only limited opportunities to plan curriculum or teaching approaches with other teachers (monthly or even yearly meetings). In the United States, and in Missouri and Oregon, the majority of students had science teachers who reported meeting monthly or less often. In Missouri, 43% of students and in Oregon, 27% of students had teachers who reported meeting once or twice a year or less.

**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 - Science - 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
<b>UNITED STATES</b>	r 37 (3.3)	31 (3.5)	26 (4.0)	6 (1.3)
<b>MISSOURI</b>	43 (4.8)	32 (4.0)	18 (3.3)	7 (2.7)
<b>OREGON</b>	27 (4.1)	37 (4.5)	27 (3.6)	9 (1.4)
<i>Australia</i>	r 10 (2.0)	50 (3.6)	30 (3.2)	9 (2.3)
<i>Austria</i>	r 20 (2.5)	37 (3.0)	36 (3.1)	6 (1.9)
<b>Belgium (Fl)</b>	48 (5.6)	28 (4.2)	21 (3.5)	3 (1.2)
<i>Belgium (Fr)</i>	s 21 (4.2)	34 (5.5)	39 (5.2)	6 (2.3)
<b>Canada</b>	38 (2.9)	25 (3.5)	31 (3.8)	6 (1.7)
<i>Colombia</i>	24 (3.3)	30 (4.4)	42 (4.8)	4 (1.8)
<b>Cyprus</b>	r 4 (1.7)	6 (0.7)	67 (3.2)	22 (2.2)
<b>Czech Republic</b>	22 (3.2)	23 (2.5)	34 (3.4)	20 (2.3)
<i>Denmark</i>	--	--	--	--
<b>England</b>	s 8 (1.6)	41 (3.1)	51 (3.2)	0 (0.1)
<b>France</b>	45 (4.2)	22 (2.8)	29 (4.2)	4 (1.4)
<i>Germany</i>	s 32 (4.5)	31 (4.8)	22 (3.6)	15 (3.4)
<i>Greece</i>	43 (4.2)	26 (3.4)	26 (3.9)	6 (1.7)
<b>Hong Kong</b>	33 (5.3)	48 (5.9)	19 (4.3)	0 (0.0)
<b>Hungary</b>	9 (1.6)	16 (2.1)	39 (2.7)	35 (3.1)
<b>Iceland</b>	r 42 (6.1)	29 (7.0)	29 (8.0)	0 (0.0)
<b>Iran, Islamic Rep.</b>	18 (3.3)	37 (4.4)	34 (4.6)	11 (3.1)
<b>Ireland</b>	r 59 (4.4)	25 (4.1)	13 (3.0)	2 (0.9)
<i>Israel</i>	r 25 (6.9)	34 (9.5)	37 (8.6)	4 (2.6)
<b>Japan</b>	24 (3.4)	29 (3.9)	46 (3.7)	1 (1.0)
<b>Korea</b>	21 (3.0)	26 (3.6)	37 (4.1)	15 (3.1)
<i>Kuwait</i>	r 10 (4.5)	2 (1.1)	66 (5.7)	22 (5.4)
<b>Latvia (LSS)</b>	r 28 (2.5)	46 (3.0)	16 (2.3)	10 (1.9)
<b>Lithuania</b>	25 (2.5)	36 (2.7)	24 (2.4)	14 (1.7)
<i>Netherlands</i>	13 (2.5)	65 (3.9)	21 (3.1)	2 (0.9)
<b>New Zealand</b>	6 (1.8)	45 (4.1)	43 (4.0)	6 (2.1)
<b>Norway</b>	7 (2.3)	20 (3.5)	65 (4.0)	8 (2.0)
<b>Portugal</b>	8 (1.6)	69 (3.0)	18 (2.8)	5 (1.2)
<i>Romania</i>	12 (1.8)	58 (2.6)	14 (1.7)	15 (1.9)
<b>Russian Federation</b>	12 (1.9)	57 (2.7)	20 (2.6)	11 (2.1)
<i>Scotland</i>	s 7 (1.7)	12 (2.6)	74 (4.0)	8 (2.3)
<b>Singapore</b>	15 (3.8)	61 (4.6)	21 (4.1)	3 (1.4)
<b>Slovak Republic</b>	4 (1.5)	23 (3.6)	35 (4.0)	39 (4.6)
<i>Slovenia</i>	r 5 (1.8)	53 (3.6)	18 (2.8)	24 (2.9)
<b>Spain</b>	17 (2.9)	48 (4.4)	32 (4.0)	2 (1.2)
<b>Sweden</b>	9 (1.8)	19 (2.5)	46 (3.5)	26 (2.6)
<b>Switzerland</b>	r 36 (4.0)	32 (4.0)	30 (3.9)	2 (1.3)
<i>Thailand</i>	s 54 (6.1)	17 (4.2)	23 (5.2)	6 (3.1)

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 Science Classes Organized?

Instructional organization can subsume many factors, including the diversity of the students in the classroom, economic factors such as the instructional resources available to the student population as well as for use within the classroom, 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 provides information on teacher reports about several factors that might limit how they teach their science classes. The results are presented visually via pie graphs. The percentage of teachers reporting that a particular factor limited how they teach science either "quite a lot" or "a great deal" also is shown next to each graph. In most countries, the challenge of dealing with students of differing academic abilities was mentioned most often. In six countries, Cyprus, Greece, Hungary, Iceland, Iran, and Korea, 75% or more of the students had science teachers who found this to be a problem. In Missouri, 50% of students had science teachers who reported students of differing academic abilities to be a limiting factor (there was insufficient data to report results for Oregon or the United States).

In many countries, large classes and high student/teacher ratios cause problems for teachers in carrying out their professional duties. The majority of students in about half the countries were taught by teachers who reported that high student/teacher ratios limited their teaching approach. In Missouri, 50% of the students were in this category. Even among the other countries, however, only the teachers in the Netherlands reported that student/teachers ratios affected instruction for fewer than 20% of the students.

Also mentioned frequently as limiting factors were inadequate physical facilities, and shortage of equipment for use in demonstrations. These were reported to limit teaching particularly in Greece, Iran, Kuwait, Romania, and the Slovak Republic. Disruptive students were reported to limit teachers of the majority of students in 13 countries. Together with students with different academic abilities and high student/teacher ratio, this was the limiting factor most often reported by science teachers in Missouri.

Table 5.7 presents teachers' reports about the size of eighth-grade science classes for the TIMSS countries. The data reveal rather large variation from country to country. Scotland appeared to have the smallest science classes, with 99% of the students in classes of 20 or fewer students. According to teachers, science classes were relatively small in a number of countries. For example, 90% or more of the students were in science classes of 30 or fewer students in Austria, Belgium (Flemish), Belgium (French), Denmark, France, Germany, Hungary, Iceland, Ireland, Lithuania, the Netherlands, Norway, Portugal, the Russian Federation, Scotland, Slovenia, and Switzerland. Science classes in Missouri appear to be comparatively large (59% of students in classes of more than 40 students). Only Korea had a greater percentage of students in science classes with more than 40 students. Again, there were insufficient data to report results for the United States and Oregon.

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



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classes often are in relation to teacher attitudes and instructional behaviors. The TIMSS data illustrate the complexity of this issue. Across countries, three of the four highest-performing countries at the eighth grade—Singapore, Korea, and Japan—are among those with the largest science classes. Within countries, several show little or no relationship between achievement and class size, often because students mostly are in classes of similar size. Within others, there appears to be a curvilinear relationship, or those students with higher achievement appear to be in larger classes. There was no consistent relationship between class size and science achievement in Missouri. In some countries, larger classes may represent the more usual situation for teaching science, with smaller classes used primarily for students needing remediation or for those students in the less advanced tracks.

**Figure 5.3**  
**Teachers' Reports on What Factors Limit How They Teach Class**  
**Science - 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
<b>MISSOURI</b>	50	25	52	42	36	50
<i>Austria</i>	r 46	r 2	r 25	r 17	r 26	r 31
<b>Belgium (Fl)</b>	r 30	r 17	r 39	r 32	r 42	r 45
<i>Belgium (Fr)</i>	s 36	s 3	s 31	s 48	s 44	s 44
<b>Canada</b>	r 38	s 21	r 42	r 31	r 27	r 46
<i>Colombia</i>	r 18	r 55	r 54	r 64	r 58	r 57
<b>Cyprus</b>	s 75	s 56	s 58	s 69	s 68	s 86
<b>Czech Republic</b>	r 64	r 13	r 46	r 43	r 29	r 42
<i>Denmark</i>	s 46	s 11	s 49	s 41	s 38	s 35
<b>France</b>	62	9	39	36	r 28	61
<i>Germany</i>	s 43	s 9	s 41	s 33	s 33	s 50
<i>Greece</i>	86	47	52	84	74	86
<b>Hong Kong</b>	57	21	53	48	44	87
<b>Hungary</b>	90	52	60	61	42	44
<b>Iceland</b>	r 76	r 43	r 64	r 54	r 59	r 71
<b>Iran, Islamic Rep.</b>	88	62	52	83	56	70
<b>Ireland</b>	s 47	x	s 49	s 36	s 40	s 43

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

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.  
 Countries/states where data were not available, or where teacher response data were available for <50% of students, are omitted from the figure (Australia, England, Sweden, the United States, and Oregon).  
 ( ) 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.  
 An "x" indicates teacher response data available for <50% of students.

**Figure 5.3 (Continued)**  
**Teachers' Reports on What Factors Limit How They Teach Class**  
**Science - 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
Israel	<sup>s</sup> 63	<sup>r</sup> 11	<sup>r</sup> 20	<sup>s</sup> 52	<sup>r</sup> 48	<sup>s</sup> 36
Japan	38	–	–	45	–	43
Korea	75	35	54	41	34	67
<i>Kuwait</i>	<sup>r</sup> 64	<sup>r</sup> 55	<sup>r</sup> 43	<sup>r</sup> 77	<sup>r</sup> 38	<sup>r</sup> 69
Latvia (LSS)	<sup>s</sup> 66	<sup>s</sup> 23	<sup>s</sup> 36	<sup>s</sup> 69	<sup>s</sup> 60	<sup>s</sup> 33
Lithuania	<sup>r</sup> 72	<sup>r</sup> 22	<sup>r</sup> 28	<sup>r</sup> 72	<sup>r</sup> 39	<sup>r</sup> 53
<i>Netherlands</i>	17	1	<sup>r</sup> 17	12	28	18
New Zealand	47	22	53	28	28	53
Norway	<sup>s</sup> 56	<sup>s</sup> 26	<sup>s</sup> 37	<sup>s</sup> 56	<sup>s</sup> 30	<sup>s</sup> 59
Portugal	68	61	59	70	46	58
Romania	53	49	60	85	83	65
Russian Federation	66	20	29	69	57	46
<i>Scotland</i>	<sup>s</sup> 53	<sup>s</sup> 21	<sup>s</sup> 34	<sup>s</sup> 25	<sup>s</sup> 29	<sup>s</sup> 25
Singapore	48	20	49	34	32	67
Slovak Republic	<sup>r</sup> 68	<sup>r</sup> 6	<sup>r</sup> 36	<sup>r</sup> 75	<sup>r</sup> 0	<sup>r</sup> 38
<i>Slovenia</i>	<sup>r</sup> 46	<sup>r</sup> 5	<sup>r</sup> 51	<sup>r</sup> 50	<sup>r</sup> 43	<sup>r</sup> 56
Spain	<sup>r</sup> 70	<sup>r</sup> 59	<sup>r</sup> 70	<sup>r</sup> 60	<sup>r</sup> 48	<sup>r</sup> 69
Switzerland	<sup>s</sup> 43	<sup>s</sup> 17	<sup>s</sup> 36	<sup>s</sup> 17	<sup>s</sup> 16	<sup>s</sup> 39
<i>Thailand</i>	<sup>r</sup> 53	<sup>r</sup> 13	<sup>r</sup> 24	<sup>r</sup> 57	<sup>r</sup> 69	<sup>r</sup> 73

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

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.  
 Countries/states where data were not available, or where teacher response data were available for <50% of students, are omitted from the figure (Australia, England, Sweden, the United States, and Oregon).  
 ( ) 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.

**Table 5.7**  
**Teachers' Reports on Average Size of Science 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
<b>UNITED STATES</b>	x x	x x	x x	x x	x x	x x	x x	x x
<b>MISSOURI</b>	r 6 (2.0)	523 (26.0)	29 (3.6)	558 (6.3)	7 (1.7)	529 (8.3)	59 (4.5)	558 (6.2)
<b>OREGON</b>	x x	x x	x x	x x	x x	x x	x x	x x
<i>Australia</i>	x x	x x	x x	x x	x x	x x	x x	x x
<i>Austria</i>	r 17 (3.9)	568 (8.9)	81 (3.9)	561 (3.6)	1 (0.7)	~ ~	0 (0.0)	~ ~
<b>Belgium (Fl)</b>	r 45 (4.6)	550 (8.4)	53 (4.5)	560 (8.1)	2 (1.2)	~ ~	0 (0.0)	~ ~
<i>Belgium (Fr)</i>	s 42 (6.2)	489 (6.1)	57 (6.1)	484 (3.9)	1 (1.3)	~ ~	0 (0.0)	~ ~
<b>Canada</b>	s 10 (2.6)	520 (11.0)	62 (4.2)	540 (3.9)	25 (3.4)	535 (6.6)	3 (1.3)	533 (12.0)
<i>Colombia</i>	r 4 (1.7)	422 (9.8)	6 (2.4)	420 (21.6)	37 (4.3)	422 (5.2)	53 (4.5)	411 (4.2)
<b>Cyprus</b>	s 2 (0.1)	~ ~	45 (3.5)	460 (4.0)	53 (3.5)	458 (3.5)	0 (0.0)	~ ~
<b>Czech Republic</b>	r 11 (2.7)	552 (6.4)	78 (5.1)	576 (5.4)	11 (4.6)	590 (11.7)	0 (0.0)	~ ~
<i>Denmark</i>	s 62 (6.7)	481 (3.7)	38 (6.7)	485 (6.7)	0 (0.0)	~ ~	0 (0.0)	~ ~
<b>England</b>	x x	x x	x x	x x	x x	x x	x x	x x
<b>France</b>	16 (3.6)	490 (6.6)	83 (3.6)	501 (2.7)	1 (0.6)	~ ~	0 (0.0)	~ ~
<i>Germany</i>	s 20 (4.5)	520 (18.4)	73 (5.1)	536 (5.5)	6 (2.8)	587 (15.7)	0 (0.0)	~ ~
<i>Greece</i>	6 (1.8)	474 (7.0)	71 (3.9)	498 (2.6)	22 (3.3)	500 (4.9)	1 (0.9)	~ ~
<b>Hong Kong</b>	0 (0.0)	~ ~	1 (1.2)	~ ~	57 (6.5)	520 (7.5)	42 (6.5)	530 (7.9)
<b>Hungary</b>	40 (3.7)	548 (4.1)	56 (3.9)	555 (4.1)	4 (1.8)	569 (8.9)	0 (0.0)	~ ~
<b>Iceland</b>	s 38 (6.5)	480 (5.2)	59 (6.8)	486 (3.7)	0 (0.0)	~ ~	3 (2.4)	519 (0.0)
<b>Iran, Islamic Rep.</b>	r 3 (1.3)	467 (18.0)	23 (4.3)	475 (6.0)	52 (5.2)	472 (3.9)	22 (4.0)	462 (6.8)
<b>Ireland</b>	s 12 (3.0)	490 (19.4)	80 (4.4)	548 (5.4)	9 (3.2)	575 (13.0)	0 (0.0)	~ ~
<i>Israel</i>	s 11 (5.9)	532 (8.3)	30 (7.0)	533 (16.0)	47 (9.8)	544 (9.3)	12 (7.4)	466 (24.8)
<b>Japan</b>	0 (0.2)	~ ~	4 (1.4)	570 (6.6)	87 (2.0)	567 (1.6)	8 (1.5)	615 (10.2)
<b>Korea</b>	6 (1.8)	573 (9.0)	1 (0.7)	~ ~	5 (1.5)	536 (8.1)	89 (2.5)	566 (2.3)
<i>Kuwait</i>	r 0 (0.0)	~ ~	48 (8.2)	427 (5.8)	50 (8.3)	425 (6.3)	2 (2.1)	~ ~
<b>Latvia (LSS)</b>	s 37 (4.0)	485 (5.2)	47 (3.8)	488 (3.4)	10 (2.6)	483 (7.9)	6 (1.6)	477 (3.5)
<b>Lithuania</b>	r 38 (3.1)	467 (5.4)	59 (2.9)	484 (5.2)	1 (0.5)	~ ~	2 (1.0)	~ ~
<i>Netherlands</i>	r 15 (5.0)	498 (21.4)	75 (5.7)	567 (5.0)	10 (3.5)	615 (13.6)	0 (0.0)	~ ~
<b>New Zealand</b>	7 (1.8)	501 (12.4)	75 (3.5)	522 (5.7)	18 (3.0)	556 (8.0)	1 (0.0)	~ ~
<b>Norway</b>	s 27 (4.4)	519 (4.6)	72 (4.7)	526 (2.8)	2 (1.4)	~ ~	0 (0.0)	~ ~
<b>Portugal</b>	15 (2.9)	469 (4.0)	77 (3.8)	481 (2.8)	8 (2.5)	487 (9.7)	0 (0.4)	~ ~
<i>Romania</i>	20 (2.5)	476 (9.5)	52 (4.5)	474 (6.1)	25 (4.2)	510 (9.9)	2 (1.3)	~ ~
<b>Russian Federation</b>	15 (2.7)	523 (11.7)	76 (3.6)	539 (3.9)	9 (2.3)	546 (14.4)	0 (0.0)	~ ~
<i>Scotland</i>	s 99 (0.9)	520 (5.9)	1 (0.6)	~ ~	0 (0.0)	~ ~	1 (0.7)	~ ~
<b>Singapore</b>	0 (0.0)	~ ~	9 (2.4)	609 (15.7)	72 (4.2)	604 (7.3)	19 (4.0)	616 (7.7)
<b>Slovak Republic</b>	r 12 (3.1)	533 (13.9)	69 (4.8)	543 (4.2)	19 (4.3)	554 (10.1)	0 (0.0)	~ ~
<i>Slovenia</i>	r 14 (2.8)	554 (7.5)	81 (3.2)	558 (3.1)	5 (1.5)	575 (13.6)	0 (0.4)	~ ~
<b>Spain</b>	r 9 (2.5)	505 (8.3)	49 (4.0)	515 (3.4)	35 (4.2)	525 (3.8)	7 (2.4)	509 (6.3)
<b>Sweden</b>	x x	x x	x x	x x	x x	x x	x x	x x
<b>Switzerland</b>	s 50 (5.0)	513 (7.0)	47 (4.8)	530 (6.2)	3 (1.9)	551 (7.5)	0 (0.0)	~ ~
<i>Thailand</i>	x x	x x	x x	x x	x x	x x	x x	x x

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.

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 &lt;50% of students.

Teachers can adopt a variety of organizational and interactive approaches in science class. Whole-class instruction can be very efficient, because it requires less time on management functions and provides more time for developing science 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 science 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 science in the workplace.

Figure 5.4 provides a pictorial view of the emphasis on individual, group, and whole class work as reported by the science teachers in the TIMSS countries. Because learning may be enhanced with teacher guidance and monitoring of individual and small-group activities, the frequency of lessons using each of these organizational approaches is shown both with and without assistance from the teacher. Internationally, teachers reported that working together as a class with the teacher teaching the whole class is a frequently used instructional approach. In most countries, 50% or more of the eighth-grade students were taught this way during most or every lesson. Students working individually with assistance from the teacher is also a popular approach, as is working in pairs or small groups with teacher assistance. Science teachers in Missouri seem to favor small group work. Working in small groups with assistance from the teacher was the most frequent approach reported, with 40% of students in classes where this approach is used in most or every lesson. Working together as a class with the teacher teaching the whole class, and working individually with assistance from the teacher are also popular approaches.

**Figure 5.4**  
**Teachers' Reports About Classroom Organization During Science 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
<b>MISSOURI</b>	16	38	32	12	40	14
<i>Austria</i>	r 3	r 65	r 13	r 3	r 18	r 12
<b>Belgium (Fl)</b>	r 11	r 62	r 19	r 6	r 13	r 7
<i>Belgium (Fr)</i>	s 11	s 53	s 24	s 8	s 8	s 4
<b>Canada</b>	s 17	r 28	r 26	r 23	r 33	s 24
<i>Colombia</i>	r 33	r 48	r 55	r 10	r 43	r 13
<b>Cyprus</b>	s 3	s 74	s 35	s 3	s 17	s 6
<b>Czech Republic</b>	11	70	r 46	15	14	4
<i>Denmark</i>	s 2	s 22	s 25	s 3	s 46	s 13
<b>France</b>	16	57	34	16	27	12
<i>Germany</i>	s 30	s 69	s 28	s 7	s 19	s 5
<i>Greece</i>	3	67	45	10	13	1
<b>Hong Kong</b>	12	45	35	2	44	13
<b>Hungary</b>	7	80	54	13	11	2
<b>Iceland</b>	s 1	r 35	r 30	r 9	r 16	r 6
<b>Iran, Islamic Rep.</b>	25	57	36	2	25	11
<b>Ireland</b>	s 7	s 62	s 25	s 6	s 20	s 6

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

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.  
 Countries/states where data were not available, or where teacher response data were available for <50% of students, are omitted from the figure (Australia, England, Sweden, the United States, and Oregon).  
 ( ) 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.

**Figure 5.4 (Continued)**  
**Teachers' Reports About Classroom Organization During Science 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
<i>Israel</i>	S 17	r 41	r 30	r 15	r 32	r 17
<b>Japan</b>	19	79	12	8	12	6
<b>Korea</b>	34	83	28	8	15	3
<i>Kuwait</i>	r 9	r 46	r 45	r 0	r 36	r 2
<b>Latvia (LSS)</b>	S 25	S 84	S 59	S 32	S 24	S 8
<b>Lithuania</b>	r 16	r 60	r 57	r 22	r 26	r 8
<i>Netherlands</i>	r 5	r 63	r 36	r 23	r 25	r 18
<b>New Zealand</b>	15	41	33	26	44	20
<b>Norway</b>	S 24	S 62	S 23	S 1	S 23	S 4
<b>Portugal</b>	14	66	54	3	54	5
<i>Romania</i>	15	86	47	8	27	r 2
<b>Russian Federation</b>	9	68	43	21	13	7
<i>Scotland</i>	S 7	S 22	S 27	S 11	S 56	S 19
<b>Singapore</b>	12	59	41	17	40	19
<b>Slovak Republic</b>	r 48	r 64	r 45	r 15	r 3	r 1
<i>Slovenia</i>	r 7	r 65	r 57	r 19	r 34	r 13
<b>Spain</b>	r 14	r 65	r 46	r 14	r 18	r 6
<b>Switzerland</b>	S 3	S 56	S 21	S 6	S 30	S 8
<i>Thailand</i>	r 15	r 38	r 33	r 10	r 32	r 11

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

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.  
 Countries/states where data were not available, or where teacher response data were available for <50% of students, are omitted from the figure (Australia, England, Sweden, the United States, and Oregon).  
 ( ) 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.

## What Activities Do Students Do in Their Science Lessons?

As shown in Table 5.8, science teachers in the participating countries generally reported heavier reliance on curriculum guides than textbooks in deciding which topics to teach. Only Japan, Korea, the Netherlands, and Thailand use textbooks more for this purpose. In contrast, in almost all countries the textbook was the major written source science teachers used in deciding how to present a topic to their classes. Curriculum guide and textbook usage in Missouri was much like the majority of countries, with curriculum guides most useful in deciding which topics to teach, and textbooks most valuable in deciding how to present a topic. Examination specifications play little role in either activity in Missouri (there was insufficient data to report results for Oregon and the United States).

The types of activities teachers asked eighth-grade students to do, however, varied from country to country. Teachers were asked how often they asked students to do reasoning tasks in science. The data in Table 5.9 reveal that such activities are very common in science classes, with the majority of students in all countries being asked to do some type of science reasoning task in most or every lesson. The activities TIMSS inquired 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, writing explanations about what was observed and why it happened, and putting events in order and giving a reason for the organization. In Cyprus, the Czech Republic, Hungary, Portugal, Romania, and the Slovak Republic, 90% or more of the students were asked to do at least one of these types of reasoning tasks in most or every lesson. In Missouri, 57% of student were asked to do reasoning tasks in most lessons and 19% in every lesson.

Students were asked about the frequency with which their teachers demonstrate an experiment or with which they themselves do an experiment or practical investigation in class. Since in almost half of the TIMSS countries science is taught not as an integrated subject but as individual science subjects (biology, chemistry, etc.), the student reports are presented to reflect this. According to students (Table 5.10), teacher demonstrations are common in almost all countries where science is taught as an integrated subject, and they are also common in chemistry and physics classes. Such demonstrations are reported much less frequently in biology and earth science classes. Among eighth-grade students in Oregon, 74% reported that their science teacher gives a demonstration of an experiment pretty often or almost always. Among Missouri students the percentage was lower (64%).



**Table 5.8** **Teachers' Reports on Their Main Sources of Written Information<sup>1</sup> When Deciding Which Topics to Teach and How to Present a Topic - Science - 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
<b>UNITED STATES</b>	x x	x x	x x	x x	x x	x x
<b>MISSOURI</b>	79 (3.7)	18 (3.6)	3 (0.9)	9 (2.2)	87 (2.2)	4 (0.4)
<b>OREGON</b>	x x	x x	x x	x x	x x	x x
<i>Australia</i>	x x	x x	--	x x	x x	--
<i>Austria</i>	r 72 (2.8)	28 (2.8)	0 (0.2)	r 29 (3.3)	70 (3.2)	1 (0.6)
<b>Belgium (Fl)</b>	r 90 (3.7)	10 (3.7)	--	r 13 (2.6)	87 (2.6)	--
<i>Belgium (Fr)</i>	s 90 (4.5)	10 (4.5)	--	s 8 (2.8)	92 (2.8)	--
<b>Canada</b>	--	--	--	--	--	--
<i>Colombia</i>	r 68 (5.0)	30 (5.0)	2 (1.1)	r 34 (4.8)	64 (5.0)	2 (1.1)
<b>Cyprus</b>	s 89 (2.2)	9 (2.1)	2 (0.1)	s 36 (3.9)	62 (3.9)	2 (0.1)
<b>Czech Republic</b>	r 76 (2.8)	24 (2.8)	--	r 8 (1.3)	92 (1.3)	--
<i>Denmark</i>	--	--	--	--	--	--
<b>England</b>	--	--	--	--	--	--
<b>France</b>	94 (1.5)	5 (1.4)	2 (0.9)	32 (2.9)	68 (2.9)	0 (0.4)
<i>Germany</i>	s 88 (3.0)	12 (3.0)	--	s 26 (5.0)	74 (5.0)	--
<i>Greece</i>	71 (3.5)	29 (3.5)	--	12 (3.1)	88 (3.1)	--
<b>Hong Kong</b>	55 (4.9)	40 (4.9)	5 (2.5)	25 (4.3)	74 (4.5)	1 (1.3)
<b>Hungary</b>	78 (2.5)	19 (2.3)	4 (1.0)	25 (2.3)	73 (2.3)	2 (0.8)
<b>Iceland</b>	s 57 (8.1)	27 (7.0)	16 (3.7)	s 22 (6.9)	78 (6.9)	0 (0.0)
<b>Iran, Islamic Rep.</b>	r 49 (5.8)	48 (6.1)	3 (1.3)	r 36 (5.8)	51 (6.4)	14 (6.1)
<b>Ireland</b>	s 68 (4.9)	32 (4.9)	--	s 16 (3.1)	84 (3.1)	--
<i>Israel</i>	s 94 (4.4)	5 (3.5)	1 (1.4)	s 23 (8.1)	77 (8.1)	0 (0.0)
<b>Japan</b>	35 (4.3)	62 (4.4)	3 (1.4)	15 (3.2)	83 (3.2)	1 (0.9)
<b>Korea</b>	16 (2.9)	77 (3.7)	7 (2.2)	16 (2.8)	81 (2.9)	3 (1.6)
<i>Kuwait</i>	--	--	--	--	--	--
<b>Latvia (LSS)</b>	s 81 (2.2)	17 (2.1)	2 (0.7)	s 33 (2.7)	65 (2.8)	2 (0.8)
<b>Lithuania</b>	x x	x x	x x	x x	x x	x x
<i>Netherlands</i>	r 3 (1.1)	72 (3.5)	24 (3.4)	r 7 (1.8)	88 (2.3)	4 (1.4)
<b>New Zealand</b>	91 (2.5)	6 (2.0)	4 (1.7)	53 (4.6)	47 (4.6)	0 (0.0)
<b>Norway</b>	s 66 (4.6)	34 (4.6)	--	s 11 (3.5)	89 (3.5)	--
<b>Portugal</b>	94 (1.5)	6 (1.5)	--	63 (3.6)	37 (3.6)	--
<i>Romania</i>	93 (1.1)	4 (0.9)	3 (0.8)	35 (2.4)	61 (2.6)	4 (1.2)
<b>Russian Federation</b>	83 (2.9)	9 (1.7)	8 (1.9)	9 (1.9)	88 (2.0)	3 (1.2)
<i>Scotland</i>	s 68 (4.2)	24 (3.9)	8 (2.0)	s 49 (5.1)	47 (5.1)	4 (1.6)
<b>Singapore</b>	76 (4.0)	24 (4.0)	0 (0.0)	11 (2.7)	89 (2.7)	1 (0.4)
<b>Slovak Republic</b>	r 80 (4.4)	20 (4.4)	0 (0.0)	r 22 (3.8)	78 (3.8)	1 (0.8)
<i>Slovenia</i>	r 88 (2.2)	9 (2.0)	3 (1.1)	r 29 (2.8)	69 (2.9)	2 (0.9)
<b>Spain</b>	--	--	--	--	--	--
<b>Sweden</b>	x x	x x	--	x x	x x	--
<b>Switzerland</b>	x x	x x	x x	x x	x x	x x
<i>Thailand</i>	r 41 (6.7)	57 (6.4)	3 (1.6)	r 22 (5.6)	78 (5.6)	0 (0.0)

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

<sup>1</sup>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.

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

**Table 5.9**  
**Teachers' Reports on How Often They Ask Students to Do Reasoning Tasks<sup>1</sup>**  
**Science - 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
<b>UNITED STATES</b>	x x	x x	x x	x x	x x	x x	x x	x x
<b>MISSOURI</b>	0 (0.0)	~ ~	24 (4.9)	534 (6.8)	57 (4.7)	570 (4.5)	19 (3.9)	545 (16.9)
<b>OREGON</b>	x x	x x	x x	x x	x x	x x	x x	x x
<i>Australia</i>	x x	x x	x x	x x	x x	x x	x x	x x
<i>Austria</i>	r 1 (0.4)	~ ~	32 (3.9)	560 (4.5)	51 (3.6)	562 (4.6)	16 (2.6)	569 (7.4)
<b>Belgium (Fl)</b>	r 5 (3.1)	497 (66.9)	26 (3.0)	554 (5.3)	53 (4.7)	556 (6.9)	15 (3.5)	573 (6.0)
<i>Belgium (Fr)</i>	s 0 (0.0)	~ ~	22 (5.5)	481 (6.3)	55 (5.9)	484 (4.6)	23 (4.4)	485 (6.2)
<b>Canada</b>	r 0 (0.0)	~ ~	13 (2.1)	533 (8.3)	63 (3.7)	533 (4.4)	24 (3.5)	542 (6.8)
<i>Colombia</i>	r 0 (0.0)	~ ~	18 (4.7)	412 (22.1)	53 (5.1)	417 (4.3)	29 (4.0)	407 (6.0)
<b>Cyprus</b>	s 1 (1.3)	~ ~	4 (1.5)	445 (15.0)	54 (4.3)	460 (3.4)	41 (4.0)	458 (4.9)
<b>Czech Republic</b>	0 (0.0)	~ ~	4 (1.1)	549 (10.5)	60 (3.1)	576 (4.3)	36 (3.2)	576 (6.4)
<i>Denmark</i>	s 2 (1.6)	~ ~	49 (6.5)	479 (5.2)	46 (6.3)	480 (4.6)	3 (2.0)	458 (22.2)
<b>England</b>	s 0 (0.0)	~ ~	11 (1.9)	539 (13.4)	63 (3.1)	561 (5.9)	26 (2.9)	582 (10.3)
<b>France</b>	0 (0.0)	~ ~	23 (2.7)	503 (4.0)	56 (3.9)	496 (3.2)	21 (3.4)	505 (4.8)
<i>Germany</i>	s 0 (0.0)	~ ~	24 (3.9)	543 (12.4)	63 (4.2)	534 (6.3)	13 (3.0)	531 (16.2)
<i>Greece</i>	1 (0.7)	~ ~	19 (2.9)	498 (4.7)	55 (4.1)	497 (3.4)	25 (2.8)	497 (3.6)
<b>Hong Kong</b>	1 (1.2)	~ ~	21 (4.7)	510 (14.2)	50 (5.8)	525 (6.2)	27 (5.1)	522 (11.5)
<b>Hungary</b>	0 (0.3)	~ ~	4 (1.1)	540 (11.0)	63 (2.4)	553 (3.1)	33 (2.2)	555 (4.0)
<b>Iceland</b>	s 1 (0.7)	~ ~	35 (6.0)	486 (9.3)	58 (5.3)	489 (3.4)	6 (2.4)	480 (8.3)
<b>Iran, Islamic Rep.</b>	3 (2.6)	493 (3.7)	24 (4.5)	472 (5.4)	56 (5.1)	468 (4.0)	17 (4.1)	469 (5.3)
<b>Ireland</b>	s 0 (0.0)	~ ~	16 (3.2)	543 (10.2)	59 (4.5)	544 (7.2)	25 (4.5)	535 (12.4)
<i>Israel</i>	r 0 (0.0)	~ ~	10 (5.3)	541 (52.2)	45 (9.3)	538 (10.2)	44 (8.9)	515 (11.8)
<b>Japan</b>	0 (0.0)	~ ~	17 (3.3)	572 (3.7)	55 (4.5)	568 (3.0)	28 (3.5)	578 (3.6)
<b>Korea</b>	0 (0.3)	~ ~	12 (2.3)	560 (4.7)	62 (3.7)	567 (2.9)	25 (3.0)	562 (4.3)
<i>Kuwait</i>	r 0 (0.0)	~ ~	16 (5.9)	438 (3.9)	58 (6.8)	420 (5.1)	26 (8.1)	434 (10.1)
<b>Latvia (LSS)</b>	s 0 (0.0)	~ ~	11 (2.0)	482 (7.4)	71 (2.2)	486 (2.6)	18 (2.2)	486 (3.9)
<b>Lithuania</b>	r 0 (0.2)	~ ~	19 (1.9)	470 (6.2)	56 (2.4)	482 (4.5)	25 (1.9)	472 (4.9)
<i>Netherlands</i>	r 1 (0.2)	~ ~	31 (3.5)	541 (11.2)	52 (3.6)	569 (6.7)	16 (2.5)	581 (7.7)
<b>New Zealand</b>	0 (0.0)	~ ~	18 (3.1)	532 (11.7)	66 (3.9)	523 (5.4)	16 (3.0)	533 (12.3)
<b>Norway</b>	s 0 (0.0)	~ ~	52 (5.6)	520 (3.2)	45 (5.5)	531 (3.0)	2 (1.6)	~ ~
<b>Portugal</b>	0 (0.0)	~ ~	7 (1.6)	478 (4.8)	60 (3.2)	479 (3.1)	32 (3.2)	481 (3.2)
<i>Romania</i>	0 (0.0)	~ ~	4 (0.8)	466 (10.0)	29 (2.1)	482 (6.2)	67 (2.0)	489 (5.3)
<b>Russian Federation</b>	0 (0.0)	~ ~	16 (2.5)	536 (8.1)	56 (3.6)	537 (5.2)	28 (3.6)	540 (5.5)
<i>Scotland</i>	--	--	--	--	--	--	--	--
<b>Singapore</b>	0 (0.0)	~ ~	26 (3.9)	592 (8.2)	57 (4.6)	612 (8.5)	16 (3.6)	611 (12.0)
<b>Slovak Republic</b>	r 0 (0.0)	~ ~	0 (0.3)	~ ~	46 (5.1)	543 (5.8)	54 (5.1)	546 (5.1)
<i>Slovenia</i>	r 0 (0.0)	~ ~	17 (2.8)	560 (5.2)	71 (3.3)	558 (3.1)	12 (2.5)	548 (5.6)
<b>Spain</b>	r 0 (0.0)	~ ~	21 (4.0)	517 (4.6)	55 (3.9)	518 (2.7)	24 (4.5)	516 (4.9)
<b>Sweden</b>	x x	x x	x x	x x	x x	x x	x x	x x
<b>Switzerland</b>	s 0 (0.0)	~ ~	18 (4.0)	507 (14.2)	73 (4.1)	528 (4.9)	8 (2.9)	518 (13.8)
<i>Thailand</i>	r 0 (0.0)	~ ~	14 (4.6)	514 (14.7)	56 (6.0)	534 (6.1)	30 (5.0)	528 (6.3)

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.

<sup>1</sup>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; write explanations about what was observed and why it happened; and put events in order and give a reason for the organization.

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 &lt;50% of students.

**Table 5.10**  
**Students' Reports on the Frequency with Which Their Teacher Gives a  
 Demonstration of an Experiment<sup>1</sup> - Science - Eighth Grade\***

Country	Percent of Students Responding Pretty Often or Almost Always				
	Science (Integrated)	Science Subject Areas			
		Biology	Chemistry	Earth Science	Physics
<b>UNITED STATES</b>	68 (1.4)	..	..	..	..
<b>MISSOURI</b>	64 (2.8)	..	..	..	..
<b>OREGON</b>	74 (2.0)	..	..	..	..
<i>Australia</i>	75 (1.1)	..	..	..	..
<i>Austria</i>	68 (2.0)	..	..	..	..
<b>Belgium (Fl)</b>	..	79 (1.7)	..	18 (1.6)	x x
<sup>2</sup> <i>Belgium (Fr)</i>	s 62 (3.6)	x x	..	..	x x
<b>Canada</b>	73 (1.5)	..	..	..	..
<i>Colombia</i>	59 (1.9)	..	..	..	..
<b>Cyprus</b>	89 (0.7)	..	..	..	..
<b>Czech Republic</b>	..	20 (2.0)	70 (2.5)	3 (0.4)	60 (2.4)
<sup>3</sup> <i>Denmark</i>	..	32 (1.8)	..	r 20 (1.4)	81 (1.5)
<b>England</b>	90 (0.9)	..	..	..	..
<sup>4</sup> <b>France</b>	..	56 (1.9)	..	..	90 (1.1)
<i>Germany</i>	..	30 (1.7)	s 76 (1.8)	..	70 (1.6)
<i>Greece</i>	..	..	75 (1.4)	43 (1.5)	77 (1.5)
<b>Hong Kong</b>	91 (1.1)	..	..	..	..
<b>Hungary</b>	..	18 (1.5)	80 (1.7)	9 (0.8)	68 (1.5)
<b>Iceland</b>	..	33 (3.6)	x x	x x	s 72 (2.3)
<b>Iran, Islamic Rep.</b>	63 (2.3)	..	..	..	..
<b>Ireland</b>	84 (1.7)	..	..	..	..
<i>Israel</i>	73 (2.7)	..	..	..	..
<b>Japan</b>	66 (1.6)	..	..	..	..
<b>Korea</b>	42 (1.7)	..	..	..	..
<i>Kuwait</i>	81 (0.9)	..	..	..	..
<b>Latvia (LSS)</b>	..	49 (1.9)	77 (1.6)	..	73 (1.7)
<b>Lithuania</b>	..	25 (1.6)	57 (2.1)	10 (0.9)	59 (1.9)
<sup>5</sup> <i>Netherlands</i>	..	r 28 (2.2)	..	6 (0.6)	53 (2.4)
<b>New Zealand</b>	79 (1.2)	..	..	..	..
<b>Norway</b>	71 (1.6)	..	..	..	..
<b>Portugal</b>	--	--	--	--	--
<i>Romania</i>	..	49 (1.3)	63 (1.7)	34 (1.4)	60 (1.6)
<b>Russian Federation</b>	..	30 (1.5)	71 (1.9)	16 (1.4)	70 (1.6)
<i>Scotland</i>	89 (1.1)	..	..	..	..
<b>Singapore</b>	86 (1.0)	..	..	..	..
<b>Slovak Republic</b>	..	29 (1.5)	64 (1.8)	12 (0.8)	58 (2.0)
<i>Slovenia</i>	..	37 (2.0)	72 (1.7)	..	61 (1.8)
<b>Spain</b>	28 (1.8)	..	..	..	..
<b>Sweden</b>	..	61 (1.9)	s 90 (0.9)	r 21 (1.2)	r 83 (1.0)
<b>Switzerland</b>	51 (2.1)	..	..	..	..
<i>Thailand</i>	84 (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.

<sup>1</sup>Countries administered either an integrated science or separate subject area form of the questionnaire. A dot (.) denotes questions not administered by design. Percentages for separate science subject areas are based only on those students taking each subject.<sup>2</sup>Data for Belgium (Fr) are reported for students in both integrated science classes and separate biology and physics classes.<sup>3</sup>Physics data for Denmark are for students taking physics/chemistry classes.<sup>4</sup>Biology data for France are for students taking biology/geology classes; physics data are for students taking physics/chemistry classes.<sup>5</sup>Physics data for the Netherlands include students in both physics classes and physics/chemistry classes.

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

Countries with integrated science where students report high frequencies of teacher demonstrations usually also have high reported frequencies of student experiments or practical investigations, and this was true of Oregon and Missouri, and the United States also (see Table 5.11). In countries where science is taught as individual subjects, students reported more frequent teacher demonstrations than student practical work in most countries, particularly for chemistry and physics.

Students were also asked about the frequency with which they use things from everyday life in solving problems in science class (Table 5.12). Among countries with integrated science, more than half of the eighth-grade students in Canada, Colombia, Cyprus, England, Hong Kong, Iran, Scotland, Singapore, and the United States reported being asked to solve such problems on a frequent basis (pretty often or almost always). Students in Missouri and Oregon reported similar frequencies to students in the United States generally. Using everyday things for science problems was reportedly less common in countries with individual science subjects, although more than half of the students in Latvia (LSS) reported that they do so frequently in all science subject classes (biology, chemistry, and physics).

**Table 5.11**  
**Students' Reports on Frequency of Doing an Experiment or  
 Practical Investigation in Science Class<sup>1</sup> - Eighth Grade\***

Country	Percent of Students Responding Pretty Often or Almost Always				
	Science (Integrated)	Science Subject Areas			
		Biology	Chemistry	Earth Science	Physics
<b>UNITED STATES</b>	62 (1.7)	..	..	..	..
<b>MISSOURI</b>	55 (3.2)	..	..	..	..
<b>OREGON</b>	70 (2.2)	..	..	..	..
<i>Australia</i>	77 (1.4)	..	..	..	..
<i>Austria</i>	33 (2.2)	..	..	..	..
<b>Belgium (Fl)</b>	..	43 (1.8)	..	11 (1.1)	x x
<sup>2</sup> <i>Belgium (Fr)</i> s	36 (3.2)	x x	..	..	x x
<b>Canada</b>	70 (1.8)	..	..	..	..
<i>Colombia</i>	47 (1.9)	..	..	..	..
<b>Cyprus</b>	36 (1.0)	..	..	..	..
<b>Czech Republic</b>	..	20 (1.6)	35 (2.2)	3 (0.4)	29 (2.0)
<sup>3</sup> <i>Denmark</i>	..	32 (2.2)	..	r 22 (1.4)	79 (1.3)
<b>England</b>	91 (0.6)	..	..	..	..
<sup>4</sup> <b>France</b>	..	36 (2.0)	..	..	74 (2.0)
<i>Germany</i>	..	21 (1.6)	s 48 (3.1)	..	41 (2.1)
<i>Greece</i>	..	..	35 (1.7)	29 (1.6)	40 (1.7)
<b>Hong Kong</b>	83 (2.0)	..	..	..	..
<b>Hungary</b>	..	7 (0.6)	20 (1.6)	6 (0.6)	20 (1.0)
<b>Iceland</b>	..	32 (3.8)	x x	x x	s 74 (3.0)
<b>Iran, Islamic Rep.</b>	32 (1.4)	..	..	..	..
<b>Ireland</b>	61 (2.7)	..	..	..	..
<i>Israel</i>	53 (2.8)	..	..	..	..
<b>Japan</b>	77 (1.5)	..	..	..	..
<b>Korea</b>	33 (1.7)	..	..	..	..
<i>Kuwait</i>	47 (2.0)	..	..	..	..
<b>Latvia (LSS)</b>	..	36 (1.7)	50 (2.3)	..	46 (1.9)
<b>Lithuania</b>	..	17 (1.8)	24 (1.6)	8 (0.6)	29 (1.6)
<sup>5</sup> <i>Netherlands</i> r	..	r 20 (2.6)	..	5 (0.8)	49 (2.8)
<b>New Zealand</b>	81 (1.3)	..	..	..	..
<b>Norway</b>	66 (2.2)	..	..	..	..
<sup>6</sup> <b>Portugal</b>	..	26 (1.5)	..	..	36 (1.7)
<i>Romania</i>	..	34 (1.1)	49 (1.8)	32 (1.3)	49 (1.7)
<b>Russian Federation</b>	..	17 (1.0)	45 (2.4)	12 (1.0)	44 (1.6)
<i>Scotland</i>	87 (0.9)	..	..	..	..
<b>Singapore</b>	85 (1.0)	..	..	..	..
<b>Slovak Republic</b>	..	19 (1.1)	25 (1.5)	12 (0.7)	30 (1.5)
<i>Slovenia</i>	..	15 (1.3)	25 (1.9)	..	31 (1.6)
<b>Spain</b>	23 (1.6)	..	..	..	..
<b>Sweden</b>	..	65 (1.8)	s 92 (0.8)	r 23 (1.1)	r 82 (1.3)
<b>Switzerland</b>	35 (1.7)	..	..	..	..
<i>Thailand</i>	55 (1.2)	..	..	..	..

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

<sup>1</sup>Countries administered either an integrated science or separate subject area form of the questionnaire. A dot (.) denotes questions not administered by design. Percentages for separate science subject areas are based only on those students taking each subject.

<sup>2</sup>Data for Belgium (Fr) are reported for students in both integrated science classes and separate biology and physics classes.

<sup>3</sup>Physics data for Denmark are for students taking physics/chemistry classes.

<sup>4</sup>Biology data for France are for students taking biology/geology classes; physics data are for students taking physics/chemistry classes.

<sup>5</sup>Physics data for the Netherlands include students in both physics classes and physics/chemistry classes.

<sup>6</sup>Biology data for Portugal are for students taking natural science classes; physics data are for students taking physical science classes.

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

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

**Table 5.12**  
**Students' Reports on Frequency of Using Things from Everyday**  
**Life in Solving Science Problems<sup>1</sup> - Eighth Grade\***

Country	Percent of Students Responding Pretty Often or Almost Always				
	Science (Integrated)	Science Subject Areas			
		Biology	Chemistry	Earth Science	Physics
<b>UNITED STATES</b>	51 (0.9)	..	..	..	..
<b>MISSOURI</b>	46 (2.0)	..	..	..	..
<b>OREGON</b>	50 (1.5)	..	..	..	..
<i>Australia</i>	43 (0.8)	..	..	..	..
<i>Austria</i>	31 (1.0)	..	..	..	..
<b>Belgium (Fl)</b>	..	44 (1.2)	..	40 (1.2)	x x
<sup>2</sup> <i>Belgium (Fr)</i>	x x	x x	..	..	x x
<b>Canada</b>	52 (1.1)	..	..	..	..
<i>Colombia</i>	52 (1.4)	..	..	..	..
<b>Cyprus</b>	65 (1.1)	..	..	..	..
<b>Czech Republic</b>	..	33 (1.3)	31 (1.5)	35 (1.5)	39 (1.3)
<sup>3</sup> <i>Denmark</i>	..	23 (1.2)	..	r 19 (1.1)	27 (1.2)
<b>England</b>	51 (1.2)	..	..	..	..
<sup>4</sup> <b>France</b>	..	41 (1.1)	..	..	51 (1.5)
<i>Germany</i>	..	34 (1.5)	s 34 (1.7)	..	37 (1.3)
<i>Greece</i>	..	..	48 (1.2)	52 (1.5)	65 (1.2)
<b>Hong Kong</b>	57 (1.5)	..	..	..	..
<b>Hungary</b>	..	35 (1.4)	29 (1.2)	32 (1.3)	33 (1.1)
<b>Iceland</b>	..	31 (2.2)	x x	x x	s 38 (1.9)
<b>Iran, Islamic Rep.</b>	53 (1.4)	..	..	..	..
<b>Ireland</b>	41 (1.2)	..	..	..	..
<i>Israel</i>	40 (2.0)	..	..	..	..
<b>Japan</b>	23 (0.9)	..	..	..	..
<b>Korea</b>	17 (0.8)	..	..	..	..
<i>Kuwait</i>	47 (2.1)	..	..	..	..
<b>Latvia (LSS)</b>	..	65 (1.4)	73 (1.3)	..	77 (1.1)
<b>Lithuania</b>	..	24 (1.2)	30 (1.2)	22 (1.1)	44 (1.4)
<sup>5</sup> <i>Netherlands</i>	..	r 36 (1.5)	..	31 (1.4)	31 (1.4)
<b>New Zealand</b>	48 (1.1)	..	..	..	..
<b>Norway</b>	31 (1.0)	..	..	..	..
<sup>6</sup> <b>Portugal</b>	..	35 (1.2)	..	..	43 (1.4)
<i>Romania</i>	..	52 (1.2)	41 (1.3)	45 (1.4)	46 (1.1)
<b>Russian Federation</b>	..	36 (2.7)	32 (2.0)	34 (1.8)	40 (1.8)
<i>Scotland</i>	57 (1.4)	..	..	..	..
<b>Singapore</b>	59 (1.1)	..	..	..	..
<b>Slovak Republic</b>	..	35 (1.6)	30 (1.2)	40 (1.4)	31 (1.2)
<i>Slovenia</i>	..	41 (1.7)	32 (1.2)	..	24 (1.9)
<b>Spain</b>	44 (1.3)	..	..	..	..
<b>Sweden</b>	..	37 (1.1)	s 43 (1.7)	r 33 (1.3)	r 48 (1.3)
<b>Switzerland</b>	40 (1.1)	..	..	..	..
<i>Thailand</i>	48 (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.

<sup>1</sup>Countries administered either an integrated science or separate subject area form of the questionnaire. A dot (.) denotes questions not administered by design. Percentages for separate science subject areas are based only on those students taking each subject.

<sup>2</sup>Data for Belgium (Fr) are reported for students in both integrated science classes and separate biology and physics classes.

<sup>3</sup>Physics data for Denmark are for students taking physics/chemistry classes.

<sup>4</sup>Biology data for France are for students taking biology/geology classes; physics data are for students taking physics/chemistry classes.

<sup>5</sup>Physics data for the Netherlands include students in both physics classes and physics/chemistry classes.

<sup>6</sup>Biology data for Portugal are for students taking natural science classes; physics data are for students taking physical science classes.

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

An "x" indicates a <50% student response rate.

## How Are Calculators and Computers Used?

As shown in Table 5.13, nearly all eighth-grade students reported having a calculator in the home, except in Iran (61%), Romania (62%), and Thailand (68%). 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, France, Germany, Kuwait, New Zealand, Norway, Sweden, Switzerland, and the United States. In Missouri, 64% of students reported having a computer in the home, compared with 76% in Oregon. Fewer than 20% of the students reported home computers in Colombia, Iran, Latvia (LSS), Romania, and Thailand.

Table 5.14 provides teachers' reports about how often calculators are used in eighth-grade science classes. Even though calculators appear to be widely available in most countries, teachers reported relatively low levels of calculator use in science classrooms. Only in Hungary, Kuwait, Latvia (LSS), Lithuania, the Russian Federation, and the Slovak Republic were the majority of students reported to use calculators as often as once or twice a week. The lowest levels of usage were reported in Japan and Korea, with more than 70% of students taught by teachers who reported that calculators are never or hardly ever used in their science classes. Teachers in Missouri reported moderate calculator usage, with 40% of students in science classes where calculators are used at least once or twice a week. Only 12% of Missouri students were in science classes where calculators are never or hardly ever used (data were insufficient for Oregon and the United States).

As revealed in Table 5.15, teachers reported that students use calculators in science classes for a variety of purposes. Routine computation and checking answers were the most common purposes in Missouri and in many of the countries, and solving complex problems, tests and examinations, and exploring number concepts were less common.

Table 5.16 contains teachers' reports about how often computers are used in science class to solve exercises or problems. Such usage is reportedly quite rare, and only in Canada, Denmark, England, Iceland, Israel, Kuwait, Slovenia, and Switzerland did more than 20% of the students have teachers who reported at least some usage. In Missouri, 31% of students had teachers who reported using computers in at least some science lessons. Table 5.17 contains students' responses to a similar question, although expressed as the percentage of students using computers to solve problems in science class at least once in a while. Internationally, teachers and students agree that the computer is rarely used in most students' science lessons. Students reported moderate use of computers (more than 20% of the students in some lessons) in Austria, Canada, Cyprus, Denmark, England, Greece, Israel, New Zealand, Romania, the Russian Federation, Scotland, Slovenia, Sweden, and the United States. In Missouri, 41% of students reported using computers in science class at least once in a while, as did 46% of students in Oregon.

**Table 5.13****Students' Reports on Having a Calculator and Computer in the Home - Science - 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
<b>UNITED STATES</b>	98 (0.3)	536 (4.6)	2 (0.3)	~ ~	59 (1.7)	555 (4.1)	41 (1.7)	506 (5.4)
<b>MISSOURI</b>	99 (0.2)	556 (6.3)	1 (0.2)	~ ~	64 (1.9)	569 (7.1)	36 (1.9)	532 (6.9)
<b>OREGON</b>	99 (0.4)	566 (7.4)	1 (0.4)	~ ~	76 (1.8)	577 (7.2)	24 (1.8)	523 (7.1)
<i>Australia</i>	97 (0.3)	548 (3.8)	3 (0.3)	472 (13.9)	73 (1.2)	554 (4.3)	27 (1.2)	525 (4.2)
<i>Austria</i>	100 (0.1)	558 (3.8)	0 (0.1)	~ ~	59 (1.5)	565 (4.0)	41 (1.5)	548 (4.7)
<b>Belgium (Fl)</b>	97 (0.8)	553 (4.0)	3 (0.8)	467 (11.4)	67 (1.3)	558 (4.2)	33 (1.3)	536 (5.3)
<i>Belgium (Fr)</i>	98 (0.3)	472 (2.9)	2 (0.3)	~ ~	60 (1.4)	481 (3.0)	40 (1.4)	457 (3.6)
<b>Canada</b>	98 (0.2)	533 (2.6)	2 (0.2)	~ ~	61 (1.3)	543 (2.5)	39 (1.3)	513 (3.1)
<i>Colombia</i>	88 (1.5)	415 (3.6)	12 (1.5)	389 (9.1)	11 (1.2)	431 (9.7)	89 (1.2)	409 (3.9)
<b>Cyprus</b>	96 (0.4)	466 (2.0)	4 (0.4)	403 (6.3)	39 (0.9)	472 (2.9)	61 (0.9)	459 (2.5)
<b>Czech Republic</b>	99 (0.2)	574 (4.3)	1 (0.2)	~ ~	36 (1.2)	593 (6.0)	64 (1.2)	563 (3.6)
<i>Denmark</i>	99 (0.3)	479 (3.1)	1 (0.3)	~ ~	76 (1.2)	484 (3.1)	24 (1.2)	464 (4.7)
<b>England</b>	99 (0.2)	554 (3.5)	1 (0.2)	~ ~	89 (0.8)	553 (3.7)	11 (0.8)	558 (6.5)
<b>France</b>	99 (0.2)	499 (2.6)	1 (0.2)	~ ~	50 (1.3)	504 (3.0)	50 (1.3)	492 (3.0)
<i>Germany</i>	99 (0.2)	532 (4.7)	1 (0.2)	~ ~	71 (1.0)	538 (4.6)	29 (1.0)	517 (6.4)
<i>Greece</i>	87 (0.6)	504 (2.2)	13 (0.6)	455 (3.7)	29 (1.0)	512 (4.3)	71 (1.0)	492 (2.1)
<b>Hong Kong</b>	99 (0.1)	524 (4.7)	1 (0.1)	~ ~	39 (1.9)	539 (5.0)	61 (1.9)	514 (4.9)
<b>Hungary</b>	97 (0.4)	556 (2.8)	3 (0.4)	496 (14.3)	37 (1.2)	581 (3.2)	63 (1.2)	539 (3.1)
<b>Iceland</b>	100 (0.1)	494 (4.1)	0 (0.1)	~ ~	77 (1.4)	494 (4.6)	23 (1.4)	491 (3.6)
<b>Iran, Islamic Rep.</b>	61 (1.8)	482 (2.8)	39 (1.8)	457 (3.6)	4 (0.4)	474 (11.3)	96 (0.4)	472 (2.4)
<b>Ireland</b>	97 (0.3)	540 (4.4)	3 (0.3)	506 (9.0)	78 (1.1)	542 (4.7)	22 (1.1)	530 (6.0)
<i>Israel</i>	99 (0.3)	529 (5.3)	1 (0.3)	~ ~	76 (2.1)	540 (5.8)	24 (2.1)	492 (4.6)
<b>Japan</b>	--	--	--	--	--	--	--	--
<b>Korea</b>	91 (0.5)	567 (2.0)	9 (0.5)	540 (5.5)	39 (1.2)	584 (2.7)	61 (1.2)	553 (2.2)
<i>Kuwait</i>	84 (1.2)	434 (3.4)	16 (1.2)	412 (7.1)	53 (2.0)	431 (4.6)	47 (2.0)	430 (3.6)
<b>Latvia (LSS)</b>	94 (0.5)	486 (2.7)	6 (0.5)	475 (5.9)	13 (0.9)	487 (5.3)	87 (0.9)	485 (2.6)
<b>Lithuania</b>	90 (1.0)	481 (3.5)	10 (1.0)	441 (6.4)	42 (1.4)	476 (3.9)	58 (1.4)	477 (4.1)
<i>Netherlands</i>	100 (0.1)	561 (5.2)	0 (0.1)	~ ~	85 (1.2)	563 (6.3)	15 (1.2)	547 (6.6)
<b>New Zealand</b>	99 (0.2)	528 (4.3)	1 (0.2)	~ ~	60 (1.3)	538 (4.8)	40 (1.3)	509 (4.8)
<b>Norway</b>	99 (0.2)	528 (1.9)	1 (0.2)	~ ~	64 (1.1)	534 (2.4)	36 (1.1)	516 (3.0)
<b>Portugal</b>	99 (0.2)	480 (2.3)	1 (0.2)	~ ~	39 (1.8)	493 (3.2)	61 (1.8)	471 (2.2)
<i>Romania</i>	62 (1.5)	495 (5.1)	38 (1.5)	473 (6.8)	19 (1.2)	504 (7.1)	81 (1.2)	482 (4.9)
<b>Russian Federation</b>	92 (0.8)	541 (3.8)	8 (0.8)	508 (8.8)	35 (1.5)	542 (4.7)	65 (1.5)	536 (4.7)
<i>Scotland</i>	98 (0.4)	520 (5.3)	2 (0.4)	~ ~	90 (0.6)	518 (5.3)	10 (0.6)	522 (8.6)
<b>Singapore</b>	99 (0.1)	608 (5.6)	1 (0.1)	~ ~	49 (1.5)	626 (6.2)	51 (1.5)	590 (5.4)
<b>Slovak Republic</b>	99 (0.2)	545 (3.2)	1 (0.2)	~ ~	31 (1.2)	561 (3.9)	69 (1.2)	537 (3.5)
<i>Slovenia</i>	98 (0.3)	561 (2.5)	2 (0.3)	~ ~	47 (1.3)	579 (3.2)	53 (1.3)	543 (2.9)
<b>Spain</b>	99 (0.2)	517 (1.7)	1 (0.2)	~ ~	42 (1.2)	528 (2.7)	58 (1.2)	509 (2.1)
<b>Sweden</b>	99 (0.1)	536 (2.9)	1 (0.1)	~ ~	60 (1.3)	547 (2.9)	40 (1.3)	518 (3.6)
<b>Switzerland</b>	99 (0.2)	523 (2.6)	1 (0.2)	~ ~	66 (1.2)	530 (2.9)	34 (1.2)	507 (3.2)
<i>Thailand</i>	68 (2.2)	528 (4.5)	32 (2.2)	520 (3.1)	4 (0.9)	542 (10.7)	96 (0.9)	525 (3.7)

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.

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



**Table 5.14****Teachers' Reports on Frequency of Students' Use of Calculators in Science Class'  
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
<b>UNITED STATES</b>	x x	x x	x x	x x	x x	x x	x x	x x
<b>MISSOURI</b>	12 (2.8)	518 (12.0)	48 (4.7)	558 (5.5)	32 (3.8)	576 (6.5)	8 (3.2)	522 (19.7)
<b>OREGON</b>	x x	x x	x x	x x	x x	x x	x x	x x
<i>Australia</i>	x x	x x	x x	x x	x x	x x	x x	x x
<i>Austria</i>	r 61 (3.0)	563 (3.4)	32 (3.2)	561 (5.2)	4 (1.3)	566 (9.0)	3 (0.8)	557 (16.4)
<b>Belgium (FI)</b>	r 61 (4.5)	550 (8.5)	14 (2.5)	572 (5.5)	9 (2.5)	557 (4.9)	16 (2.9)	560 (4.8)
<i>Belgium (Fr)</i>	s 31 (5.9)	479 (6.5)	37 (5.3)	481 (5.1)	9 (3.0)	506 (7.9)	23 (3.9)	486 (6.1)
<b>Canada</b>	r 16 (2.7)	532 (7.7)	38 (4.1)	536 (6.7)	21 (2.7)	538 (4.2)	25 (4.0)	539 (5.5)
<i>Colombia</i>	r 50 (5.2)	420 (4.8)	21 (3.8)	407 (6.6)	17 (5.0)	396 (18.1)	12 (3.1)	416 (13.1)
<b>Cyprus</b>	s 51 (3.9)	454 (3.5)	13 (2.5)	467 (8.9)	12 (3.1)	465 (8.4)	25 (3.7)	462 (5.2)
<b>Czech Republic</b>	r 22 (1.9)	572 (5.5)	30 (3.5)	582 (7.9)	31 (2.8)	572 (7.7)	17 (2.4)	575 (3.9)
<i>Denmark</i>	s 56 (5.8)	476 (4.9)	26 (5.3)	478 (6.1)	10 (3.8)	500 (10.8)	9 (3.6)	479 (6.0)
<b>England</b>	x x	x x	x x	x x	x x	x x	x x	x x
<b>France</b>	r 17 (2.4)	505 (5.0)	39 (3.6)	499 (3.5)	22 (2.4)	499 (4.4)	22 (2.8)	496 (3.8)
<i>Germany</i>	s 40 (4.5)	536 (7.3)	16 (3.2)	518 (14.2)	20 (3.5)	560 (9.2)	24 (3.6)	530 (12.5)
<i>Greece</i>	64 (4.0)	496 (2.7)	8 (1.9)	499 (6.0)	15 (2.7)	495 (5.8)	13 (2.5)	504 (5.3)
<b>Hong Kong</b>	59 (5.8)	525 (7.5)	24 (5.1)	516 (11.5)	5 (2.7)	488 (26.1)	12 (3.5)	542 (10.5)
<b>Hungary</b>	r 31 (2.9)	551 (4.2)	8 (1.5)	566 (6.9)	20 (2.0)	549 (4.1)	40 (3.3)	554 (5.4)
<b>Iceland</b>	s 31 (8.3)	489 (11.3)	35 (8.4)	484 (3.6)	17 (4.0)	488 (7.8)	17 (4.3)	486 (6.3)
<b>Iran, Islamic Rep.</b>	68 (5.3)	469 (3.3)	22 (4.7)	467 (4.3)	6 (1.7)	489 (7.0)	4 (1.9)	465 (7.3)
<b>Ireland</b>	s 54 (4.8)	536 (7.7)	28 (3.9)	547 (9.4)	12 (3.5)	567 (13.2)	6 (2.2)	539 (19.1)
<i>Israel</i>	s 53 (8.8)	535 (11.7)	35 (8.7)	510 (16.1)	4 (3.1)	514 (46.3)	8 (4.8)	535 (4.1)
<b>Japan</b>	91 (2.4)	570 (2.1)	9 (2.4)	580 (8.1)	0 (0.0)	~ ~	0 (0.5)	~ ~
<b>Korea</b>	73 (3.5)	568 (2.3)	12 (2.4)	555 (6.1)	11 (1.9)	556 (5.0)	4 (2.3)	575 (7.6)
<i>Kuwait</i>	r 16 (5.6)	419 (6.6)	24 (6.0)	443 (4.6)	30 (8.0)	418 (6.5)	29 (7.1)	425 (10.9)
<b>Latvia (LSS)</b>	s 27 (2.2)	488 (3.7)	18 (2.1)	483 (4.6)	27 (2.1)	488 (3.4)	29 (2.4)	480 (3.4)
<b>Lithuania</b>	r 35 (2.0)	476 (4.4)	10 (1.3)	472 (8.1)	21 (2.2)	475 (5.8)	34 (2.4)	479 (5.0)
<i>Netherlands</i>	34 (3.0)	548 (10.8)	35 (3.1)	562 (6.9)	22 (3.5)	585 (8.4)	9 (1.9)	561 (10.0)
<b>New Zealand</b>	30 (3.9)	511 (6.6)	40 (4.2)	528 (7.2)	21 (3.4)	549 (9.4)	9 (2.5)	515 (16.0)
<b>Norway</b>	s 35 (5.0)	522 (4.2)	34 (4.7)	530 (3.6)	15 (4.1)	527 (6.8)	17 (4.1)	518 (6.0)
<b>Portugal</b>	36 (2.1)	482 (2.9)	17 (2.2)	481 (3.7)	19 (2.5)	484 (4.7)	28 (2.0)	473 (3.8)
<i>Romania</i>	66 (2.3)	481 (5.3)	10 (1.3)	484 (7.3)	12 (1.5)	501 (9.3)	12 (1.6)	499 (8.5)
<b>Russian Federation</b>	40 (2.3)	531 (5.2)	6 (1.3)	530 (10.8)	32 (2.9)	533 (5.8)	22 (2.9)	549 (5.7)
<i>Scotland</i>	--	--	--	--	--	--	--	--
<b>Singapore</b>	19 (3.2)	601 (13.7)	31 (4.1)	604 (10.3)	17 (3.4)	598 (15.4)	32 (4.4)	623 (9.5)
<b>Slovak Republic</b>	r 1 (0.8)	~ ~	9 (2.9)	533 (13.9)	42 (4.6)	545 (5.9)	48 (5.0)	543 (5.6)
<i>Slovenia</i>	r 29 (2.2)	561 (3.1)	27 (2.7)	556 (5.4)	27 (2.7)	554 (3.3)	18 (2.2)	561 (4.7)
<b>Spain</b>	r 40 (4.3)	515 (3.7)	14 (3.6)	517 (6.1)	17 (3.4)	529 (3.9)	29 (4.3)	513 (3.9)
<b>Sweden</b>	x x	x x	x x	x x	x x	x x	x x	x x
<b>Switzerland</b>	x x	x x	x x	x x	x x	x x	x x	x x
<i>Thailand</i>	r 62 (6.0)	526 (5.8)	20 (4.7)	527 (9.0)	7 (3.5)	527 (14.8)	11 (4.1)	544 (13.2)

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

<sup>b</sup>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.

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 5.15**  
**Teachers' Reports on Ways in Which Calculators Are Used At Least Once or Twice a Week - Science - 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
<b>UNITED STATES</b>	x x	x x	x x	x x	x x	x x
<b>MISSOURI</b>	12 (2.8)	29 (4.8)	14 (3.1)	35 (4.7)	17 (4.2)	6 (2.3)
<b>OREGON</b>	x x	x x	x x	x x	x x	x x
<i>Australia</i>	x x	x x	x x	x x	x x	x x
<i>Austria</i>	r 61 (3.0)	r 5 (1.4)	r 2 (0.9)	r 5 (1.4)	r 3 (1.0)	r 2 (0.6)
<b>Belgium (Fl)</b>	r 61 (4.5)	r 17 (3.8)	r 14 (2.9)	r 20 (3.9)	r 20 (3.3)	r 8 (2.6)
<i>Belgium (Fr)</i>	s 31 (5.9)	s 27 (4.6)	s 23 (4.5)	s 29 (4.8)	s 23 (4.5)	s 12 (3.7)
<b>Canada</b>	r 16 (2.7)	r 34 (3.9)	r 23 (4.0)	r 39 (4.2)	r 32 (4.0)	s 21 (3.6)
<i>Colombia</i>	r 50 (5.2)	r 20 (5.1)	r 9 (2.7)	r 21 (5.4)	r 17 (3.6)	r 18 (3.5)
<b>Cyprus</b>	s 51 (3.9)	s 23 (4.1)	s 17 (3.4)	s 29 (3.5)	s 28 (4.0)	s 11 (2.3)
<b>Czech Republic</b>	r 22 (1.9)	r 39 (2.9)	r 17 (2.9)	r 37 (2.9)	r 29 (2.9)	r 11 (2.1)
<i>Denmark</i>	s 56 (5.8)	s 12 (4.4)	s 8 (3.7)	s 14 (4.6)	s 10 (3.4)	s 3 (2.2)
<b>England</b>	x x	x x	x x	x x	x x	x x
<b>France</b>	r 17 (2.4)	r 29 (3.7)	r 24 (3.4)	r 39 (3.1)	r 19 (3.3)	r 12 (3.1)
<i>Germany</i>	s 40 (4.5)	s 40 (4.7)	s 16 (4.4)	s 43 (4.8)	s 28 (4.6)	s 16 (4.5)
<i>Greece</i>	64 (4.0)	22 (3.5)	6 (1.9)	23 (3.3)	16 (2.8)	8 (2.2)
<b>Hong Kong</b>	59 (5.8)	5 (2.7)	8 (3.3)	16 (4.1)	7 (3.2)	6 (3.0)
<b>Hungary</b>	s 31 (2.9)	s 39 (3.1)	s 22 (2.8)	s 44 (3.2)	s 50 (3.1)	s 54 (3.5)
<b>Iceland</b>	s 31 (8.3)	s 27 (4.8)	s 19 (4.6)	s 32 (5.0)	s 30 (4.9)	s 20 (4.4)
<b>Iran, Islamic Rep.</b>	68 (5.3)	1 (0.9)	4 (1.9)	3 (1.8)	6 (1.8)	4 (1.5)
<b>Ireland</b>	s 54 (4.8)	s 12 (3.1)	s 4 (1.7)	s 15 (3.4)	s 7 (2.3)	s 2 (1.1)
<i>Israel</i>	s 53 (8.8)	s 7 (4.9)	s 8 (5.5)	s 13 (6.2)	s 9 (5.3)	s 6 (4.9)
<b>Japan</b>	91 (2.4)	0 (0.5)	0 (0.0)	0 (0.0)	0 (0.5)	0 (0.0)
<b>Korea</b>	73 (3.5)	5 (2.4)	5 (2.4)	10 (2.7)	8 (2.2)	8 (2.6)
<i>Kuwait</i>	r 16 (5.6)	r 40 (8.9)	r 27 (7.0)	r 53 (8.2)	r 43 (8.4)	r 38 (7.1)
<b>Latvia (LSS)</b>	s 27 (2.2)	s 44 (2.6)	s 25 (2.5)	s 55 (2.2)	s 38 (2.4)	s 14 (2.3)
<b>Lithuania</b>	s 35 (2.0)	s 48 (2.1)	s 16 (2.0)	s 49 (1.8)	s 46 (2.2)	s 15 (2.0)
<i>Netherlands</i>	34 (3.0)	23 (2.5)	13 (2.5)	r 28 (2.4)	r 14 (2.3)	r 5 (1.6)
<b>New Zealand</b>	30 (3.9)	6 (1.8)	5 (1.8)	27 (3.8)	11 (2.8)	6 (2.3)
<b>Norway</b>	s 35 (5.0)	s 24 (4.8)	s 14 (3.9)	s 27 (4.9)	--	--
<b>Portugal</b>	36 (2.1)	40 (2.2)	12 (1.9)	39 (2.0)	30 (2.5)	17 (2.1)
<i>Romania</i>	66 (2.3)	17 (1.8)	r 4 (0.9)	r 19 (1.7)	r 19 (1.8)	r 5 (1.0)
<b>Russian Federation</b>	40 (2.3)	44 (2.5)	14 (1.9)	50 (2.1)	43 (2.6)	27 (2.7)
<i>Scotland</i>	--	--	--	--	--	--
<b>Singapore</b>	19 (3.2)	42 (4.7)	33 (4.3)	39 (4.9)	38 (4.7)	31 (4.2)
<b>Slovak Republic</b>	r 1 (0.8)	r 70 (4.1)	r 29 (4.7)	r 81 (3.8)	r 60 (4.8)	r 59 (4.6)
<i>Slovenia</i>	r 29 (2.2)	r 30 (2.5)	r 12 (1.8)	r 34 (2.9)	r 28 (2.6)	r 15 (2.3)
<b>Spain</b>	r 40 (4.3)	r 33 (4.8)	r 13 (3.3)	r 34 (4.7)	r 36 (4.9)	r 19 (3.5)
<b>Sweden</b>	x x	x x	x x	x x	x x	x x
<b>Switzerland</b>	x x	x x	x x	x x	x x	x x
<i>Thailand</i>	s 62 (6.0)	s 8 (3.5)	s 0 (0.4)	r 14 (4.7)	s 17 (5.0)	s 11 (3.8)

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 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.

An "x" indicates teacher response data available for &lt;50% of students.

**Table 5.16**  
**Teachers' Reports on Frequency of Using Computers in Science 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
<b>UNITED STATES</b>	x x	x x	x x	x x	x x	x x
<b>MISSOURI</b>	69 (4.7)	557 (5.2)	29 (4.6)	564 (6.8)	2 (1.7)	~ ~
<b>OREGON</b>	x x	x x	x x	x x	x x	x x
<i>Australia</i>	x x	x x	x x	x x	x x	x x
<i>Austria</i>	r 85 (2.6)	565 (3.1)	14 (2.6)	547 (7.1)	1 (0.2)	~ ~
<b>Belgium (FI)</b>	r 98 (1.0)	555 (5.9)	2 (1.0)	~ ~	0 (0.0)	~ ~
<i>Belgium (Fr)</i>	s 95 (2.0)	483 (3.5)	5 (2.0)	491 (13.5)	0 (0.0)	~ ~
<b>Canada</b>	r 76 (3.3)	536 (2.9)	23 (3.4)	535 (9.9)	0 (0.4)	~ ~
<i>Colombia</i>	r 95 (2.5)	413 (4.5)	3 (1.4)	439 (51.1)	2 (2.1)	~ ~
<b>Cyprus</b>	s 92 (1.1)	456 (2.6)	8 (1.1)	483 (7.5)	0 (0.0)	~ ~
<b>Czech Republic</b>	93 (2.0)	573 (4.6)	6 (1.7)	603 (11.0)	2 (1.1)	~ ~
<i>Denmark</i>	s 63 (5.9)	482 (4.4)	35 (5.8)	475 (5.2)	2 (2.0)	~ ~
<b>England</b>	s 70 (3.3)	567 (6.9)	30 (3.3)	558 (7.3)	0 (0.0)	~ ~
<b>France</b>	97 (1.2)	499 (2.5)	3 (1.2)	508 (11.4)	0 (0.0)	~ ~
<i>Germany</i>	s 95 (1.8)	536 (6.2)	5 (1.8)	539 (23.1)	0 (0.0)	~ ~
<i>Greece</i>	93 (3.2)	498 (2.2)	6 (3.2)	481 (5.0)	0 (0.2)	~ ~
<b>Hong Kong</b>	95 (2.5)	523 (5.3)	4 (2.2)	487 (38.3)	1 (1.2)	~ ~
<b>Hungary</b>	--	--	--	--	--	--
<b>Iceland</b>	s 73 (6.1)	489 (4.5)	22 (6.0)	484 (4.0)	5 (1.7)	479 (9.2)
<b>Iran, Islamic Rep.</b>	99 (0.5)	469 (2.4)	1 (0.5)	~ ~	0 (0.0)	~ ~
<b>Ireland</b>	s 96 (1.4)	540 (6.0)	4 (1.4)	588 (14.8)	0 (0.0)	~ ~
<i>Israel</i>	r 75 (8.0)	538 (8.3)	24 (7.9)	498 (13.4)	1 (1.1)	~ ~
<b>Japan</b>	84 (2.8)	572 (2.0)	16 (2.8)	569 (5.8)	0 (0.0)	~ ~
<b>Korea</b>	96 (1.7)	566 (2.2)	4 (1.7)	555 (8.3)	0 (0.0)	~ ~
<i>Kuwait</i>	r 78 (5.5)	427 (4.7)	21 (5.4)	420 (8.7)	1 (0.9)	~ ~
<b>Latvia (LSS)</b>	s 91 (1.5)	485 (2.6)	6 (1.3)	483 (6.5)	3 (0.8)	479 (9.6)
<b>Lithuania</b>	r 96 (1.1)	477 (4.2)	3 (0.9)	482 (13.6)	1 (0.5)	~ ~
<i>Netherlands</i>	r 85 (2.6)	559 (7.4)	15 (2.6)	578 (7.9)	0 (0.0)	~ ~
<b>New Zealand</b>	90 (2.7)	526 (4.7)	10 (2.7)	527 (12.5)	0 (0.0)	~ ~
<b>Norway</b>	s 96 (1.9)	525 (2.3)	4 (1.9)	523 (12.8)	0 (0.0)	~ ~
<b>Portugal</b>	99 (0.5)	480 (2.5)	0 (0.3)	~ ~	0 (0.4)	~ ~
<i>Romania</i>	r 94 (1.3)	487 (4.7)	4 (1.1)	504 (11.9)	2 (0.7)	~ ~
<b>Russian Federation</b>	88 (1.7)	538 (4.6)	8 (1.5)	534 (8.0)	3 (1.0)	528 (15.1)
<i>Scotland</i>	--	--	--	--	--	--
<b>Singapore</b>	95 (1.5)	606 (5.8)	5 (1.5)	625 (22.3)	0 (0.0)	~ ~
<b>Slovak Republic</b>	r 96 (2.0)	546 (3.9)	4 (2.0)	514 (7.8)	0 (0.0)	~ ~
<i>Slovenia</i>	r 60 (3.1)	556 (3.5)	26 (3.1)	559 (4.3)	15 (2.2)	558 (5.3)
<b>Spain</b>	r 92 (2.7)	519 (2.1)	7 (2.5)	501 (8.6)	1 (0.9)	~ ~
<b>Sweden</b>	x x	x x	x x	x x	x x	x x
<b>Switzerland</b>	s 78 (4.3)	527 (4.9)	22 (4.3)	510 (12.7)	0 (0.0)	~ ~
<i>Thailand</i>	r 92 (3.6)	530 (5.3)	3 (2.2)	521 (15.5)	5 (2.9)	512 (8.3)

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.

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

**Table 5.17** **Students' Reports on Frequency of Using Computers in Science Class<sup>1</sup> - Eighth Grade\***

Country	Percent of Students Responding At Least Once in a While				
	Science (Integrated)	Science Subject Areas			
		Biology	Chemistry	Earth Science	Physics
<b>UNITED STATES</b>	35 (2.2)	..	..	..	..
<b>MISSOURI</b>	41 (3.8)	..	..	..	..
<b>OREGON</b>	46 (4.1)	..	..	..	..
<i>Australia</i>	16 (1.4)	..	..	..	..
<i>Austria</i>	23 (2.4)	..	..	..	..
<b>Belgium (Fl)</b>	..	9 (1.1)	..	8 (0.9)	x x
<sup>2</sup> <i>Belgium (Fr)</i>	x x	x x	..	..	x x
<b>Canada</b>	24 (1.5)	..	..	..	..
<i>Colombia</i>	6 (0.5)	..	..	..	..
<b>Cyprus</b>	23 (1.1)	..	..	..	..
<b>Czech Republic</b>	..	2 (0.5)	5 (1.5)	6 (2.3)	6 (1.9)
<sup>3</sup> <i>Denmark</i>	..	36 (2.9)	..	r 39 (2.6)	17 (2.1)
<b>England</b>	36 (2.5)	..	..	..	..
<sup>4</sup> <b>France</b>	..	8 (1.5)	..	..	12 (1.5)
<i>Germany</i>	..	10 (0.9)	s 13 (1.6)	..	15 (1.6)
<i>Greece</i>	..	..	22 (1.0)	23 (1.4)	24 (1.2)
<b>Hong Kong</b>	11 (0.9)	..	..	..	..
<b>Hungary</b>	..	5 (0.5)	7 (0.9)	6 (0.6)	8 (0.8)
<b>Iceland</b>	..	11 (2.5)	x x	x x	s 12 (2.4)
<b>Iran, Islamic Rep.</b>	9 (0.9)	..	..	..	..
<b>Ireland</b>	8 (1.3)	..	..	..	..
<i>Israel</i>	21 (4.0)	..	..	..	..
<b>Japan</b>	16 (2.4)	..	..	..	..
<b>Korea</b>	9 (0.8)	..	..	..	..
<i>Kuwait</i>	19 (1.7)	..	..	..	..
<b>Latvia (LSS)</b>	..	3 (0.4)	5 (0.6)	..	8 (1.3)
<b>Lithuania</b>	..	4 (0.5)	6 (0.7)	6 (0.6)	8 (0.8)
<sup>5</sup> <i>Netherlands</i>	..	r 11 (1.9)	..	16 (2.6)	12 (1.7)
<b>New Zealand</b>	20 (2.2)	..	..	..	..
<b>Norway</b>	12 (1.3)	..	..	..	..
<sup>6</sup> <b>Portugal</b>	..	4 (0.4)	..	..	7 (0.8)
<i>Romania</i>	..	21 (1.0)	24 (1.1)	23 (1.1)	25 (1.3)
<b>Russian Federation</b>	..	4 (0.8)	s 38 (1.9)	6 (1.0)	8 (1.0)
<i>Scotland</i>	32 (2.0)	..	..	..	..
<b>Singapore</b>	7 (1.3)	..	..	..	..
<b>Slovak Republic</b>	..	2 (0.3)	4 (0.7)	3 (0.3)	5 (0.8)
<i>Slovenia</i>	..	8 (0.8)	13 (0.9)	..	20 (1.5)
<b>Spain</b>	9 (1.3)	..	..	..	..
<b>Sweden</b>	..	18 (2.0)	s 17 (1.7)	r 25 (2.1)	r 23 (2.0)
<b>Switzerland</b>	13 (1.5)	..	..	..	..
<i>Thailand</i>	9 (1.0)	..	..	..	..

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.

<sup>1</sup>Countries administered either an integrated science or separate subject area form of the questionnaire. A dot (.) denotes questions not administered by design. Percentages for separate science subject areas are based only on those students taking each subject.

<sup>2</sup>Data for Belgium (Fr) are reported for students in both integrated science classes and separate biology and physics classes.

<sup>3</sup>Physics data for Denmark are for students taking physics/chemistry classes.

<sup>4</sup>Biology data for France are for students taking biology/geology classes; physics data are for students taking physics/chemistry classes.

<sup>5</sup>Physics data for the Netherlands include students in both physics classes and physics/chemistry classes.

<sup>6</sup>Biology data for Portugal are for students taking natural science classes; physics data are for students taking physical science classes.

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

## 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 assign science homework and the typical lengths of such assignments. Internationally, most eighth-grade students are assigned science homework at least once a week, although more than half of the students in Belgium (Flemish), Belgium (French), the Czech Republic, Denmark, Hong Kong, Japan, Korea, Scotland, and Slovenia are taught by teachers who reported that they assign homework less than once a week. The majority of students in Missouri were assigned up to 30 minutes of science homework once or twice a week (the data for the United States and Oregon were insufficient).

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 science homework. In most countries, 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 Austria, Germany, Hungary, Iran, Japan, the Netherlands, Norway, and the Slovak Republic. Ninety-seven percent of students in Missouri have their science homework assignments corrected and returned to them.

Many teachers do not count homework directly in determining grades, using it more as a method to monitor students' understanding and correct misconceptions. They may warn students, however, that failing to complete homework assignments can result in grades being lowered. In general for the TIMSS countries, teachers reported that science homework assignments contributed only sometimes to students' grades or marks. 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, the Czech Republic, Denmark, France, Hong Kong, Hungary, Ireland, Japan, Latvia (LSS), Lithuania, the Netherlands, Norway, Romania, Singapore, the Slovak Republic, Slovenia, Switzerland, and Thailand. At the other end of the continuum, teachers reported that homework always contributed to the grades for the majority of the students in Colombia, Kuwait, Portugal, the Russian Federation, and Spain. Missouri was one of the participants with the highest percentage of students whose teachers reported that homework sometimes or always contributes to students' grades.

**Table 5.18**  
**Teachers' Reports About the Amount of Science 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
<b>UNITED STATES</b>	x x	x x	x x	x x	x x	x x	x x
<b>MISSOURI</b>	0 (0.0)	20 (4.5)	0 (0.0)	42 (4.9)	11 (3.4)	25 (4.6)	2 (0.3)
<b>OREGON</b>	x x	x x	x x	x x	x x	x x	x x
<i>Australia</i>	x x	x x	x x	x x	x x	x x	x x
<i>Austria</i>	--	--	--	--	--	--	--
<b>Belgium (Fl)</b>	r 16 (2.9)	72 (4.1)	4 (1.3)	7 (2.2)	0 (0.4)	1 (0.9)	0 (0.0)
<i>Belgium (Fr)</i>	s 4 (2.0)	57 (5.4)	4 (1.9)	31 (4.8)	2 (1.5)	2 (1.1)	1 (0.6)
<b>Canada</b>	r 4 (1.8)	16 (2.5)	4 (2.8)	47 (4.1)	8 (2.2)	18 (2.4)	2 (1.3)
<i>Colombia</i>	r 1 (1.4)	5 (2.1)	8 (2.2)	26 (4.1)	37 (5.2)	11 (3.0)	11 (3.0)
<b>Cyprus</b>	s 1 (1.3)	1 (0.6)	0 (0.0)	27 (3.6)	12 (3.1)	45 (4.6)	14 (3.8)
<b>Czech Republic</b>	r 4 (1.3)	75 (3.6)	0 (0.2)	21 (3.4)	0 (0.0)	0 (0.1)	0 (0.0)
<i>Denmark</i>	s 15 (4.7)	49 (6.4)	5 (3.2)	26 (5.6)	0 (0.0)	6 (2.7)	0 (0.0)
<b>England</b>	s 0 (0.0)	10 (2.1)	2 (0.8)	54 (3.3)	32 (3.0)	2 (1.4)	0 (0.1)
<b>France</b>	2 (0.9)	31 (3.6)	3 (1.2)	54 (3.6)	6 (1.5)	5 (1.5)	0 (0.0)
<i>Germany</i>	s 3 (1.5)	41 (4.1)	0 (0.4)	43 (3.8)	0 (0.4)	12 (2.8)	0 (0.0)
<i>Greece</i>	0 (0.0)	9 (2.3)	1 (0.9)	28 (3.1)	11 (3.4)	34 (3.5)	17 (3.1)
<b>Hong Kong</b>	1 (1.1)	37 (5.3)	21 (4.6)	36 (5.5)	4 (2.2)	1 (1.3)	0 (0.0)
<b>Hungary</b>	2 (0.7)	27 (2.3)	1 (0.4)	21 (2.3)	1 (0.5)	42 (2.5)	6 (1.2)
<b>Iceland</b>	s 3 (1.9)	23 (3.9)	2 (1.4)	49 (6.1)	12 (5.6)	11 (6.6)	0 (0.0)
<b>Iran, Islamic Rep.</b>	2 (1.3)	7 (3.1)	9 (3.3)	26 (5.8)	41 (5.4)	3 (1.1)	13 (2.8)
<b>Ireland</b>	s 0 (0.4)	5 (2.1)	0 (0.2)	34 (4.1)	4 (1.8)	53 (4.6)	4 (1.5)
<i>Israel</i>	r 0 (0.0)	19 (6.5)	0 (0.0)	48 (8.0)	13 (6.3)	18 (6.9)	3 (2.8)
<b>Japan</b>	10 (2.3)	55 (4.2)	14 (3.4)	12 (3.1)	5 (2.1)	4 (1.4)	0 (0.5)
<b>Korea</b>	2 (1.0)	39 (3.7)	11 (2.6)	29 (3.9)	10 (2.4)	8 (2.7)	0 (0.4)
<i>Kuwait</i>	r 0 (0.0)	0 (0.0)	0 (0.0)	20 (4.6)	3 (2.5)	68 (5.4)	9 (4.2)
<b>Latvia (LSS)</b>	s 1 (0.6)	23 (1.9)	1 (0.6)	58 (2.6)	3 (1.1)	14 (1.6)	1 (0.4)
<b>Lithuania</b>	r 1 (0.4)	19 (1.9)	0 (0.3)	62 (2.5)	4 (1.0)	13 (1.6)	1 (0.6)
<i>Netherlands</i>	r 0 (0.5)	11 (2.2)	0 (0.0)	76 (3.3)	3 (1.0)	9 (2.0)	1 (0.6)
<b>New Zealand</b>	0 (0.2)	12 (2.0)	2 (1.0)	54 (3.9)	2 (0.5)	30 (3.7)	0 (0.0)
<b>Norway</b>	s 0 (0.0)	11 (3.5)	1 (1.2)	65 (5.1)	9 (2.9)	14 (3.6)	0 (0.0)
<b>Portugal</b>	0 (0.2)	14 (2.4)	2 (0.9)	59 (3.0)	5 (1.2)	19 (2.7)	1 (0.8)
<i>Romania</i>	8 (1.2)	35 (2.3)	2 (0.6)	34 (2.0)	8 (1.3)	6 (1.2)	6 (1.0)
<b>Russian Federation</b>	0 (0.0)	1 (0.5)	0 (0.2)	65 (2.8)	16 (2.4)	12 (2.6)	6 (1.2)
<i>Scotland</i>	s 2 (1.4)	62 (4.8)	4 (1.7)	30 (4.5)	2 (1.3)	0 (0.2)	0 (0.0)
<b>Singapore</b>	0 (0.0)	14 (3.5)	3 (1.8)	49 (4.4)	28 (3.8)	6 (2.3)	0 (0.4)
<b>Slovak Republic</b>	r 2 (1.2)	37 (4.8)	0 (0.0)	59 (4.7)	0 (0.0)	2 (1.4)	0 (0.0)
<i>Slovenia</i>	r 3 (1.1)	56 (3.4)	2 (0.6)	37 (3.5)	2 (0.9)	0 (0.3)	0 (0.0)
<b>Spain</b>	r 0 (0.0)	8 (2.8)	4 (1.9)	45 (4.9)	5 (2.1)	30 (4.5)	8 (2.6)
<b>Sweden</b>	x x	x x	x x	x x	x x	x x	x x
<b>Switzerland</b>	s 4 (1.1)	43 (5.0)	3 (1.4)	38 (5.2)	3 (1.4)	8 (2.7)	1 (1.1)
<i>Thailand</i>	r 0 (0.0)	7 (3.0)	7 (3.4)	34 (6.4)	40 (6.7)	6 (2.8)	7 (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 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 unavailable.

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 &lt;50% of students.

**Table 5.19****Teachers' Reports on Their Use of Students' Written Science Homework<sup>1</sup> - 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
<b>UNITED STATES</b>	x x	x x	x x	x x	x x	x x	x x	x x
<b>MISSOURI</b>	0 (0.0)	3 (1.3)	35 (4.6)	62 (4.6)	0 (0.0)	1 (0.8)	42 (4.8)	57 (4.8)
<b>OREGON</b>	x x	x x	x x	x x	x x	x x	x x	x x
<i>Australia</i>	x x	x x	x x	x x	x x	x x	x x	x x
<i>Austria</i>	s 24 (3.1)	16 (2.7)	31 (2.9)	29 (3.8)	s 29 (3.8)	34 (4.1)	26 (3.7)	12 (2.7)
<b>Belgium (Fl)</b>	r 6 (2.0)	16 (4.0)	15 (3.3)	63 (4.7)	r 16 (4.0)	24 (6.1)	29 (4.1)	31 (5.0)
<i>Belgium (Fr)</i>	s 6 (2.6)	3 (1.9)	35 (5.9)	56 (6.4)	s 5 (2.8)	14 (3.9)	53 (6.2)	28 (5.1)
<b>Canada</b>	s 1 (0.7)	3 (1.7)	53 (5.2)	43 (5.1)	s 7 (2.2)	12 (2.2)	48 (3.9)	33 (3.6)
<i>Colombia</i>	r 0 (0.0)	1 (0.9)	14 (5.2)	85 (5.2)	r 1 (1.0)	5 (2.0)	40 (4.8)	54 (4.9)
<b>Cyprus</b>	s 5 (1.8)	15 (3.5)	51 (4.4)	29 (4.3)	s 0 (0.0)	6 (2.1)	46 (4.4)	49 (4.7)
<b>Czech Republic</b>	r 10 (1.9)	11 (2.1)	37 (3.4)	41 (3.1)	r 28 (3.6)	35 (3.5)	30 (3.2)	7 (1.3)
<i>Denmark</i>	s 14 (5.0)	8 (3.3)	31 (5.8)	46 (6.7)	s 41 (6.6)	17 (5.0)	29 (6.5)	13 (4.9)
<b>England</b>	s 1 (0.7)	2 (0.9)	31 (3.4)	66 (3.6)	s 3 (1.2)	8 (1.6)	45 (3.0)	44 (3.5)
<b>France</b>	7 (1.8)	18 (3.1)	45 (3.7)	30 (3.1)	25 (2.8)	28 (3.4)	39 (4.2)	8 (1.9)
<i>Germany</i>	s 3 (1.3)	28 (4.3)	56 (4.9)	13 (2.9)	s 17 (2.9)	22 (3.5)	52 (4.7)	9 (2.8)
<i>Greece</i>	6 (1.8)	17 (2.6)	43 (3.7)	34 (3.4)	2 (0.9)	12 (2.6)	41 (3.6)	45 (3.9)
<b>Hong Kong</b>	0 (0.0)	4 (2.3)	17 (3.7)	79 (3.8)	26 (5.3)	27 (5.1)	26 (5.0)	21 (5.1)
<b>Hungary</b>	14 (1.6)	32 (2.5)	39 (2.3)	15 (1.7)	16 (2.0)	39 (2.5)	34 (2.5)	11 (1.7)
<b>Iceland</b>	s 2 (1.4)	22 (7.2)	54 (7.6)	22 (4.0)	s 4 (3.1)	12 (4.5)	51 (8.1)	33 (6.8)
<b>Iran, Islamic Rep.</b>	17 (6.4)	22 (4.3)	26 (5.0)	35 (5.2)	9 (3.0)	25 (5.7)	43 (5.6)	23 (4.4)
<b>Ireland</b>	s 4 (1.9)	15 (3.2)	45 (4.7)	36 (4.3)	s 23 (3.9)	31 (4.3)	37 (4.5)	8 (2.6)
<i>Israel</i>	r 6 (4.4)	19 (6.8)	45 (8.8)	29 (6.3)	r 8 (4.5)	16 (5.4)	51 (8.9)	25 (5.8)
<b>Japan</b>	23 (4.4)	21 (3.6)	23 (3.9)	33 (4.5)	20 (3.2)	35 (3.8)	23 (3.8)	21 (3.6)
<b>Korea</b>	1 (0.7)	5 (2.2)	58 (4.0)	35 (3.6)	6 (1.8)	18 (3.0)	57 (3.9)	20 (3.0)
<i>Kuwait</i>	r 0 (0.0)	0 (0.0)	4 (2.9)	96 (2.9)	r 0 (0.0)	0 (0.0)	26 (6.9)	74 (6.9)
<b>Latvia (LSS)</b>	s 5 (1.2)	11 (1.7)	43 (2.3)	41 (2.5)	s 37 (3.2)	29 (3.0)	21 (2.1)	13 (1.7)
<b>Lithuania</b>	r 5 (1.1)	12 (1.5)	39 (2.3)	44 (2.1)	s 39 (2.7)	14 (2.0)	33 (2.6)	13 (2.3)
<i>Netherlands</i>	r 36 (3.0)	34 (2.8)	29 (3.3)	1 (0.7)	r 44 (3.2)	23 (2.9)	25 (3.6)	8 (1.7)
<b>New Zealand</b>	3 (1.3)	10 (2.5)	50 (3.9)	37 (3.9)	12 (2.7)	17 (2.9)	58 (3.5)	12 (2.6)
<b>Norway</b>	s 5 (2.4)	24 (4.6)	54 (5.6)	17 (4.1)	s 7 (2.8)	27 (4.7)	53 (4.8)	13 (3.8)
<b>Portugal</b>	5 (1.3)	18 (2.4)	46 (3.2)	30 (2.9)	1 (0.7)	4 (1.3)	37 (3.0)	57 (3.2)
<i>Romania</i>	r 9 (1.4)	11 (1.7)	33 (2.7)	47 (2.9)	r 12 (1.6)	18 (1.9)	46 (2.8)	24 (2.2)
<b>Russian Federation</b>	1 (0.5)	4 (1.0)	29 (2.9)	66 (2.9)	1 (0.5)	5 (0.8)	30 (2.2)	65 (2.5)
<i>Scotland</i>	--	--	--	--	--	--	--	--
<b>Singapore</b>	0 (0.0)	2 (1.5)	13 (3.2)	85 (3.2)	30 (4.3)	26 (3.7)	37 (4.8)	7 (2.8)
<b>Slovak Republic</b>	r 11 (3.2)	20 (4.3)	46 (5.1)	22 (3.7)	r 38 (4.5)	31 (4.6)	25 (4.2)	6 (2.2)
<i>Slovenia</i>	r 9 (1.8)	15 (2.3)	49 (3.4)	27 (2.9)	r 36 (3.6)	37 (3.5)	24 (3.0)	3 (1.1)
<b>Spain</b>	r 2 (1.3)	7 (2.3)	26 (4.3)	66 (4.3)	r 2 (1.7)	6 (2.3)	40 (4.2)	51 (4.5)
<b>Sweden</b>	x x	x x	x x	x x	x x	x x	x x	x x
<b>Switzerland</b>	s 8 (2.6)	18 (4.3)	51 (5.6)	22 (4.2)	s 28 (4.4)	35 (5.1)	35 (5.6)	2 (1.8)
<i>Thailand</i>	r 0 (0.0)	1 (0.5)	21 (5.2)	78 (5.2)	s 9 (3.9)	18 (4.5)	47 (6.6)	26 (5.4)

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

<sup>1</sup>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.

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.

## 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 each type of assessment varied greatly from country to country. The most heavily weighted type of assessment was 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 students in many European and Eastern European countries. In contrast, teachers were less in agreement about assessment approaches within Canada, England, Hong Kong, Ireland, Korea, New Zealand, and Thailand, where no type of assessment was weighted heavily for as many as 80% of the students. This was also the case for Missouri, where projects or practical exercises seem to be given the most weight, followed by teacher-made tests requiring explanations, homework assignments, and teacher-made objective tests.

As might be anticipated, science 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. Teachers in Missouri reported that they use assessment information "quite a lot" or "a great deal" to provide student feedback (92%), to provide grades or marks (90%), and to plan for future lessons (78%).

As reported in Table 5.22, eighth-grade students reported quite a lot of testing in science classes. Missouri and Oregon, and the United States, had among the highest percentages of students that reported having frequent (i.e., pretty often or almost always) quizzes or tests in science class. Among countries where science is taught as an integrated subject, the majority of the students reported having frequent quizzes and tests in Austria, Canada, Colombia, Cyprus, England, Hong Kong, Iran, Ireland, Kuwait, Singapore, Spain, Thailand, and the United States. Where the science subjects are taught separately, the majority reported frequent quizzes and tests in Belgium (Flemish), France, Germany, Greece, Lithuania, the Netherlands, Portugal, Romania, the Russian Federation, Slovenia, and Sweden. Countries with relatively little testing in science classes included Japan and Korea (integrated science), and the Czech Republic, Denmark, Hungary, Iceland, Latvia (LSS), and the Slovak Republic (separate science subjects).



**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 Science 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
<b>UNITED STATES</b>	x x	x x	x x	x x	x x	x x	x x
<b>MISSOURI</b>	17 (3.9)	64 (4.0)	62 (4.7)	63 (4.4)	77 (4.3)	36 (4.9)	41 (4.7)
<b>OREGON</b>	x x	x x	x x	x x	x x	x x	x x
<i>Australia</i>	x x	x x	x x	x x	x x	x x	x x
<i>Austria</i>	r 5 (1.6)	r 74 (3.0)	r 20 (3.3)	s 20 (3.2)	r 41 (3.6)	r 97 (1.2)	r 84 (2.4)
<b>Belgium (Fl)</b>	r 11 (5.3)	r 92 (1.8)	r 28 (4.7)	r 20 (4.1)	r 39 (4.6)	r 48 (4.2)	r 50 (4.3)
<i>Belgium (Fr)</i>	s 6 (2.5)	s 84 (3.8)	s 33 (5.4)	s 41 (5.2)	s 34 (6.0)	s 67 (5.5)	s 61 (5.2)
<b>Canada</b>	r 8 (2.0)	r 75 (3.8)	r 49 (4.7)	r 50 (3.9)	r 76 (3.9)	r 36 (3.1)	r 32 (3.7)
<i>Colombia</i>	r 18 (3.7)	r 75 (4.3)	r 63 (4.0)	r 94 (2.1)	r 84 (3.0)	r 85 (3.0)	r 87 (3.4)
<b>Cyprus</b>	s 24 (4.3)	s 79 (3.4)	s 68 (4.0)	s 91 (2.6)	s 76 (4.1)	s 82 (3.4)	s 98 (1.5)
<b>Czech Republic</b>	r 40 (2.8)	93 (1.3)	r 37 (3.2)	10 (1.7)	r 48 (4.4)	r 72 (2.9)	94 (1.6)
<i>Denmark</i>	s 30 (5.5)	s 63 (5.9)	s 24 (5.6)	s 41 (5.9)	s 91 (3.1)	s 87 (4.2)	s 89 (3.7)
<b>England</b>	x x	s 68 (2.5)	x x	s 66 (2.6)	s 74 (2.4)	s 65 (2.9)	s 61 (3.2)
<b>France</b>	20 (2.6)	89 (2.1)	44 (3.7)	37 (3.7)	51 (3.7)	71 (3.6)	68 (3.9)
<i>Germany</i>	s 5 (2.5)	s 84 (3.5)	s 10 (2.4)	s 30 (4.4)	s 55 (4.7)	s 72 (4.9)	s 86 (2.3)
<i>Greece</i>	25 (3.5)	91 (2.0)	55 (4.1)	64 (3.9)	53 (4.4)	85 (2.5)	97 (1.5)
<b>Hong Kong</b>	22 (4.6)	49 (5.7)	78 (5.1)	53 (5.7)	41 (5.5)	43 (5.6)	43 (4.7)
<b>Hungary</b>	46 (2.8)	89 (1.8)	36 (2.3)	42 (2.8)	82 (2.1)	71 (2.4)	88 (1.7)
<b>Iceland</b>	s 5 (1.6)	s 94 (2.8)	s 55 (6.6)	s 87 (4.9)	s 48 (7.5)	s 42 (7.7)	s 43 (7.6)
<b>Iran, Islamic Rep.</b>	19 (3.6)	89 (2.9)	59 (6.0)	45 (5.3)	52 (5.0)	42 (5.6)	93 (2.1)
<b>Ireland</b>	s 28 (3.8)	s 69 (4.4)	x x	s 67 (4.9)	s 63 (4.8)	s 69 (4.9)	s 76 (4.4)
<i>Israel</i>	s 21 (7.9)	r 69 (8.4)	r 92 (4.2)	r 35 (7.4)	r 48 (7.8)	r 60 (6.5)	r 71 (7.9)
<b>Japan</b>	16 (3.2)	72 (3.2)	45 (4.0)	44 (4.2)	88 (2.8)	79 (3.8)	69 (3.8)
<b>Korea</b>	s 23 (4.5)	s 41 (4.2)	s 41 (4.2)	s 16 (3.6)	s 55 (4.7)	s 38 (4.9)	s 38 (4.6)
<i>Kuwait</i>	r 22 (6.7)	r 84 (4.7)	r 90 (4.5)	r 67 (7.4)	r 52 (7.0)	r 67 (5.4)	r 85 (5.6)
<b>Latvia (LSS)</b>	s 62 (2.5)	s 81 (2.3)	s 65 (2.6)	s 74 (2.5)	s 89 (1.7)	s 80 (2.3)	s 97 (0.9)
<b>Lithuania</b>	s 15 (1.6)	s 48 (2.6)	s 29 (2.8)	s 36 (2.7)	s 41 (3.0)	s 36 (2.8)	s 82 (2.3)
<i>Netherlands</i>	r 60 (3.7)	r 90 (2.4)	r 64 (3.4)	r 11 (2.8)	r 25 (3.3)	r 17 (2.6)	r 14 (2.7)
<b>New Zealand</b>	10 (2.3)	63 (3.8)	56 (4.4)	30 (4.0)	66 (4.1)	53 (4.4)	36 (4.2)
<b>Norway</b>	s 6 (2.1)	s 95 (2.2)	s 8 (2.8)	s 56 (4.6)	s 68 (5.1)	s 68 (4.6)	s 74 (5.0)
<b>Portugal</b>	13 (2.0)	88 (1.9)	53 (2.9)	81 (2.5)	71 (2.9)	88 (2.1)	94 (1.6)
<i>Romania</i>	r 21 (2.2)	82 (1.8)	72 (2.1)	r 72 (2.3)	68 (2.1)	90 (1.3)	99 (0.6)
<b>Russian Federation</b>	--	96 (1.3)	63 (2.9)	77 (2.9)	74 (3.0)	97 (1.1)	--
<i>Scotland</i>	--	--	--	--	--	--	--
<b>Singapore</b>	--	80 (3.4)	61 (4.4)	48 (4.7)	77 (4.2)	47 (4.7)	46 (4.7)
<b>Slovak Republic</b>	r 76 (4.0)	r 97 (1.7)	r 24 (3.9)	r 27 (4.1)	r 76 (4.5)	r 93 (2.4)	r 99 (0.9)
<i>Slovenia</i>	r 46 (3.4)	r 89 (2.0)	r 29 (3.5)	r 39 (3.7)	r 76 (3.1)	r 76 (3.2)	r 88 (2.4)
<b>Spain</b>	r 8 (2.6)	r 97 (1.6)	r 43 (4.4)	r 76 (3.9)	r 62 (4.2)	r 88 (3.4)	r 92 (2.9)
<b>Sweden</b>	x x	x x	x x	x x	x x	x x	x x
<b>Switzerland</b>	s 11 (2.8)	s 88 (3.6)	s 20 (4.0)	s 13 (3.1)	s 46 (5.0)	s 54 (5.6)	s 61 (5.1)
<i>Thailand</i>	s 20 (5.1)	r 63 (5.9)	r 81 (4.5)	r 64 (5.7)	r 70 (5.7)	r 67 (5.7)	r 68 (5.8)

\*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.

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 5.21** **Teachers' Reports on Ways Assessment Information Is Used "Quite A Lot" or "A Great Deal" - Science - 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 Track	To Plan for Future Lessons
<b>UNITED STATES</b>	x x	x x	x x	x x	x x	x x
<b>MISSOURI</b>	90 (4.2)	92 (4.4)	51 (4.7)	65 (4.8)	13 (3.3)	78 (3.9)
<b>OREGON</b>	x x	x x	x x	x x	x x	x x
<i>Australia</i>	x x	x x	x x	x x	x x	x x
<i>Austria</i>	--	r 66 (3.3)	r 51 (3.2)	r 36 (4.3)	r 4 (1.2)	r 29 (3.0)
<b>Belgium (Fl)</b>	r 71 (3.6)	r 61 (5.1)	r 65 (4.8)	r 65 (4.1)	r 59 (5.0)	r 33 (5.0)
<i>Belgium (Fr)</i>	s 83 (4.4)	s 69 (6.2)	s 84 (5.2)	s 39 (5.4)	--	s 73 (4.9)
<b>Canada</b>	r 90 (3.0)	r 82 (2.6)	r 55 (4.3)	r 78 (3.2)	s 29 (4.0)	r 59 (4.1)
<i>Colombia</i>	r 70 (4.5)	r 95 (2.0)	r 85 (3.4)	r 54 (4.8)	r 22 (4.4)	r 86 (3.4)
<b>Cyprus</b>	s 93 (2.0)	s 85 (2.9)	s 95 (2.4)	s 83 (3.0)	s 63 (4.8)	s 84 (3.2)
<b>Czech Republic</b>	94 (1.4)	r 92 (1.8)	97 (0.9)	r 53 (3.1)	r 19 (3.1)	r 79 (2.7)
<i>Denmark</i>	s 41 (5.5)	s 75 (5.7)	s 50 (6.0)	s 36 (6.2)	s 67 (6.1)	s 83 (5.0)
<b>England</b>	x x	x x	x x	x x	x x	x x
<b>France</b>	91 (1.8)	92 (1.9)	91 (1.7)	52 (3.4)	38 (3.8)	72 (3.4)
<i>Germany</i>	s 81 (3.4)	s 83 (3.5)	s 82 (3.5)	s 41 (4.4)	s 20 (3.6)	s 72 (4.1)
<i>Greece</i>	95 (1.7)	88 (2.6)	93 (2.0)	91 (2.1)	35 (4.3)	72 (3.5)
<b>Hong Kong</b>	73 (5.5)	64 (5.0)	74 (3.8)	13 (4.1)	5 (2.5)	63 (5.4)
<b>Hungary</b>	58 (2.6)	67 (2.4)	90 (1.7)	84 (1.9)	85 (1.7)	72 (2.1)
<b>Iceland</b>	s 73 (7.4)	s 67 (5.5)	s 55 (5.9)	s 43 (5.3)	s 6 (2.9)	s 70 (7.3)
<b>Iran, Islamic Rep.</b>	85 (3.4)	r 63 (4.6)	73 (5.7)	61 (4.6)	52 (5.6)	73 (3.8)
<b>Ireland</b>	s 60 (4.0)	s 81 (3.4)	s 77 (4.2)	s 70 (4.0)	s 31 (4.5)	s 75 (3.9)
<i>Israel</i>	r 85 (6.9)	s 74 (8.9)	r 82 (7.2)	s 78 (5.8)	r 59 (8.6)	r 91 (4.9)
<b>Japan</b>	79 (3.6)	68 (4.3)	64 (4.5)	15 (2.9)	16 (3.0)	54 (4.4)
<b>Korea</b>	44 (4.1)	34 (3.9)	50 (4.0)	6 (1.8)	4 (1.6)	41 (3.9)
<i>Kuwait</i>	r 83 (6.4)	r 69 (7.3)	r 76 (6.7)	r 47 (8.8)	r 76 (7.7)	r 83 (4.7)
<b>Latvia (LSS)</b>	s 93 (1.4)	s 91 (1.5)	s 92 (1.7)	s 22 (1.8)	s 47 (2.4)	s 91 (1.7)
<b>Lithuania</b>	r 80 (1.9)	r 55 (2.5)	r 56 (2.9)	r 42 (2.5)	r 35 (2.6)	r 73 (2.5)
<i>Netherlands</i>	r 91 (2.1)	r 57 (4.2)	r 42 (3.6)	r 55 (3.5)	r 58 (3.6)	r 42 (3.7)
<b>New Zealand</b>	91 (2.4)	83 (3.3)	59 (4.1)	84 (2.9)	21 (3.0)	58 (3.7)
<b>Norway</b>	s 70 (4.9)	s 63 (5.2)	s 24 (4.3)	s 15 (3.2)	s 15 (3.2)	s 61 (5.1)
<b>Portugal</b>	92 (1.9)	87 (1.9)	97 (1.1)	63 (3.3)	37 (3.0)	89 (1.9)
<i>Romania</i>	97 (0.8)	86 (1.9)	r 90 (1.3)	70 (2.3)	75 (2.2)	90 (1.6)
<b>Russian Federation</b>	94 (1.5)	81 (2.4)	95 (1.2)	29 (2.6)	77 (2.5)	95 (1.4)
<i>Scotland</i>	--	--	--	--	--	--
<b>Singapore</b>	76 (4.1)	88 (3.2)	82 (3.7)	33 (4.2)	31 (4.3)	73 (4.2)
<b>Slovak Republic</b>	r 80 (4.4)	r 85 (3.5)	r 83 (3.7)	r 63 (4.9)	r 13 (2.9)	r 76 (4.0)
<i>Slovenia</i>	r 66 (3.2)	r 95 (1.4)	r 87 (2.4)	r 61 (3.3)	r 30 (2.8)	r 83 (2.7)
<b>Spain</b>	r 95 (1.9)	r 89 (3.0)	r 92 (2.6)	r 91 (2.6)	r 64 (4.1)	r 90 (3.1)
<b>Sweden</b>	x x	x x	x x	x x	x x	x x
<b>Switzerland</b>	s 79 (4.4)	s 85 (3.8)	s 71 (4.5)	s 32 (4.8)	s 18 (4.0)	s 69 (5.1)
<i>Thailand</i>	r 73 (5.2)	r 84 (4.7)	r 86 (4.8)	r 47 (6.1)	r 76 (4.3)	r 88 (4.4)

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.

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 &lt;50% of students.

**Table 5.22**  
**Students' Reports on Frequency of Having a Quiz or Test in Their Science Lessons<sup>1</sup>**  
**Eighth Grade\***

Country	Percent of Students Responding Pretty Often or Almost Always				
	Science (Integrated)	Science Subject Areas			
		Biology	Chemistry	Earth Science	Physics
<b>UNITED STATES</b>	77 (1.4)	..	..	..	..
<b>MISSOURI</b>	76 (1.5)	..	..	..	..
<b>OREGON</b>	72 (2.8)	..	..	..	..
<i>Australia</i>	44 (1.2)	..	..	..	..
<i>Austria</i>	75 (1.5)	..	..	..	..
<b>Belgium (FI)</b>	..	71 (2.0)	..	68 (1.8)	x x
<sup>2</sup> <i>Belgium (Fr)</i>	x x	x x	..	..	x x
<b>Canada</b>	60 (1.4)	..	..	..	..
<i>Colombia</i>	75 (1.9)	..	..	..	..
<b>Cyprus</b>	78 (1.1)	..	..	..	..
<b>Czech Republic</b>	..	32 (2.3)	37 (2.1)	30 (1.7)	34 (1.8)
<sup>3</sup> <i>Denmark</i>	..	27 (1.9)	..	r 32 (1.6)	48 (1.9)
<b>England</b>	54 (2.0)	..	..	..	..
<sup>4</sup> <b>France</b>	..	67 (1.7)	..	..	83 (1.4)
<i>Germany</i>	..	57 (2.2)	s 56 (2.2)	..	50 (2.1)
<i>Greece</i>	..	..	57 (1.3)	51 (1.2)	56 (1.2)
<b>Hong Kong</b>	62 (2.6)	..	..	..	..
<b>Hungary</b>	..	21 (1.4)	25 (1.3)	19 (1.1)	24 (1.3)
<b>Iceland</b>	..	16 (2.5)	x x	x x	x x
<b>Iran, Islamic Rep.</b>	66 (1.4)	..	..	..	..
<b>Ireland</b>	50 (1.5)	..	..	..	..
<i>Israel</i>	47 (2.9)	..	..	..	..
<b>Japan</b>	32 (2.2)	..	..	..	..
<b>Korea</b>	22 (1.3)	..	..	..	..
<i>Kuwait</i>	66 (1.9)	..	..	..	..
<b>Latvia (LSS)</b>	..	26 (1.5)	20 (1.1)	..	16 (1.1)
<b>Lithuania</b>	..	55 (2.2)	67 (1.6)	50 (2.2)	69 (1.4)
<sup>5</sup> <i>Netherlands</i>	..	r 54 (2.7)	..	50 (2.5)	45 (1.9)
<b>New Zealand</b>	49 (1.7)	..	..	..	..
<b>Norway</b>	45 (1.7)	..	..	..	..
<sup>6</sup> <b>Portugal</b>	..	57 (1.4)	..	..	53 (1.3)
<i>Romania</i>	..	73 (1.3)	76 (1.2)	73 (1.4)	75 (1.1)
<b>Russian Federation</b>	..	57 (2.1)	73 (1.4)	57 (1.1)	74 (1.0)
<i>Scotland</i>	46 (1.4)	..	..	..	..
<b>Singapore</b>	74 (1.4)	..	..	..	..
<b>Slovak Republic</b>	..	30 (1.8)	48 (2.3)	29 (2.1)	38 (1.6)
<i>Slovenia</i>	..	44 (1.9)	52 (1.9)	..	53 (1.9)
<b>Spain</b>	75 (1.4)	..	..	..	..
<b>Sweden</b>	..	60 (1.9)	x x	r 66 (1.5)	r 63 (2.0)
<b>Switzerland</b>	49 (1.4)	..	..	..	..
<i>Thailand</i>	62 (1.5)	..	..	..	..

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.

<sup>1</sup>Countries administered either an integrated science or separate subject area form of the questionnaire. A dot (.) denotes questions not administered by design. Percentages for separate science subject areas are based only on those students taking each subject.

<sup>2</sup>Data for Belgium (Fr) are reported for students in both integrated science classes and separate biology and physics classes.

<sup>3</sup>Physics data for Denmark are for students taking physics/chemistry classes.

<sup>4</sup>Biology data for France are for students taking biology/geology classes; physics data are for students taking physics/chemistry classes.

<sup>5</sup>Physics data for the Netherlands include students in both physics classes and physics/chemistry classes.

<sup>6</sup>Biology data for Portugal are for students taking natural science classes; physics data are for students taking physical science classes.

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.

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



# 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.<sup>1</sup> 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.

<sup>1</sup> 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.<sup>2</sup> 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*.<sup>3</sup>

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.

<sup>2</sup> 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.

<sup>3</sup> 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.<sup>4</sup>

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.

<sup>4</sup> 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 Science Test

The TIMSS curriculum framework underlying the science tests at all three populations was developed by groups of science educators with input from the TIMSS National Research Coordinators (NRCs). As shown in Figure A.1, the science curriculum framework contains three dimensions or aspects. The **content** aspect represents the subject matter content of school science. 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 science. The **perspectives** aspect focuses on the development of students' attitudes, interest, and motivations in science.<sup>5</sup>

Working within the science curriculum framework, science test specifications were developed for Population 2 that included items representing a wide range of science topics and eliciting a range of skills from the students. The tests were developed through an international consensus involving input from experts in science 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 the sciences. 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.<sup>6</sup>

<sup>5</sup> 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.

<sup>6</sup> 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 1*. 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** 

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**The Three Aspects and Major Categories of the Science Framework**

### **Content**

- Earth Sciences
- Life Sciences
- Physical sciences
- Science, technology, and mathematics
- History of science and technology
- Environmental issues
- Nature of science
- Science and other disciplines

### **Performance Expectations**

- Understanding
- Theorizing, analyzing, and solving problems
- Using tools, routine procedures and science processes
- Investigating the natural world
- Communicating

### **Perspectives**

- Attitudes
- Careers
- Participation
- Increasing interest
- Safety
- Habits of mind

Table A.1 presents the five content areas included in the Population 2 science test and the numbers of items and score points in each category. Distributions also are included for the five 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. 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.<sup>7</sup>

<sup>7</sup> 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.

**Table A.1**  
**Distribution of Science 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 Free-Response Items <sup>1</sup>	Number of Score Points <sup>2</sup>
Earth Science	16%	22	17	5	24
Life Science	30%	40	31	9	44
Physics	30%	40	28	12	42
Chemistry	14%	19	15	4	21
Environmental Issues and the Nature of Science	10%	14	11	3	15
Total	100%	135	102	33	146

Performance Category	Percentage of Items	Total Number of Items	Number of Multiple-Choice Items	Number of Free-Response Items <sup>1</sup>	Number of Score Points <sup>2</sup>
Understanding Simple Information	40%	55	53	2	55
Understanding Complex Information	29%	39	29	10	41
Theorizing, Analyzing, and Solving Problems	21%	28	9	19	36
Using Tools, Routine Procedures, and Science Processes	6%	8	8	0	8
Investigating the Natural World	4%	5	3	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 information about the grades tested in each country.

<sup>1</sup>Free-Response Items include both short-answer and extended-response types.

<sup>2</sup>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.

## 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 science 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.<sup>8</sup>

## 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

<sup>8</sup> 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.

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.

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.<sup>9</sup> 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.

<sup>9</sup> 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.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%

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

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

\*One region (Baden-Wuerttemberg) did not participate.

**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
<b>UNITED STATES</b>	220	217	169	14	183
<b>MISSOURI</b>	60	60	44	11	55
<b>OREGON</b>	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

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.

**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
<b>UNITED STATES</b>	8026	104	108	7814	727	7087
<b>MISSOURI</b>	2324	35	30	2259	144	2115
<b>OREGON</b>	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

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.



**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)
<b>UNITED STATES</b>	77.3	84.9	91.8	71.0	77.9
<b>MISSOURI</b>	73.3	90.0	93.9	68.8	84.5
<b>OREGON</b>	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

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.

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 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 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.

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.

**Figure A.2** **Countries Grouped for Reporting of Achievement According to Their Compliance with Guidelines for Sample Implementation and Participation Rates**

<b>Eighth Grade*</b>	
<b>Countries satisfying guidelines for sample participation rates, grade selection, and sampling procedures</b>	
† Belgium (Fl) Canada Cyprus Czech Republic <sup>12</sup> England France Hong Kong Hungary Iceland Iran, Islamic Rep. Ireland Japan Korea <sup>1</sup> Latvia (LSS)	<sup>1</sup> Lithuania † Missouri New Zealand Norway Oregon Portugal Russian Federation Singapore Slovak Republic Spain Sweden <sup>1</sup> Switzerland † United States
<b>Countries not satisfying guidelines for sample participation</b>	
Australia Austria Belgium (Fr)	Bulgaria Netherlands Scotland
<b>Countries not meeting age/grade specifications (high percentage of older students)</b>	
Colombia <sup>11</sup> Germany	Romania Slovenia
<b>Countries with unapproved sampling procedures at the classroom level</b>	
Denmark Greece	Thailand
<b>Countries with unapproved sampling procedures at classroom level and not meeting other guidelines</b>	
<sup>1</sup> Israel Kuwait	South Africa

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.  
<sup>1</sup> National Desired Population does not cover all of International Desired Population (see Table 1). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.  
<sup>2</sup> National Defined Population covers less than 90 percent of National Desired Population (see Table 1).

## 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.<sup>10</sup> 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

<sup>10</sup> 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.

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 science 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 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.<sup>11</sup> 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.

<sup>11</sup> 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 1*. Chestnut Hill, MA: Boston College.

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.<sup>12</sup>

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 science 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 88% to 100% and an overall average of 95% 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.

### Test Reliability

Table A.7 displays the science 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 0.84 in Australia and Bulgaria to 0.69 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 0.78. The median reliabilities for the United States, Missouri and Oregon were 0.83, 0.84, and 0.84, respectively.

<sup>12</sup> 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\***  
**Science 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
<b>UNITED STATES</b>	97	90	100	89	74	100
<b>MISSOURI</b>	99	89	100	94	77	100
<b>OREGON</b>	99	95	100	91	59	100
Australia	91	69	99	78	48	97
Belgium (Fl)	100	95	100	98	82	100
Bulgaria	91	63	100	81	50	100
Canada	92	76	100	80	59	99
Colombia	97	83	100	91	73	100
Czech Republic	96	87	100	90	61	100
England	97	90	100	91	65	100
France	99	95	100	97	89	100
Germany	94	81	100	84	66	100
Hong Kong	94	72	100	87	56	100
Iceland	95	74	100	83	22	98
Iran, Islamic Rep.	88	67	100	73	33	99
Ireland	95	87	100	89	69	100
Japan	100	96	100	98	87	100
Netherlands	92	75	100	79	17	100
New Zealand	97	90	100	90	63	100
Norway	95	87	100	91	71	100
Portugal	96	88	100	91	75	100
Russian Federation	96	87	100	91	73	100
Scotland	89	73	99	74	52	96
Singapore	98	92	100	95	86	100
Slovak Republic	92	62	100	81	43	100
Spain	95	85	100	88	73	98
Sweden	94	80	100	83	54	99
Switzerland	98	93	100	93	85	99
<b>AVERAGE</b>	95	82	100	87	62	99

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 33 mathematics items, including 4 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.

**Table A.7**  
**Cronbach's Alpha Reliability Coefficients<sup>1</sup> - TIMSS Science Test  
 Eighth Grade\***

Country	Upper Grade
<b>UNITED STATES</b>	0.83
<b>MISSOURI</b>	0.84
<b>OREGON</b>	0.84
Australia	0.84
Austria	0.81
Belgium (Fl)	0.78
Belgium (Fr)	0.79
Bulgaria	0.84
Canada	0.78
Colombia	0.72
Cyprus	0.79
Czech Republic	0.78
Denmark	0.77
England	0.83
France	0.73
Germany	0.82
Greece	0.77
Hong Kong	0.78
Hungary	0.79
Iceland	0.75
Iran, Islamic Rep.	0.71
Ireland	0.82
Israel	0.83
Japan	0.79
Korea	0.79
Kuwait	0.69
Latvia (LSS)	0.76
Lithuania	0.75
Netherlands	0.76
New Zealand	0.82
Norway	0.78
Portugal	0.75
Romania	0.82
Russian Federation	0.79
Scotland	0.82
Singapore	0.77
Slovak Republic	0.81
Slovenia	0.78
South Africa	0.82
Spain	0.73
Sweden	0.77
Switzerland	0.78
Thailand	0.73
<b>International Median</b>	0.78

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.  
<sup>1</sup>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.



## 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.<sup>13</sup> 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,<sup>14</sup> both the International Study Center and ACER conducted a review of the item statistics.

<sup>13</sup> 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.

<sup>14</sup> 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.

## 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 science results were summarized using an item response theory (IRT) scaling method (Rasch model).<sup>15</sup> This scaling method produces a science 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 science 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 science content, the performance of the students across the items was sufficiently consistent that it could be usefully summarized in a single science 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.<sup>16</sup> 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 science 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.

<sup>15</sup> 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.

<sup>16</sup> 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.<sup>17</sup> 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.

<sup>17</sup> 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 the Sciences**  
**Eighth Grade\***

Country	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
<b>UNITED STATES</b>	359 (6.3)	465 (7.7)	537 (6.5)	608 (5.4)	705 (8.6)
<b>MISSOURI</b>	369 (7.3)	482 (10.5)	556 (6.6)	631 (6.1)	736 (2.2)
<b>OREGON</b>	375 (4.9)	493 (4.6)	566 (8.3)	641 (5.0)	748 (4.5)
Australia	371 (6.6)	475 (4.6)	545 (6.5)	619 (3.9)	720 (1.4)
Austria	395 (6.0)	499 (4.1)	558 (3.7)	623 (6.0)	721 (2.6)
Belgium (Fl)	416 (5.3)	499 (6.6)	548 (4.9)	609 (4.5)	680 (1.4)
Belgium (Fr)	332 (5.4)	415 (3.9)	472 (5.3)	532 (4.5)	609 (5.7)
Bulgaria	386 (5.2)	488 (2.0)	560 (7.3)	641 (4.3)	747 (6.9)
Canada	380 (3.7)	472 (4.2)	529 (4.0)	594 (3.0)	685 (3.8)
Colombia	291 (8.3)	358 (6.4)	410 (5.8)	467 (8.8)	533 (2.6)
Cyprus	316 (1.4)	403 (2.8)	462 (3.0)	526 (2.9)	605 (4.2)
Czech Republic	438 (4.9)	513 (2.9)	570 (5.3)	634 (5.1)	716 (4.5)
Denmark	334 (5.4)	423 (3.8)	477 (3.6)	541 (3.2)	615 (3.0)
England	380 (2.0)	484 (5.2)	549 (5.9)	625 (4.7)	727 (6.7)
France	374 (3.9)	446 (4.6)	498 (3.9)	553 (3.1)	623 (4.6)
Germany	362 (9.3)	463 (6.6)	535 (8.5)	602 (4.2)	691 (5.5)
Greece	363 (3.8)	439 (2.3)	495 (2.2)	557 (3.0)	643 (1.4)
Hong Kong	376 (10.6)	467 (7.1)	524 (7.2)	583 (4.1)	669 (1.4)
Hungary	408 (6.1)	497 (5.2)	552 (4.2)	616 (4.2)	703 (2.5)
Iceland	363 (0.6)	442 (5.3)	491 (3.8)	555 (6.9)	623 (14.7)
Iran, Islamic Rep.	355 (4.3)	422 (2.5)	467 (2.8)	520 (2.3)	592 (6.8)
Ireland	383 (2.6)	471 (10.1)	536 (5.0)	605 (4.9)	694 (1.9)
Israel	356 (14.7)	460 (9.1)	526 (10.4)	591 (5.3)	694 (11.1)
Japan	421 (0.5)	514 (4.3)	573 (1.5)	632 (1.8)	715 (1.7)
Korea	408 (1.2)	504 (1.8)	564 (2.4)	629 (4.1)	719 (1.4)
Kuwait	316 (8.5)	380 (4.3)	427 (4.2)	484 (4.3)	551 (2.2)
Latvia (LSS)	353 (4.4)	432 (5.4)	482 (2.4)	540 (3.0)	625 (6.5)
Lithuania	346 (2.7)	421 (8.5)	476 (5.8)	533 (3.1)	613 (5.3)
Netherlands	419 (11.7)	505 (9.3)	561 (6.0)	619 (5.0)	701 (8.8)
New Zealand	364 (6.9)	458 (6.3)	524 (5.5)	594 (3.6)	692 (3.7)
Norway	385 (3.8)	470 (1.9)	526 (3.0)	588 (1.9)	671 (4.7)
Portugal	362 (4.4)	429 (1.1)	477 (1.4)	531 (2.1)	602 (5.3)
Romania	321 (3.8)	420 (8.5)	484 (5.2)	556 (6.7)	653 (6.6)
Russian Federation	386 (8.5)	474 (8.1)	535 (5.3)	606 (3.6)	697 (8.0)
Scotland	357 (8.5)	451 (5.1)	513 (6.1)	584 (7.1)	686 (6.0)
Singapore	457 (5.2)	541 (7.4)	603 (7.4)	674 (6.5)	768 (6.1)
Slovak Republic	396 (7.1)	484 (8.8)	543 (5.6)	607 (4.3)	696 (2.3)
Slovenia	421 (2.9)	501 (4.7)	556 (4.2)	620 (3.6)	709 (4.6)
South Africa	185 (2.8)	261 (4.7)	313 (3.6)	376 (9.2)	526 (15.3)
Spain	393 (4.0)	465 (1.7)	514 (2.9)	571 (3.1)	649 (3.3)
Sweden	386 (5.5)	476 (6.2)	533 (5.2)	598 (4.1)	686 (1.7)
Switzerland	371 (3.9)	460 (5.2)	524 (4.9)	587 (4.6)	669 (0.9)
Thailand	409 (2.3)	479 (4.5)	525 (5.6)	575 (4.8)	646 (3.6)

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.

( ) Standard errors appear in parentheses.

**Table B.2**  
**Standard Deviations of Achievement in Science**  
**Eighth Grade\***

Country	Overall		Boys		Girls	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
<b>UNITED STATES</b>	534 (4.7)	106 (1.6)	539 (4.9)	110 (2.0)	530 (5.2)	101 (1.8)
<b>MISSOURI</b>	555 (5.2)	110 (2.1)	564 (6.1)	114 (2.6)	547 (4.8)	105 (2.3)
<b>OREGON</b>	564 (4.5)	111 (1.6)	576 (5.5)	117 (1.9)	552 (3.8)	105 (2.1)
Australia	545 (3.9)	106 (1.7)	550 (5.2)	110 (2.3)	540 (4.1)	103 (2.0)
Austria	558 (3.7)	98 (3.0)	566 (4.0)	97 (3.6)	549 (4.6)	98 (3.4)
Belgium (Fl)	550 (4.2)	81 (1.7)	558 (6.0)	82 (3.2)	543 (5.8)	79 (1.7)
Belgium (Fr)	471 (2.8)	86 (2.1)	479 (4.8)	89 (3.2)	463 (2.9)	81 (2.3)
Bulgaria	565 (5.3)	111 (2.4)	--	--	--	--
Canada	531 (2.6)	93 (1.0)	537 (3.1)	95 (1.7)	525 (3.7)	89 (1.5)
Colombia	411 (4.1)	76 (1.9)	418 (7.3)	79 (3.6)	405 (4.6)	71 (2.4)
Cyprus	463 (1.9)	89 (1.3)	461 (2.2)	93 (1.9)	465 (2.7)	83 (1.4)
Czech Republic	574 (4.3)	87 (1.8)	586 (4.2)	87 (2.3)	562 (5.8)	85 (2.3)
Denmark	478 (3.1)	88 (1.4)	494 (3.6)	90 (1.8)	463 (3.9)	83 (2.0)
England	552 (3.3)	106 (1.8)	562 (5.6)	108 (2.5)	542 (4.2)	102 (2.8)
France	498 (2.5)	77 (1.4)	506 (2.7)	76 (1.8)	490 (3.3)	77 (1.8)
Germany	531 (4.8)	101 (1.8)	542 (5.9)	101 (2.6)	524 (4.9)	99 (2.1)
Greece	497 (2.2)	85 (0.9)	505 (2.6)	85 (1.5)	489 (3.1)	84 (1.4)
Hong Kong	522 (4.7)	89 (2.1)	535 (5.5)	90 (2.7)	507 (5.1)	86 (2.4)
Hungary	554 (2.8)	90 (1.5)	563 (3.1)	89 (1.9)	545 (3.4)	90 (2.1)
Iceland	494 (4.0)	79 (1.4)	501 (5.1)	83 (2.1)	486 (4.6)	74 (1.5)
Iran, Islamic Rep.	470 (2.4)	73 (1.0)	477 (3.8)	76 (1.2)	461 (3.2)	67 (1.5)
Ireland	538 (4.5)	96 (1.9)	544 (6.6)	99 (3.0)	532 (5.2)	92 (1.9)
Israel	524 (5.7)	104 (3.5)	545 (6.4)	103 (3.8)	512 (6.1)	98 (4.2)
Japan	571 (1.6)	90 (1.0)	579 (2.4)	93 (1.5)	562 (2.0)	86 (1.3)
Korea	565 (1.9)	94 (1.2)	576 (2.7)	95 (1.7)	551 (2.3)	91 (1.5)
Kuwait	430 (3.7)	74 (1.3)	416 (6.6)	76 (1.9)	444 (3.3)	69 (1.3)
Latvia (LSS)	485 (2.7)	81 (1.4)	492 (3.3)	82 (2.0)	478 (3.2)	79 (1.7)
Lithuania	476 (3.4)	81 (1.5)	484 (3.8)	81 (2.0)	470 (4.0)	81 (2.0)
Netherlands	560 (5.0)	85 (1.9)	570 (6.4)	85 (3.2)	550 (4.9)	83 (2.0)
New Zealand	525 (4.4)	100 (1.7)	538 (5.4)	103 (2.3)	512 (5.2)	95 (2.0)
Norway	527 (1.9)	87 (1.5)	534 (3.2)	91 (2.1)	520 (2.0)	83 (1.8)
Portugal	480 (2.3)	74 (1.0)	490 (2.8)	73 (1.5)	468 (2.7)	73 (1.2)
Romania	486 (4.7)	102 (1.8)	492 (5.3)	104 (2.1)	480 (5.0)	99 (2.3)
Russian Federation	538 (4.0)	95 (2.0)	544 (4.9)	97 (2.7)	533 (3.7)	93 (2.2)
Scotland	517 (5.2)	100 (2.4)	528 (6.4)	101 (2.6)	507 (4.8)	96 (2.6)
Singapore	607 (5.5)	95 (2.0)	612 (6.7)	95 (2.4)	603 (7.0)	95 (2.8)
Slovak Republic	544 (3.2)	92 (1.2)	552 (3.5)	92 (1.6)	537 (3.9)	92 (1.9)
Slovenia	560 (2.5)	88 (1.3)	573 (3.2)	89 (1.8)	548 (3.2)	85 (1.6)
South Africa	326 (6.6)	99 (4.8)	337 (9.5)	102 (6.3)	315 (6.0)	94 (5.2)
Spain	517 (1.7)	78 (0.9)	526 (2.1)	77 (1.3)	508 (2.3)	77 (1.3)
Sweden	535 (3.0)	90 (1.2)	543 (3.4)	91 (1.5)	528 (3.4)	89 (1.7)
Switzerland	522 (2.5)	91 (1.4)	529 (3.2)	94 (1.9)	514 (3.0)	87 (1.7)
Thailand	525 (3.7)	72 (1.2)	524 (3.9)	72 (1.4)	526 (4.3)	72 (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.

A dash (–) indicates data are not available.

( ) Standard errors appear in parentheses.

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