

# TIMSS 2011 international results in science

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TRENDS IN INTERNATIONAL MATHEMATICS AND SCIENCE STUDY

# TIMSS



## TIMSS 2011 International Results in Science

Michael O. Martin, Ina V.S. Mullis, Pierre Foy, and Gabrielle M. Stanco



International Association  
for the Evaluation of  
Educational Achievement



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Michael O. Martin, Ina V.S. Mullis, Pierre Foy,  
and Gabrielle M. Stanco



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International Study Center  
Lynch School of Education, Boston College

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Michael O. Martin, Ina V.S. Mullis, Pierre Foy, and Gabrielle M. Stanco

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### **Organizations and Individuals Responsible for TIMSS 2011**



# Foreword

In both technologically advanced and developing economies, understanding educational outcomes is central to effective educational planning and reform. Further, in today's global innovation economy, competence in mathematics and science remains an educational imperative.

For more than 50 years, the International Association for the Evaluation of Educational Achievement (IEA) has been conducting comparative studies of educational achievement in a number of curriculum areas, including mathematics and science. TIMSS 2011 represents the fifth cycle of the Trends in International Mathematics and Science Study (TIMSS), developed by IEA. During the past two decades, TIMSS has reported on mathematics and science achievement trends at the fourth and eighth grades, providing educational policymakers, administrators, teachers, and researchers with powerful insights into how educational systems are functioning as well as critical intelligence about the possibilities for educational reform and improvement.

The *TIMSS 2011 International Results in Science* presents extensive information on student performance in science, including trends over the five assessments since 1995. Also included are data on performance in the science content domains (earth science, biology, chemistry, etc.) and on competence in managing the problem solving challenges

in these science contexts. In addition, the TIMSS 2011 report contains vital information on key curricular, instructional, and resource-related factors that can impact the teaching and learning process. These data on student achievement trends and the contexts for teaching and learning science will ensure that TIMSS continues to set the standard for studies of this type and be regarded as a fundamental source of information for educational policymakers, planners, and researchers alike.

TIMSS requires and represents a significant commitment of resources and dedication to achieve a common vision. Clearly, projects of this magnitude rely on the cooperation and support of a large number of individuals, institutions, and organizations around the world. IEA is particularly indebted to the staff members of the TIMSS & PIRLS International Study Center at Boston College, who have been charged with the overall leadership of this project. Their contributions have been augmented by the staff of the IEA Data Processing and Research Center, the IEA Secretariat, Statistics Canada, and Educational Testing Service, for whose support I am also extremely grateful. While the work of the staff of this consortium makes projects like TIMSS possible, the continued leadership and direction of the TIMSS Executive Directors Ina Mullis and Michael Martin remain central to the success of this project.

In addition, projects of this size are possible only with considerable financial support. I am particularly grateful for support from IEA's major funding partners, including the US National Center for Education Statistics, the World Bank, and the many self-funding countries without which this project would not have been possible. I also wish to thank Boston College for its continued support of the TIMSS & PIRLS International Study Center.

Finally, as always, TIMSS would not have been possible without the National Research Coordinators and their colleagues, whose responsibility it was to manage the study at the local level, and the participation of the many teachers, students, and policymakers around the world who gave freely of their time in the interest of advancing our common understanding of reading achievement. On behalf of all who benefit from the use of the information provided by TIMSS, we are thankful for this commitment.

Hans Wagemaker  
Executive Director, IEA





# Executive Summary

TIMSS is an international assessment of mathematics and science at the fourth and eighth grades that has been conducted every four years since 1995. In 2011, nationally representative samples of students in 63 countries and 14 benchmarking entities (regional jurisdictions of countries, such as states) participated in TIMSS. Countries and benchmarking participants could elect to participate in the fourth grade assessment, the eighth grade assessment, or both: fifty-two countries and seven benchmarking entities participated in the fourth grade assessment, and 45 countries and 14 benchmarking entities participated in the eighth grade assessment. Several of the countries, where fourth and eighth grade students were expected to find the TIMSS assessments too difficult, administered the fourth and eighth grade assessments to their sixth and ninth grade students.

In total, more than 600,000 students participated in TIMSS 2011. TIMSS 2011 continues the series of international assessments in mathematics and science conducted by the International Association for the Evaluation of Educational Achievement (IEA).

IEA pioneered international comparative assessments of educational achievement in the 1960s to gain a deeper understanding of the effects of policies and practices across countries' different systems of education. TIMSS is directed by IEA's TIMSS & PIRLS International Study Center at Boston College.

The TIMSS science assessment is based on a comprehensive framework developed collaboratively with the participating countries that is organized around two dimensions:

- ◆ A content dimension specifying the domains or subject matter to be assessed within science; and
- ◆ A cognitive dimension specifying the domains or thinking processes expected of students as they engage with the science content.

The content domains and topic areas within them are different for the fourth and eighth grades, but the cognitive domains are the same for both grades, encompassing a range of cognitive processes involved in solving problems throughout the primary and middle school years.

Fourth Grade Content Domains	Eighth Grade Content Domains
45% Life Science	35% Biology
35% Physical Science	20% Chemistry
20% Earth Science	25% Physics
	20% Earth Science
Fourth Grade Cognitive Domains	Eighth Grade Cognitive Domains
40% Knowing	35% Knowing
40% Applying	35% Applying
20% Reasoning	30% Reasoning

Given the frameworks' broad coverage goals, the science assessment item pools were necessarily large—172 and 217 assessment items at the fourth and eighth grades, respectively—with about half being multiple choice and half being constructed response items where students write their answers. The achievement results are reported on

the TIMSS achievement scales for the fourth and eighth grades, each with a range of 0–1,000 (although student performance typically ranges between 300 and 700). TIMSS uses the centerpoint of the scale (500) as a point of reference that remains constant from assessment to assessment.

## East Asian Countries Among the Top-performers in TIMSS 2011

Korea and Singapore were the top-performing countries in science in TIMSS 2011 at the fourth grade, followed by Finland, Japan, the Russian Federation, and Chinese Taipei. At the eighth grade, Singapore had the highest average achievement. The next highest-performing countries—Korea, Chinese

Taipei, and Japan—had higher achievement than all other countries except Singapore. Finland was the next highest-performing country.

**Top-performing Countries in TIMSS 2011**

Fourth Grade	Eighth Grade
Korea	Singapore
Singapore	Chinese Taipei
Finland	Korea
Japan	Japan
Russian Federation	Finland
Chinese Taipei	

In addition to the six top-performers at the fourth grade, the United States was the next highest performing country, followed by the Czech Republic, Hong Kong SAR, Hungary, Sweden, the Slovak Republic, Austria, and the Netherlands, which had similar levels of achievement. The US states of Florida and North Carolina and the Canadian province

of Alberta had performance similar to these countries. At the eighth grade, Slovenia, the Russian Federation, Hong Kong SAR, and England also were included in the top nine high-achieving countries. The US state of Massachusetts was outperformed only by Singapore, and the states of Minnesota, Colorado, Indiana, Connecticut, North Carolina, and Florida as well as the Canadian province of Alberta also had high achievement, comparable to the top nine countries.

While there were small differences from country to country, there was a substantial range in performance from the top-performing to the lower-performing countries. Twenty-seven countries at the fourth grade had average achievement above the TIMSS scale centerpoint of 500, as did five benchmarking participants. At the eighth grade, 16 countries and ten benchmarking participants had average achievement above 500.

**More Increases Than Decreases, Particularly at the Fourth Grade**

At the fourth grade, 17 countries and three benchmarking participants have comparable data from 1995 and 2011, providing trends over the past 16 years. Since 1995, eight of these countries raised their levels of science achievement and only one had a decrease. Among the benchmarking participants, the Canadian province of Ontario increased achievement and the province of Québec decreased achievement between 1995 and 2011.

**Trends Between 1995 and 2011, Fourth Grade**

Countries Improving	Countries Declining
Hong Kong SAR	Norway
Hungary	
Iran	
Japan	
Korea	
Portugal	
Singapore	
Slovenia	

At the eighth grade, there was more balance between science achievement growth and decline among countries, although more countries had increases than at the fourth grade. Of the 25 countries and eight benchmarking participants with comparable data spanning from 1995 or 1999 to 2011, eleven countries had increased achievement and six countries had decreased achievement. In addition, three benchmarking participants had increased achievement—the Canadian province of Ontario and the US

**Trends Between 1995 or 1999\* and 2011, Eighth Grade**

Countries Improving	Countries Declining
Chile	Hungary
Hong Kong SAR	Macedonia
Iran	Malaysia
Japan	Norway
Korea	Sweden
Lithuania	Thailand
Russian Federation	
Singapore	
Slovenia	
Tunisia	
United States	

\*The 1999 assessment only was given at the eighth grade, and a number of countries joined at that time.

states of Massachusetts and North Carolina—while the Canadian province of Québec had decreased achievement.

**Overview of TIMSS 2011 International Benchmarks, Fourth Grade**

Advanced
• Apply understanding of scientific processes and show knowledge of scientific inquiry.
High
• Apply knowledge and understanding to explain phenomena in everyday and abstract contexts.
Intermediate
• Have basic knowledge and understanding of practical situations in the sciences.
Low
• Show some elementary knowledge of life, physical, and earth sciences.

**Overview of TIMSS 2011 International Benchmarks, Eighth Grade**

Advanced
• Communicate an understanding of complex and abstract concepts in biology, chemistry, physics, and earth science.
High
• Demonstrate understanding of concepts related to science cycles, systems, and principles.
Intermediate
• Apply understanding of basic scientific knowledge in various contexts.
Low
• Recognize some basic facts from the life and physical sciences.

*This report contains a number of items illustrating performance at the TIMSS International Benchmarks at the fourth and eighth grades.*

**Trends at TIMSS International Benchmarks**

TIMSS reports achievement at four points along the scale as international benchmarks: Advanced International Benchmark (625), High International Benchmark (550), Intermediate International Benchmark (475), and Low International Benchmark (400). At the fourth grade, reflecting the upward trends in average achievement, there were more improvements across the International Benchmarks in 2011 than there were declines. Six countries showed improvement at all four benchmarks between 1995 and 2011, raising the level of performance across the entire distribution of student achievement.

Reflecting less improvement across countries at the eighth grade, three countries declined since 1995 at all four benchmarks (Hungary, Sweden, and Norway), and only three countries improved at all four benchmarks.

### High Percentages of East Asian Students Reach TIMSS International Benchmarks

At the fourth grade, Singapore and Korea, the two countries with the highest average science achievement, also were the countries with the largest percentages of students reaching the Advanced International Benchmark. One-third of the Singaporean students reached this advanced level of performance, as did 29 percent of students in Korea. Twenty percent of the students in Finland reached this level, followed by the Russian Federation (16%), Chinese Taipei (15%), the United States (15%), and Japan (14%). Although relatively few students reached the Advanced International Benchmark in most countries (median percentage across countries: 5%), the high median percentage reaching the Low International Benchmark (92%) indicates that many countries have been successful in educating almost all of their fourth grade students to a basic level of science achievement.

At the eighth grade, four East Asian countries had the largest percentages of students reaching the Advanced International Benchmark: Singapore had the highest percentage (40%), followed by Chinese Taipei (24%), Korea (20%), and Japan (18%). Next, the Russian Federation and England had 14 percent of their students reaching the Advanced Benchmark; Slovenia and Finland had 13 percent reaching this level. Several of the US states had similarly high percentages of students reaching the Advanced Benchmark, including Massachusetts (24%), Minnesota (16%), Colorado (14%), Connecticut (14%), and Florida (13%). In comparison to the fourth grade, the percentage of eighth grade students reaching each of the International Benchmarks was lower. For example, the median percentage of students reaching the Low International Benchmark was 79 percent (compared to 92% at the fourth grade), indicating that more eighth grade students were being “left behind” their classmates.

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#### Countries with Increases at All Four TIMSS International Benchmarks between 1995 and 2011, Fourth Grade

Singapore	Portugal
Korea	Slovenia
Hong Kong SAR	Iran

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#### Countries with Increases at All Four TIMSS International Benchmarks between 1995 and 2011, Eighth Grade

Korea
Lithuania
Slovenia

## More Countries Demonstrate Relative Strength in Knowing Science Than in Applying Scientific Knowledge or Reasoning

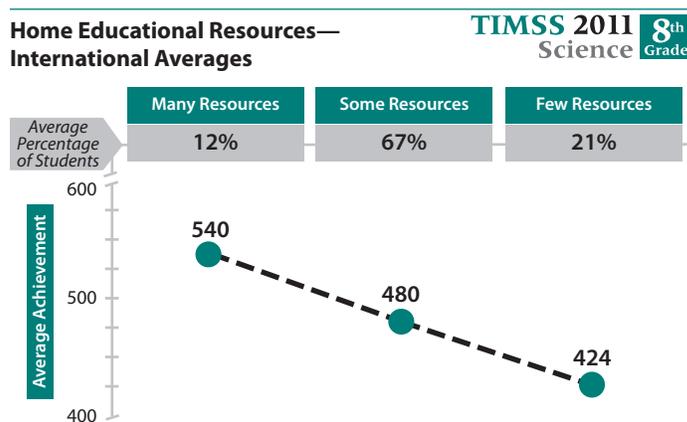
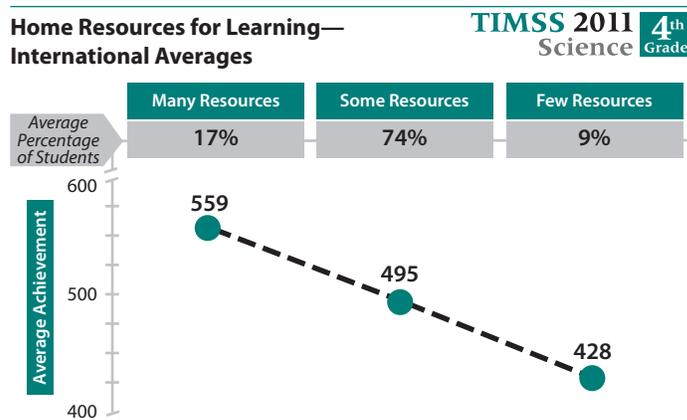
Generally, TIMSS 2011 participants with the highest achievement overall also had the highest achievement in the science content domains (e.g., biology and physics). Internationally, more countries demonstrated relative strengths in knowing science (i.e., recalling/recognizing, defining, and describing) than in applying scientific knowledge and reasoning.

## Home Resources Strongly Related to Science Achievement

Research consistently shows a strong positive relationship between achievement and indicators of socioeconomic status, such as parents' or caregivers' level of education. At the fourth and sixth grades, TIMSS used the parents' reports on the availability of key home resources to create the Home Resources for Learning scale, including parents' education, parents' occupation, books in the home, and

study supports. Internationally, on average, almost three-quarters of the fourth grade students (74%) had **Some Resources**, and the 17 percent of students with **Many Resources** had substantially higher science achievement than the nine percent with **Few Resources**—a 131-point difference.

At the eighth and ninth grades, TIMSS asked the students themselves about their parents' education, books in the home, and study supports, with similar results. Internationally, the twelve percent of eighth grade students with **Many Resources** had the highest average achievement, the two-thirds with **Some Resources** had the next highest achievement, and the one-fifth with **Few Resources** had the lowest average achievement.



## Successful Schools Tend to Be Well-resourced

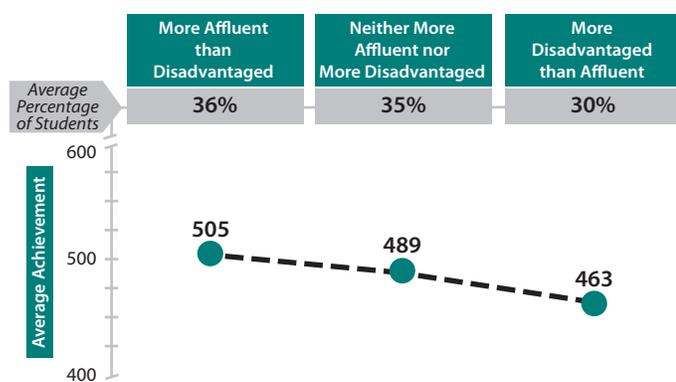
Ever since the Coleman report in 1966, researchers have recognized that the compositional characteristics of a school's student body can affect student achievement. To provide information on this topic, TIMSS routinely asks school principals to report on their students' economic home backgrounds and home language. While there was variation across countries, higher average science achievement was associated with students attending schools where a greater percentage of students had the following characteristics:

- ◆ Were from relatively affluent socioeconomic backgrounds; and
- ◆ Spoke the language of the TIMSS assessment as their first language.

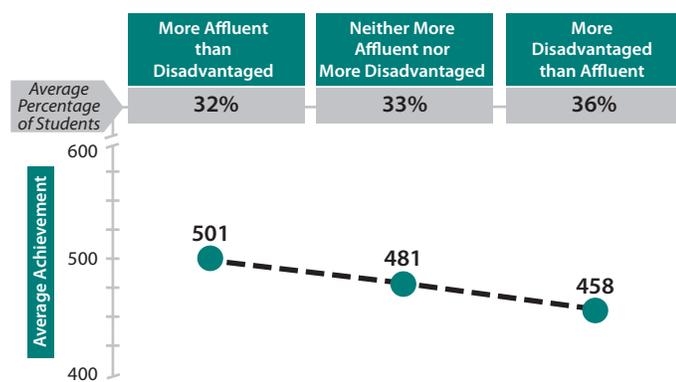
For example, students were distributed relatively equally across three types of schools categorized by the affluence of their home backgrounds. At the fourth grade, 36 percent attended schools with relatively more students from affluent than from economically disadvantaged homes, and these students had the highest average achievement. At the other end of the range, 30 percent of students attended schools with relatively more students from economically disadvantaged homes, and these students had the lowest average achievement.

Similarly, at the eighth grade, 32 percent attended schools with relatively more students from affluent than disadvantaged homes, and these students had the highest average achievement. Conversely, 36 percent of students attended schools with relatively more students from economically disadvantaged homes, and these students had the lowest average achievement.

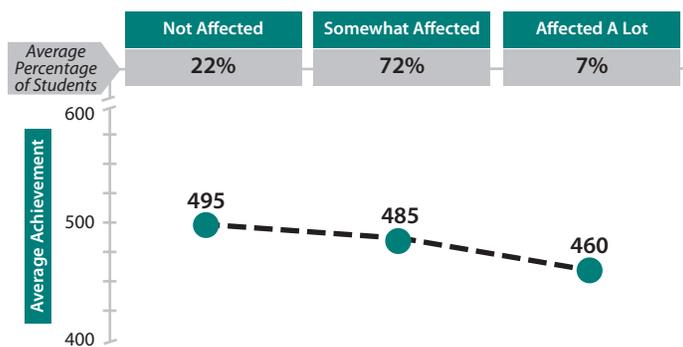
**School Composition by Student Home Economic Background—International Averages** **TIMSS 2011** **4<sup>th</sup> Grade** **Science**



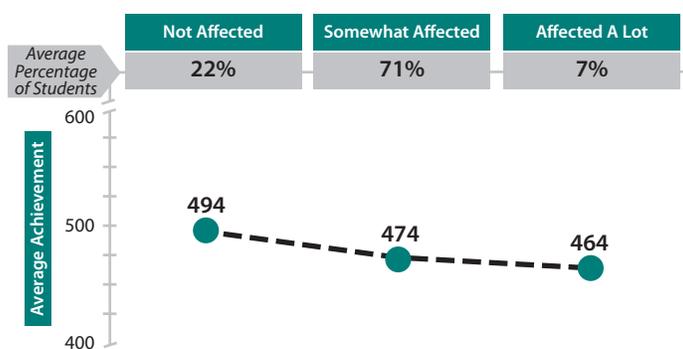
**School Composition by Student Home Economic Background—International Averages** **TIMSS 2011** **8<sup>th</sup> Grade** **Science**



**Instruction Affected by Science Resource Shortages—International Averages** **TIMSS 2011** **4<sup>th</sup> Grade** **Science**



**Instruction Affected by Science Resource Shortages—International Averages** **TIMSS 2011** **8<sup>th</sup> Grade** **Science**



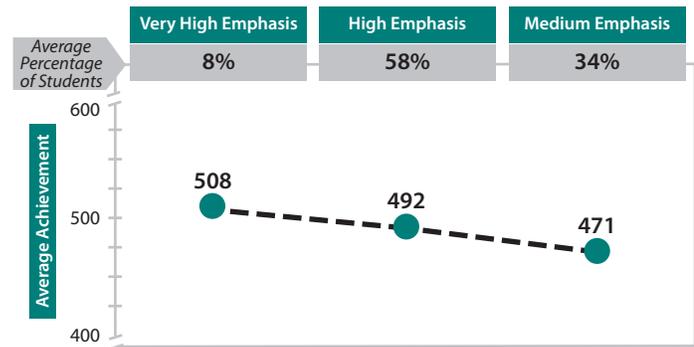
Successful schools also are likely to have better working conditions and facilities as well as more instructional materials, such as books, computers, technological support, and supplies. TIMSS 2011 created the Science Resource Shortages scale based on principals' responses concerning inadequacies in general school resources in general school resources (materials, supplies, heating/cooling/lighting, buildings, space, and staff) as well as resources specifically targeted to support science instruction (specialized teachers, computers, computer software, calculators, library materials, and audio-visual resources). Many countries were fortunate to have very few,

if any, students in schools where instruction was **Affected A Lot** by resource shortages. However, this was a crucial problem in some countries. At both the fourth and eighth grades, the one-quarter of students in schools **Not Affected** by resource shortages had higher average science achievement than their counterparts in less well-resourced schools. For students at the sixth and ninth grades, there was more impact from lack of resources, with greater percentages of students in schools **Affected A Lot** by resource shortages.

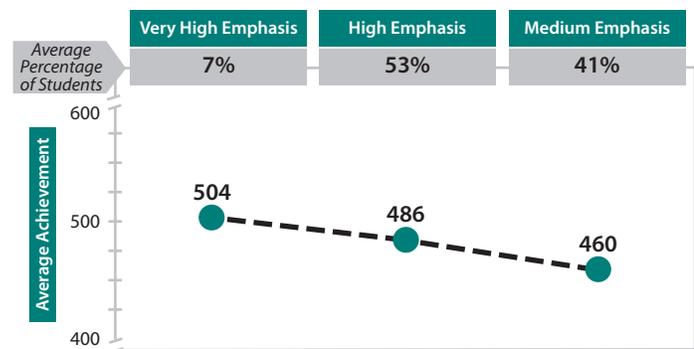
## Successful Schools Emphasize Academic Success and Have Safe and Orderly Environments

Students with the highest science achievement typically attend schools that emphasize academic success, as indicated by rigorous curricular goals, effective teachers, students that desire to do well, and parental support. Both principals and teachers answered the questions comprising the School Emphasis on Academic Success scale, and both were extremely positive and remarkably similar in their responses. At both the fourth and eighth grades, there was a direct correspondence between average science achievement and principals' reports, with higher emphasis on academic success related to higher average science achievement.

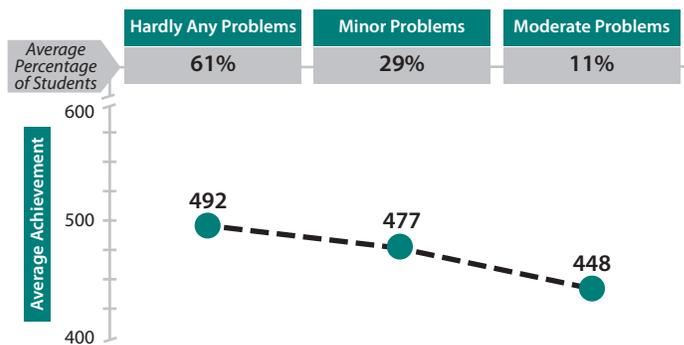
**Principals' School Emphasis on Academic Success—International Averages** **TIMSS 2011** **4<sup>th</sup> Grade** **Science**



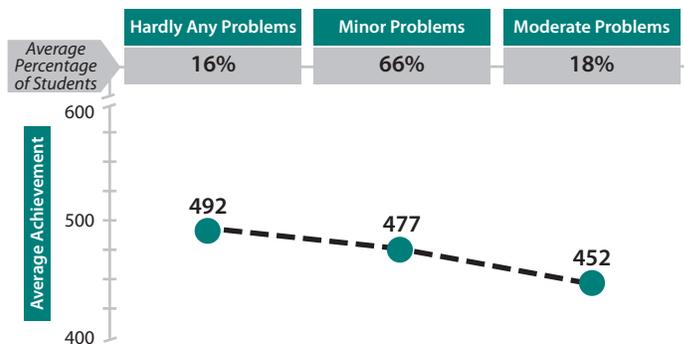
**Principals' School Emphasis on Academic Success—International Averages** **TIMSS 2011** **8<sup>th</sup> Grade** **Science**



**Principals' Problems with School Discipline and Safety—International Averages** **TIMSS 2011** **4<sup>th</sup> Grade** **Science**



**Principals' Problems with School Discipline and Safety—International Averages** **TIMSS 2011** **8<sup>th</sup> Grade** **Science**



In contrast, schools with discipline and safety problems are not conducive to high achievement. The sense of security that comes from attending a school with few behavior problems and having little or no concern about student or teacher safety promotes a stable learning environment. To create the School Discipline and Safety scale, principals provided their perceptions about the degree to which a series of ten discipline, disorderly, and bullying behaviors were problems in their schools.

At both the fourth and eighth grades, students who attended schools with disorderly environments and who reported more frequent bullying had much lower achievement than their counterparts in safe and orderly schools. Interestingly, across the fourth grade countries, 61 percent

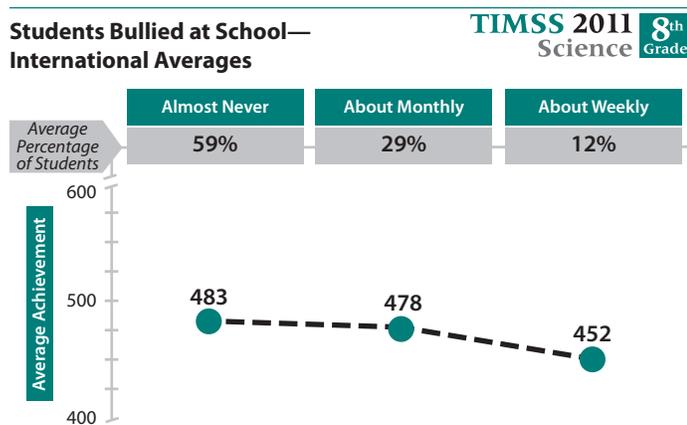
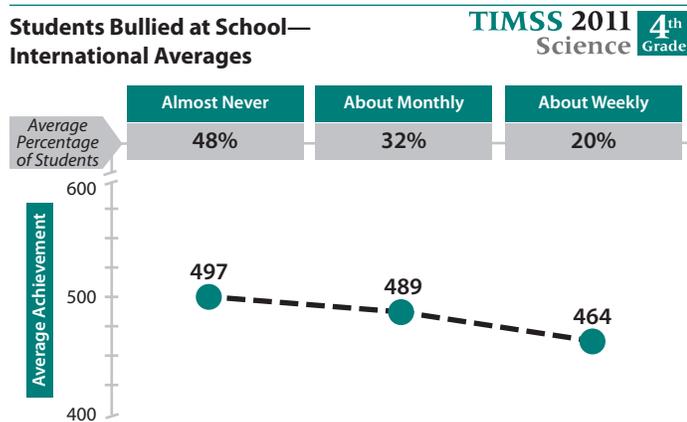
of students, on average, attended schools with **Hardly Any Problems** with discipline or safety, 29 percent were in schools with **Minor Problems**, and 11 percent attended schools with **Moderate Problems**.

Across the eighth grade countries, however, discipline appeared to be more of an issue; principals reported that only 16 percent of students were in schools with **Hardly Any Problems**, 66 percent were in schools with **Minor Problems**, and 18 percent attended schools with **Moderate Problems**.

There is growing evidence that bullying in schools is on the rise, especially with the emergence of cyber-bullying, and that bullying does have a negative impact on students' educational achievement. The Students Bullied at School scale was based on how often students experienced six bullying behaviors, such as "Someone spread lies about me" and "I was made to do things I didn't want to do by other students."

At both the fourth and eighth grades, an increase in the frequency of bullying was related to a decrease in average science achievement. Unsettlingly, across countries, although nearly half of the fourth grade students reported **Almost Never** being bullied (48%), the majority were bullied either **About Monthly** (32%) or **About Weekly** (20%).

In contrast to principals' reports of more school discipline and safety problems at the eighth grade than fourth grade, the eighth grade students reported experiencing somewhat less bullying behavior than the fourth grade students.



## Teacher Preparation and Career Satisfaction Related to Higher Science Achievement

In view of the importance of a well-prepared teaching force to an effective education, TIMSS 2011 collected a variety of information about teacher education. Internationally, most students were taught by the following:

- ◆ Teachers with bachelor's or postgraduate university degrees (80% at the fourth grade, and 90% at the eighth grade);
- ◆ Teachers with at least 10 years of experience (70% at the fourth grade, and 62% at the eighth grade);
- ◆ Teachers who reported being **Very Well** prepared to teach the TIMSS science topics (62% at the fourth grade, and 72% at the eighth grade); and
- ◆ Teachers **Very Confident** in teaching science (59% at the fourth grade, 73% at the eighth grade).

At both the fourth and eighth grades, students with more experienced and more confident teachers had higher science achievement.

The TIMSS 2011 Teacher Career Satisfaction scale categorized students based on their teachers' degree of agreement with six statements, such as "I do important work as a teacher" and "I plan to continue as a teacher for as long as I can." At both the fourth and eighth grades, teacher satisfaction was positively related to average science achievement, and very few students had teachers that expressed any dissatisfaction except in a small number of countries.

Internationally, the fourth grade students with **Satisfied** science teachers (54%) had higher achievement than those with teachers that were only **Somewhat Satisfied** (41%) or **Less Than Satisfied** (5%). The eighth grade science teachers reported somewhat lower levels of career satisfaction, with the 47 percent of students taught by **Satisfied** science teachers having higher science achievement than those taught by only **Somewhat Satisfied** (45%) or **Less Than Satisfied** (8%) teachers.

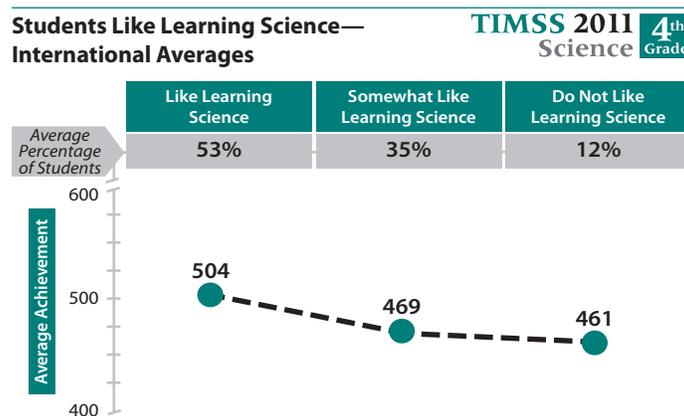
## Students with Positive Attitudes Toward Science Have Higher Achievement, but Attitudes Less Positive at the Eighth Grade

Each successive TIMSS assessment has shown a strong positive relationship within countries between student attitudes toward science and their science achievement. The relationship is bidirectional, with attitudes and achievement mutually influencing each other.

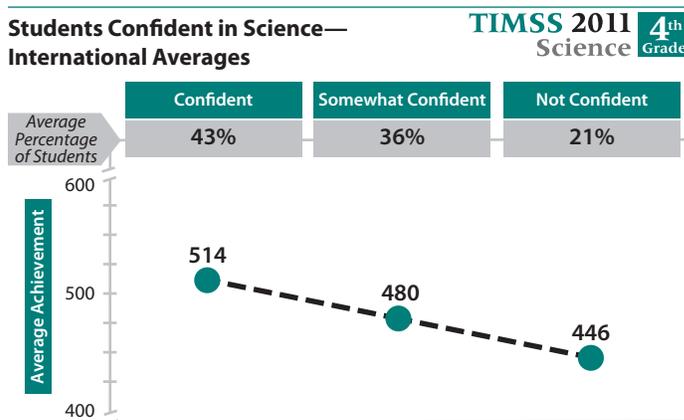
The Students Like Learning Science scale was based on students' degree of agreement with six statements, such as "I enjoy learning science" and "I learn many interesting things in science." Internationally, more than half of the fourth grade students **Like Learning Science**, and they had higher average achievement than those that **Somewhat Like Learning Science** (35%) or those that **Do Not Like Learning Science** (12%).

At the eighth grade, 16 of the TIMSS countries teach science subjects separately (i.e., biology, chemistry, physics, and earth science) rather than as a general or integrated subject. TIMSS asked students in these countries about their liking of the individual subjects and the results were scaled separately for each subject. Compared to the fourth grade, substantially fewer eighth grade students reported positive attitudes toward learning science. Among countries teaching general or integrated science, only about one-third (35%) of students **Like Learning Science**, compared to 53 percent at the fourth grade. Accompanying this decrease is a widening achievement gap between students who like learning the subject (515, on average) and those who do not (450).

Among separate science subject countries, the average percentage of students liking learning biology (36%) and earth science (33%) was similar to the percentage liking learning science in general or integrated science countries, but fewer students like learning chemistry (25%) or physics (26%). In all four science subjects, the students who liked learning the subject had higher average achievement than those who only somewhat liked or did not like learning it.



The Students Confident in Science scale includes six statements (nine at the eighth grade), such as "Science is harder for me than for many of my classmates"(reverse coded) and "My teachers tells me I am good at science." Internationally, just 43 percent of the fourth grade students expressed confidence in their science ability, but their science achievement was higher than for the students who felt **Somewhat Confident**. The students lacking confidence (21%) had the lowest achievement.



At the eighth grade, only 20 percent of the students in general or integrated science countries, on average internationally, felt **Confident** in their science ability, with most students either **Somewhat Confident** (49%) or **Not Confident** (31%). The achievement gap was 86 points between the **Confident** and **Not Confident** students.

The eighth grade students in separate science countries were similar to students in general or integrated countries in their confidence in biology and earth science (21% and 19% **Confident**, respectively) but less confident in chemistry and physics (14% **Confident** for each). In all four science subjects, there was a strong positive relationship between student confidence and average science achievement.

The Students Value Science scale asked the eighth grade students about six different aspects of valuing science, including “I think learning science will help me in my daily life” and “I need to do well in science to get the job I want.” Internationally, the eighth grade students in general or integrated science countries placed a high value on science, with 41 percent who **Value** science and another 33 percent who **Somewhat Value** the subject. However, about one-fourth (26%) **Do Not Value** science. Students who said they value science had higher average achievement than students who only valued it somewhat, and those students, in turn, had higher achievement than students who did not value science.

Students in separate science subject countries do not seem to value the individual science subjects in the same way as students in general science countries. Across the four science subjects, only about one-fourth (25–29%) of the students reported that they value the subjects and about two-fifths (36–42%) reported that they did not value them.

## More Time for Science Instruction in Countries Teaching Science as Separate Subjects

On average at the fourth grade, countries reported devoting 85 hours per year to science instruction, although the amount of instructional time varied widely. Instructional time for science was much greater at the eighth grade, 158 hours per year on average, mainly because of the greater attention given to science instruction in the separate science countries. These countries devote 54 to 59 hours per year, on average, to each science subject, for an overall average of 225 hours of science instruction per year.

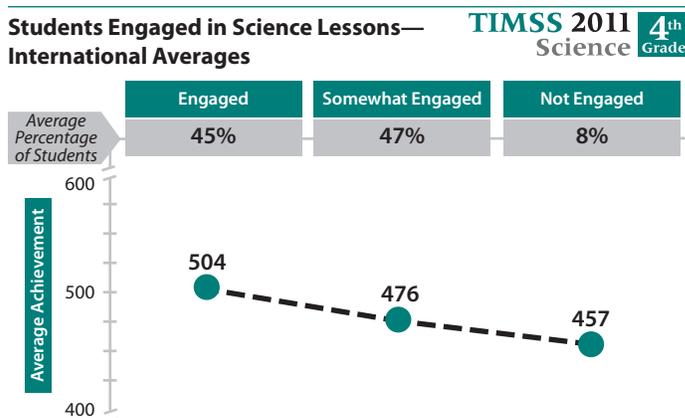
## Engaging Instruction Related to Higher Science Achievement

Historically, educational studies, including TIMSS, have struggled to link student achievement to instructional activities. Typically, teachers are asked to report how frequently they use various instructional activities and strategies, and such information can be very useful. However, in light of the growing body of evidence about the complexities of teaching and learning, researchers are beginning to understand that these lists of activities cannot be used as proxies for the characteristics of good teaching.

To help build a better bridge between curriculum and instruction, TIMSS 2011 collected information about the concept of student engagement in learning, which focuses on the cognitive interaction between the student and the instructional content. To measure aspects of student engagement, TIMSS 2011 developed both a teacher scale, called the Engaging Students in Learning scale, and a student scale, called the Engaged in Science Lessons scale.

For the Engaging Students in Learning scale, students were categorized according to how often their teachers reported using six instructional practices (four at the eighth grade) intended to interest students and reinforce learning (e.g., summarizing the lesson's learning goals, questioning to elicit reasons and explanations, and bringing interesting things to class). Many fourth grade students internationally (71%) had science teachers that made efforts to use these practices to engage them during **Most Lessons**, and the rest had teachers that used such practices in **About Half the Lessons** (with a few exceptions). Internationally, at the eighth grade, 80 percent of students had teachers that reported using the instructional practices to engage students during **Most Lessons**.

From the students' perspective, the Engaged in Science Lessons scale asked how much students agreed with five statements, such as "I know what my teacher expects me to do" and "I am interested in what my teacher says." Internationally, the fourth grade students **Engaged** in their science lessons (45%) had the highest achievement, followed by those **Somewhat Engaged** (47%) and the few students **Not Engaged** (8%). At the eighth grade, internationally, smaller percentages of students reported being **Engaged**. In countries teaching



general or integrated science, only 29 percent of students, on average, reported being **Engaged** during their science lessons, although these students had the highest average achievement. Among the separate science subject countries, students reported somewhat more engagement in biology and earth science lessons (33% and 31% **Engaged**, respectively) than in chemistry and physics lessons

(26% and 27% **Engaged**, respectively). In each of the science subjects, students reporting being engaged in their lessons had higher science achievement than those who were only somewhat or not engaged.

### Science Teachers Emphasizing Science Investigations

As noted in the TIMSS 2011 Science Assessment Framework, one of the ways in which students have been encouraged to build upon their knowledge and understanding of science is through the process of scientific inquiry, and the contemporary science curricula of many countries place considerable emphasis on engaging students in this process. The Emphasize Science Investigation scale was based on teacher reports of how often, in teaching science, they ask students to engage in six activities (seven at the eighth grade), such as "Observe natural phenomena such as the weather or a plant growing and describe what they see" and "Design or plan experiments or investigations."

On average across the fourth grade countries, 40 percent of students were taught by teachers emphasizing science investigation in **About Half the Lessons or More**, although teachers of science at the fourth grade vary widely across countries in their use of inquiry activities, with the percentage of students taught by teachers emphasizing science investigation ranging from 4 to 86 percent.

There was greater use of investigation in science instruction at the eighth grade, with almost half of the students (48%) taught by teachers emphasizing investigation in **About Half the Lessons or More**. Also, science achievement was slightly higher among students whose teachers more frequently emphasize inquiry activities (479 vs. 474).

### Instruction Affected By Students Lacking in Basic Nutrition and Sleep

Finally, the characteristics of the students themselves can be very important to the classroom atmosphere. Unfortunately, some children in many countries around the world suffer from hunger, and a growing body of research, mostly in developing countries, is providing evidence that malnutrition has a negative impact on educational achievement. Similarly, a number of studies in a variety of countries have shown sleep duration and quality to be related to academic functioning at school.

On average, internationally, most fourth grade (71%) and eighth grade students (64%) were in classrooms where instruction was “not at all” limited because students were lacking in basic nutrition. These students had higher average science achievement than their peers in classrooms where instruction was limited “some or a lot” because students suffered from lack of basic nutrition. The percentage lacking in basic nutrition was much higher in some countries, including some of those that participated at the sixth and ninth grades.

Internationally, students suffering from some amount of sleep deprivation did have lower average science achievement. Teachers reported that only a scant majority of fourth grade students (54%) and not even half of the eighth grade students (42%), across countries, were in classrooms where instruction was “not at all” limited by students suffering from not enough sleep. Further, while there was considerable variation across countries, in a number of TIMSS 2011 countries and benchmarking participants at least two-thirds of students reportedly were at least somewhat sleep deprived.



# Introduction

Science has direct application to nearly all aspects of life and society, from maintaining and improving human health to understanding and solving local, regional, and global environmental issues. Students need early development in science knowledge and thinking skills not only to be thoughtful citizens engaged in public discussions on important social issues involving science, but also to be prepared to make contributions through a wide range of careers in science, medicine, and technology. Thus, the study of science in the primary and early secondary grades provides a critical foundation for students' future careers and life success.

TIMSS (Trends in International Mathematics and Science Study) has the goal of helping countries make informed decisions about how to improve teaching and learning in mathematics and science. This TIMSS 2011 report summarizes the results of the TIMSS 2011 international science assessment of fourth and eighth grade students in countries around the world. As the fifth assessment in a regular program of student assessment conducted every four years since 1995, TIMSS 2011 provides participating countries with a wealth of information about trends in the science knowledge and skills of their students. At the heart of TIMSS is a wide-ranging state-of-the-art assessment of how well students master the essential science content, concepts, and procedures that countries expect them to learn as they progress through primary and lower secondary school.

Student achievement on the TIMSS 2011 science assessment is summarized in a variety of ways, beginning with trends over time in science achievement overall as well as its major component parts (e.g., biology, chemistry). The results also monitor progress toward the TIMSS International Benchmarks of science achievement—advanced, high, intermediate, and low. Recognizing that student science achievement is the result of a complex interplay of societal, school, and home environmental factors, this TIMSS science report embeds the achievement results in the context of the major influences on student learning, including the scope and coverage of the science curriculum, home support for student learning, school resources and learning climate, teacher preparation for science instruction, and student engagement in classroom learning.

## Countries Participating in TIMSS 2011

IEA is an independent international cooperative of national research institutions and government agencies with nearly 70 member countries worldwide. IEA has a permanent secretariat based in Amsterdam, and a thriving data processing and research center in Hamburg (the IEA DPC). The decision to participate in an IEA study is coordinated through the IEA Secretariat in Amsterdam and made solely by each member country according to its own data needs and resources.

Exhibit 1 shows the 63 countries participating in TIMSS 2011, including some distinct education systems within countries that have always participated separately throughout IEA's long history (e.g., the Flemish-speaking part of Belgium and Hong Kong SAR). In addition, TIMSS 2011 included 14 benchmarking participants, including three Canadian provinces, nine US states, and two emirates from the United Arab Emirates. Countries and benchmarking participants could elect to participate in the fourth grade assessment, the eighth grade assessment, or both. Fifty-two countries and seven benchmarking participants administered the fourth grade assessment, and 45 countries and 14 benchmarking participants administered the eighth grade assessment.

Also, countries where students were expected to find the TIMSS assessments too difficult for their fourth or eighth grade students were given the option to assess students at a higher grade. Accordingly, three countries administered the fourth grade assessment to their sixth grade students and the eighth grade assessment to their ninth grade students.

Nationally representative samples of approximately 4,000 students from 150–200 schools participated in TIMSS 2011 at each grade level. More than

Armenia  
Australia  
Austria  
Azerbaijan  
Bahrain  
Belgium (Flemish)  
Botswana  
Chile  
Chinese Taipei  
Croatia  
Czech Republic  
Denmark  
England  
Finland  
Georgia  
Germany  
Ghana  
Honduras  
Hong Kong SAR  
Hungary  
Indonesia  
Iran, Islamic Rep. of  
Ireland  
Israel  
Italy  
Japan  
Jordan

Kazakhstan  
Korea, Rep. of  
Kuwait  
Lebanon  
Lithuania  
Macedonia  
Malaysia  
Malta  
Morocco  
The Netherlands  
New Zealand  
Northern Ireland  
Norway  
Oman  
Palestinian Nat'l Auth.  
Poland  
Portugal  
Qatar  
Romania  
Russian Federation  
Saudi Arabia  
Serbia  
Singapore  
Slovak Republic  
Slovenia  
South Africa  
Spain

Sweden  
Syrian Arab Republic  
Thailand  
Tunisia  
Turkey  
Ukraine  
United Arab Emirates  
United States  
Yemen

**Benchmarking Participants**

Alberta, Canada  
Ontario, Canada  
Quebec, Canada  
Abu Dhabi, UAE  
Dubai, UAE  
Alabama, USA  
California, USA  
Colorado, USA  
Connecticut, USA  
Florida, USA  
Indiana, USA  
Massachusetts, USA  
Minnesota, USA  
North Carolina, USA

300,000 students participated in the TIMSS 2011 fourth grade assessment and a further 300,000 in the eighth grade assessment.

## The TIMSS Trend Assessments in Mathematics and Science

IEA pioneered international comparative assessments of educational achievement to gain a deeper understanding of the effects of policies and practices across countries' different systems of education. IEA began its pioneering work in the 1960's with an international study of mathematics achievement, and mathematics has remained a major focus throughout its 50-year history of educational research. First administered in 1995, IEA's TIMSS is an integrated assessment of mathematics and science that has been conducted every four years since then. TIMSS is directed by IEA's TIMSS & PIRLS International Study Center at Boston College.

With assessments in 1995, 1999, 2003, 2007, and 2011, TIMSS has measured international student achievement in mathematics and science over a 16-year period, providing an unrivalled data resource for trends in mathematics and science achievement. All of the countries, institutions, and agencies involved in successive TIMSS assessments have worked collaboratively in building the most comprehensive and innovative measures of mathematics and science achievement possible, beginning in 1995 and improving with each successive assessment. Appendix A shows the participation in earlier TIMSS assessments by each TIMSS 2011 participant.

With its strong curricular focus and emphasis on policy-relevant information about the home, school, and classroom contexts, TIMSS is a valuable tool that countries can use to evaluate achievement goals and standards and monitor student achievement trends in an international context.

## New Policy-relevant Context Questionnaire Scales

TIMSS 2011 provides extensive information about home supports and school environments for teaching and learning. In particular, in 2011 the trend cycles of IEA's TIMSS and PIRLS international assessments came together producing a synergy that led to advancements in the quality of background data collected by both projects. Because PIRLS (Progress in International Reading Literacy Study) also assesses students at the fourth grade, the alignment of the two projects provided the opportunity for countries to assess the same fourth grade students in reading, mathematics, and science in conjunction with the extensive background data collected by IEA assessments—most notably, allowing TIMSS

to benefit from the *PIRLS Learning to Read Survey*, completed by students' parents or caregivers.

Having almost 40 countries participate in both assessments required a great deal of coordination, innovation, and creativity, most notably in the area of background data collection. The *TIMSS 2011 Student Questionnaires*, *Teacher Questionnaires*, *School Questionnaires*, and *Curriculum Questionnaires* were developed jointly by TIMSS and PIRLS participants, including several joint meetings of the TIMSS 2011 Questionnaire Item Review Committee and the PIRLS 2011 Questionnaire Development Group. This effort yielded nearly 20 new context questionnaire scales about learning and teaching developed in parallel across reading, mathematics, and science. Underpinning a new approach to interpreting the questionnaire data, each context questionnaire scale was created using IRT methods, and results presented for three regions of the scale (most to least desirable) using scale score equivalents of response combinations to determine the cutpoints for the regions.

## The TIMSS 2011 Science Assessment

The TIMSS 2011 science assessment is based on a comprehensive framework developed collaboratively with the participating countries. As described in the science chapter of the *TIMSS 2011 Assessment Frameworks* (Mullis, Martin, Ruddock, O'Sullivan, & Preuschoff, 2009), at each grade the science framework is organized around two dimensions: a content dimension specifying the domains or subject matter to be assessed within science, and a cognitive dimension specifying the domains or thinking processes to be assessed. The content domains and the topic areas within the domains are described separately for the fourth and eighth grades, with each topic area elaborated with specific objectives.

There are three content domains for the TIMSS 2011 fourth grade assessment:

- ◆ Life science;
- ◆ Physical science; and
- ◆ Earth science.

The eighth grade assessment has four content domains:

- ◆ Biology;
- ◆ Chemistry;

- ◆ Physics; and
- ◆ Earth science.

The following three cognitive domains describe the sets of thinking processes that students are likely to use as they engage with the science content:

- ◆ Knowing;
- ◆ Applying; and
- ◆ Reasoning.

These cognitive domains are the same for both grades, encompassing a range of cognitive processes involved in working scientifically and solving problems throughout the primary and middle school years.

Given the frameworks' broad coverage goals, the science assessment item pools were necessarily large—172 and 217 assessment items at the fourth and eighth grades, respectively—with approximately half multiple choice questions and half in a constructed response format in which students write their answers (see item counts by domain in Appendix B.1 and B.2). To keep response burden to a minimum, each student participating in the assessment responded to just a subset of the item pool, with IRT scaling used to estimate achievement on the assessment as a whole.

About 60 percent of the assessment items at each grade were retained from previous TIMSS assessments (2003 and 2007) to provide a foundation for measuring trends in science achievement across assessments; the remaining 40 percent were developed for TIMSS 2011.

Developing the assessment materials for TIMSS 2011 was a cooperative venture, involving the National Research Coordinators (NRCs) from the participating countries throughout the entire process. Having reviewed their national science curricula in the light of the TIMSS assessment approach, NRCs met to update the assessment framework for 2011 in terms of the balance of content and cognitive domain coverage and the assessment topics to be included. To develop the assessment items needed for the field test, the TIMSS & PIRLS International Study Center conducted an item-writing workshop for NRCs and their colleagues with particular backgrounds in science assessment and item development. Participating countries field tested the items and scoring guides with representative samples of students, and the results were scrutinized internally by the TIMSS 2011 panel of internationally recognized experts—the Science and Mathematics Item Review Committee.

## Quality Assurance

The TIMSS science assessments were given to carefully selected and well-documented probability samples of students at the fourth and eighth grades. The student sampling for TIMSS 2011 was conducted with careful attention to quality and comparability. Staff from Statistics Canada and the IEA DPC worked with National Research Coordinators on all phases of the sampling activities. The Statistics Canada sampling experts, in conjunction with the TIMSS 2011 sampling referee (Keith Rust, Westat, Inc.), evaluated the quality of the samples and found high levels of compliance with sampling and participation requirements, with the exception of a few cases that are annotated in the report. Appendix C provides detail about the national target population coverage and sampling participation rates.

TIMSS 2011 made every effort to attend to the quality and comparability of the data through careful planning and documentation, cooperation among participating countries, standardized procedures, and rigorous attention to quality control throughout. For example, an extensive series of verification checks was conducted to ensure the comparability of the translations of the assessment items and questionnaires, detailed documentation was required to satisfy adherence to the sampling standards, and an ambitious quality assurance program was conducted to monitor the data collection.

## TIMSS 2011 Reports

The results from TIMSS 2011 are presented in a series of major reports.

- ◆ This present report, *TIMSS 2011 International Results in Science*, summarizes fourth and eighth grade students' student achievement in each of the 63 participating countries and 14 regional benchmarking jurisdictions, and describes the educational contexts for science instruction. It includes trends in science achievement over time for participants in previous TIMSS assessments in 1995, 1999, 2003, and 2007 as well as student performance at the TIMSS International Benchmarks. Achievement results also are presented for science content and cognitive domains. The Science Report presents a rich array of information about students' backgrounds and attitudes toward science, the science curriculum, teachers' education and training, classroom characteristics and activities, and school contexts for science learning and instruction.

- ◆ As a complement to this volume, the *TIMSS 2011 International Results in Mathematics* (Mullis, Martin, Foy, & Arora, 2012) summarizes fourth and eighth grade students' mathematics achievement in each of the 63 participating countries and 14 regional benchmarking jurisdictions, and describes the educational contexts for mathematics instruction. It includes trends in mathematics achievement over time for participants in previous TIMSS assessments in 1995, 1999, 2003, and 2007 as well as student performance at the TIMSS International Benchmarks. Achievement results also are presented for mathematics content and cognitive domains. The Mathematics Report presents a rich array of information about students' backgrounds and attitudes toward mathematics, the mathematics curriculum, teachers' education and training, classroom characteristics and activities, and school contexts for mathematics learning and instruction.
- ◆ The *TIMSS 2011 Encyclopedia: Education Policy and Curriculum in Mathematics and Science, Volumes 1 and 2* (Mullis, Martin, Minnich, Stanco, Arora, Centurino, & Castle, 2012) describes national contexts for mathematics and science teaching and learning in the 63 countries and several of the regional benchmarking jurisdictions that participated in TIMSS 2011. A chapter prepared by each participant summarizes the structure of its education systems, the mathematics and science curricula and instruction in primary and secondary grades, the teacher education requirements, and the types of examinations and assessments employed. Together with selected supporting data about the countries curricula collected via online questionnaires, the chapters comprising the two volumes of the *TIMSS 2011 Encyclopedia* provide an important resource for helping to understand the teaching and learning of mathematics and science around the world, with particular emphasis on schooling through the eighth grade.
- ◆ The online publication, *Methods and Procedures in TIMSS and PIRLS 2011* (Martin & Mullis, 2012), describes the methods and procedures used to develop, implement, and analyze the results from TIMSS 2011 and is available from the TIMSS & PIRLS International Study Center's website: <http://timssandpirls.bc.edu>.

The fully documented TIMSS 2011 international database can be downloaded from the TIMSS & PIRLS International Study Center's website.

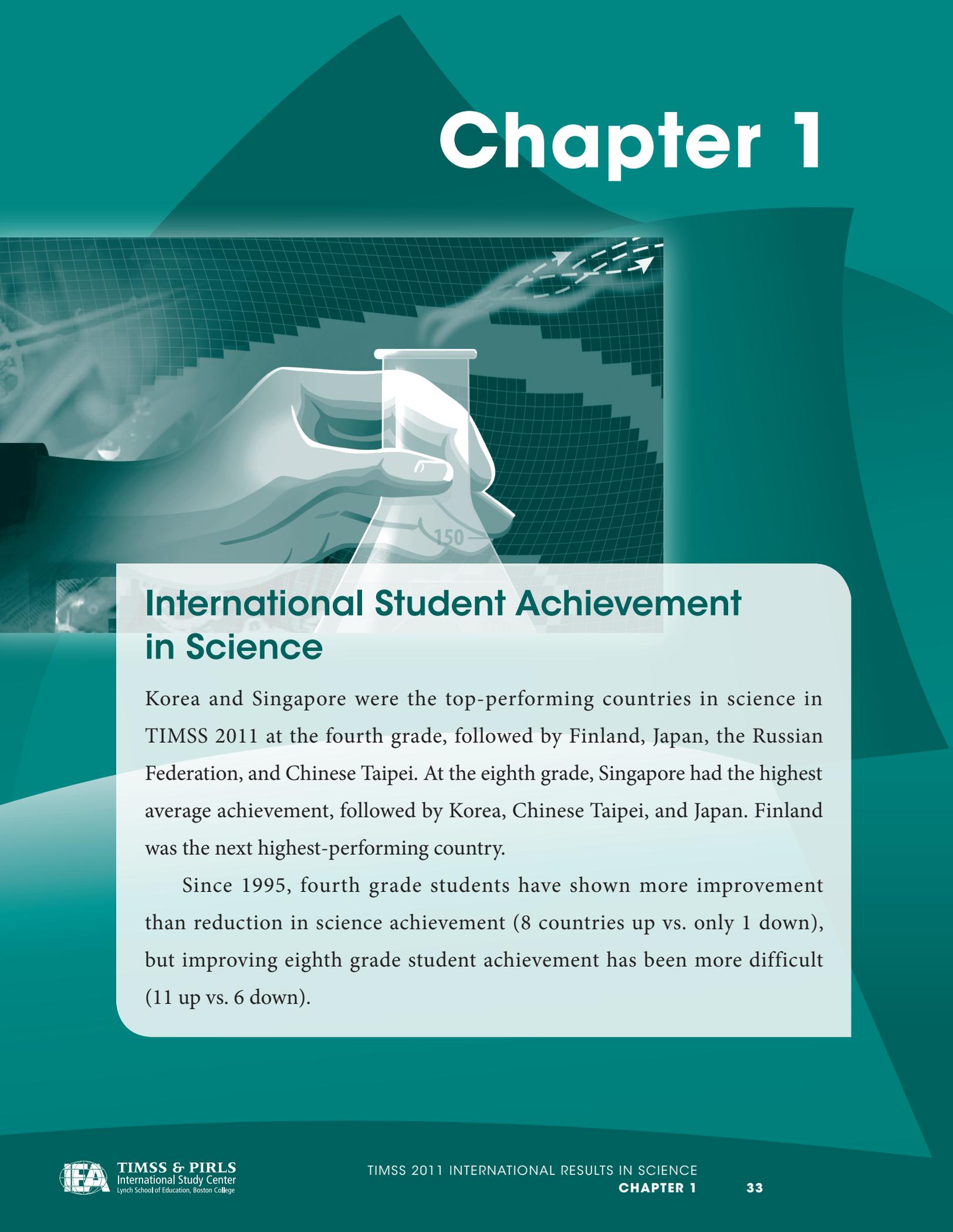
In addition, special analyses are being conducted using the TIMSS and PIRLS database of fourth grade students. This report, *TIMSS and PIRLS*

*2011: Relationships among Reading, Mathematics, and Science Achievement—Implications for Early Learning*, consists of in-depth analyses of fourth grade student achievement in reading, mathematics, and science in the countries that administered TIMSS and PIRLS to the same students in 2011. The report addresses four issues:

- ◆ Are primary schools providing a solid foundation in core subjects—reading, mathematics, and science?
- ◆ How does reading ability impact mathematics and science achievement?
- ◆ What are the characteristics of effective schools in reading, mathematics, and science? and
- ◆ How do homes support literacy and numeracy?



# Chapter 1



## International Student Achievement in Science

Korea and Singapore were the top-performing countries in science in TIMSS 2011 at the fourth grade, followed by Finland, Japan, the Russian Federation, and Chinese Taipei. At the eighth grade, Singapore had the highest average achievement, followed by Korea, Chinese Taipei, and Japan. Finland was the next highest-performing country.

Since 1995, fourth grade students have shown more improvement than reduction in science achievement (8 countries up vs. only 1 down), but improving eighth grade student achievement has been more difficult (11 up vs. 6 down).

Chapter 1 contains the science achievement results for the 52 countries and seven benchmarking participants in the fourth grade TIMSS 2011 assessment and the 45 countries and 14 benchmarking participants in the eighth grade TIMSS 2011 assessment. To summarize science achievement across the participants at fourth and eighth grades, the chapter provides:

- ◆ Averages (means) and distributions of science achievement;
- ◆ Trends in science achievement over time for participants in previous TIMSS assessments in 1995, 1999, 2003, and 2007;
- ◆ Trends across grades—Relative achievement of the 2007 fourth grade cohort as eighth grade students in 2011;
- ◆ Achievement differences by gender; and
- ◆ Trends in achievement differences by gender.

The results for percentages of students reaching the TIMSS International Benchmarks (Advanced, High, Intermediate, and Low) are presented in Chapter 2.

## Science Achievement Across Countries

### *TIMSS 2011 Science Achievement*

This section reports the TIMSS 2011 science results as average scores and distributions on the fourth and eighth grade TIMSS scales, each of which has a range of 0–1,000 (although student performance typically ranges between 300 and 700). The TIMSS science achievement scales were established in TIMSS 1995 based on the achievement distribution across all participating countries, treating each country equally. At each grade level, the scale centerpoint of 500 was set to correspond to the mean of the overall achievement distribution, and 100 points on the scale was set to correspond to the standard deviation. Achievement data from subsequent TIMSS assessment cycles were linked to these scales so that increases or decreases in average achievement may be monitored across assessments.<sup>1</sup> TIMSS uses the scale centerpoint as a point of reference that remains constant from assessment to assessment.

Exhibit 1.1 shows the distributions of student achievement for the participants in the TIMSS 2011 fourth grade assessment, including the average scale score with its 95 percent confidence interval and the ranges in performance for the middle half of the students (25<sup>th</sup> to 75<sup>th</sup> percentiles) as well as the extremes (5<sup>th</sup> and 95<sup>th</sup> percentiles). Similarly, Exhibit 1.2 shows the

<sup>1</sup> Please see *Methods and Procedures in TIMSS and PIRLS 2011* on the TIMSS and PIRLS website for further detail (<http://timssandpirls.bc.edu>).

distribution of science achievement for participants in the TIMSS 2011 eighth grade assessment.

The first page of Exhibit 1.1 presents the results for the 50 countries that assessed students at the TIMSS target population of the fourth grade. In particular, the TIMSS target population for the fourth grade assessment is the grade that represents four years of schooling, counting from the first year of ISCED Level 1.<sup>2</sup> Level 1 corresponds to primary education or the first stage of basic education, with the first year of Level 1 marking “systematic apprenticeship of reading, writing, and mathematics.” However, IEA has a policy that children should be at least 9 years old before being asked to participate in a paper-and-pencil assessment such as TIMSS. Thus, as a policy, TIMSS also tries to ensure that, at the time of testing, students do not fall under the minimum average age of 9.5 years old. So, England, Malta, and New Zealand, where students start school at a young age, were assessed in their fifth year of schooling, but still have among the youngest students and are reported together with the fourth grade countries. Exhibit C.1 in Appendix C shows the grades and average ages of the students tested across countries, together with information about the policies and practices related to age of entry to primary school across countries. The *TIMSS 2011 Encyclopedia* contains further details, such as countries’ policies about promotion and retention.

The second page of Exhibit 1.1 shows the results for three countries that assessed their sixth grade students. To meet the needs of the increasing number of developing countries wanting to participate in TIMSS 2011, the TIMSS & PIRLS International Study Center encouraged countries where the assessment was too difficult for fourth grade students to give the TIMSS fourth grade assessment at the sixth grade. The three countries that elected to assess sixth grade students were Botswana, Honduras, and Yemen (which also assessed its fourth grade students).

The second page of Exhibit 1.1 also presents the results for the TIMSS 2011 fourth grade benchmarking participants. The benchmarking participants followed the same procedures and met the same standards as the countries, the difference being that they are regional entities of countries. Benchmarking participants at the fourth grade included Florida and North Carolina (US states), Alberta, Ontario, and Québec (Canadian provinces), and Dubai and Abu Dhabi (emirates of the United Arab Emirates).

Following the same approach as Exhibit 1.1, the first page of Exhibit 1.2 presents the results for the 42 countries that assessed students at the TIMSS

2 ISCED stands for the International Standard Classification of Education developed by the UNESCO Institute for Statistics (OECD, 1999).

target population of the eighth grade, the grade that represents eight years of schooling. For the TIMSS eighth grade assessment, IEA has a policy that students should be at least 13 years old before being asked to participate. Thus, TIMSS tries to ensure that, at the time of testing, students do not fall under the minimum average age of 13.5 years old. So, England and New Zealand, where students start school at a young age, are reported together with the eighth grade countries. Exhibit C.1 in Appendix C shows the grades and average ages of students at the time of testing across countries, together with policies related to age of entry into school.

As with the fourth grade, the TIMSS & PIRLS International Study Center encouraged countries where the TIMSS eighth grade assessment was too difficult for eighth grade students to instead assess students at a higher grade. The second page of Exhibit 1.2 shows the results for three countries that assessed their ninth grade students—Botswana, Honduras, and South Africa.

The second page of Exhibit 1.2 also presents the results for the TIMSS 2011 eighth grade benchmarking participants. Benchmarking participants at the eighth grade included nine US states (Alabama, California, Colorado, Connecticut, Florida, Indiana, Massachusetts, Minnesota, and North Carolina), three Canadian provinces (Alberta, Ontario, and Québec), and two emirates (Dubai and Abu Dhabi).

For each section of Exhibit 1.1 and in Exhibit 1.2, participants are shown in decreasing order of average achievement. Also, there is a symbol by a participant's average scale score indicating if the average achievement is significantly higher (up arrow) or lower (down arrow) than the scale centerpoint of 500. TIMSS uses the centerpoint of the scale as a point of reference that remains constant from assessment to assessment. (In contrast, the international average, obtained by averaging across the mean scores for each of the participating countries, changes from assessment to assessment as the number and characteristics of the participating countries change.) Finally, several countries have annotations about 1) population coverage (detailed in Exhibit C.2); 2) sampling participation rates (explained in Exhibit C.8); and 3) the potential for bias in their achievement estimates (explained in the section after next).

### *Achievement in TIMSS 2011 at the Fourth Grade*

The results in Exhibit 1.1 (first page) show that many countries performed well in TIMSS 2011 at the fourth grade, with 27 countries having higher achievement

than the scale centerpoint of 500 and several countries having average achievement above the High International Benchmark of 550. Because there are often relatively small differences between participants in average achievement, Exhibit 1.3 shows whether or not the differences in average achievement among the countries are statistically significant.

Korea and Singapore were the top-performing countries in TIMSS 2011 at the fourth grade. Looking at the results in Exhibit 1.1 and taking into account the information in Exhibit 1.3, it can be seen that these two countries performed similarly and had higher achievement than all of the other countries. The next highest-performing country was Finland, which had higher achievement than all countries except the two with the highest achievement, followed by Japan, the Russian Federation, and Chinese Taipei. The United States was the next highest performing country, with achievement higher than all countries except the six top performers. Also included in the top 14 high-achieving countries were the Czech Republic, Hong Kong SAR, Hungary, Sweden, the Slovak Republic, Austria, and the Netherlands. The benchmarking states of Florida and North Carolina and the province of Alberta had performance similar to these countries.

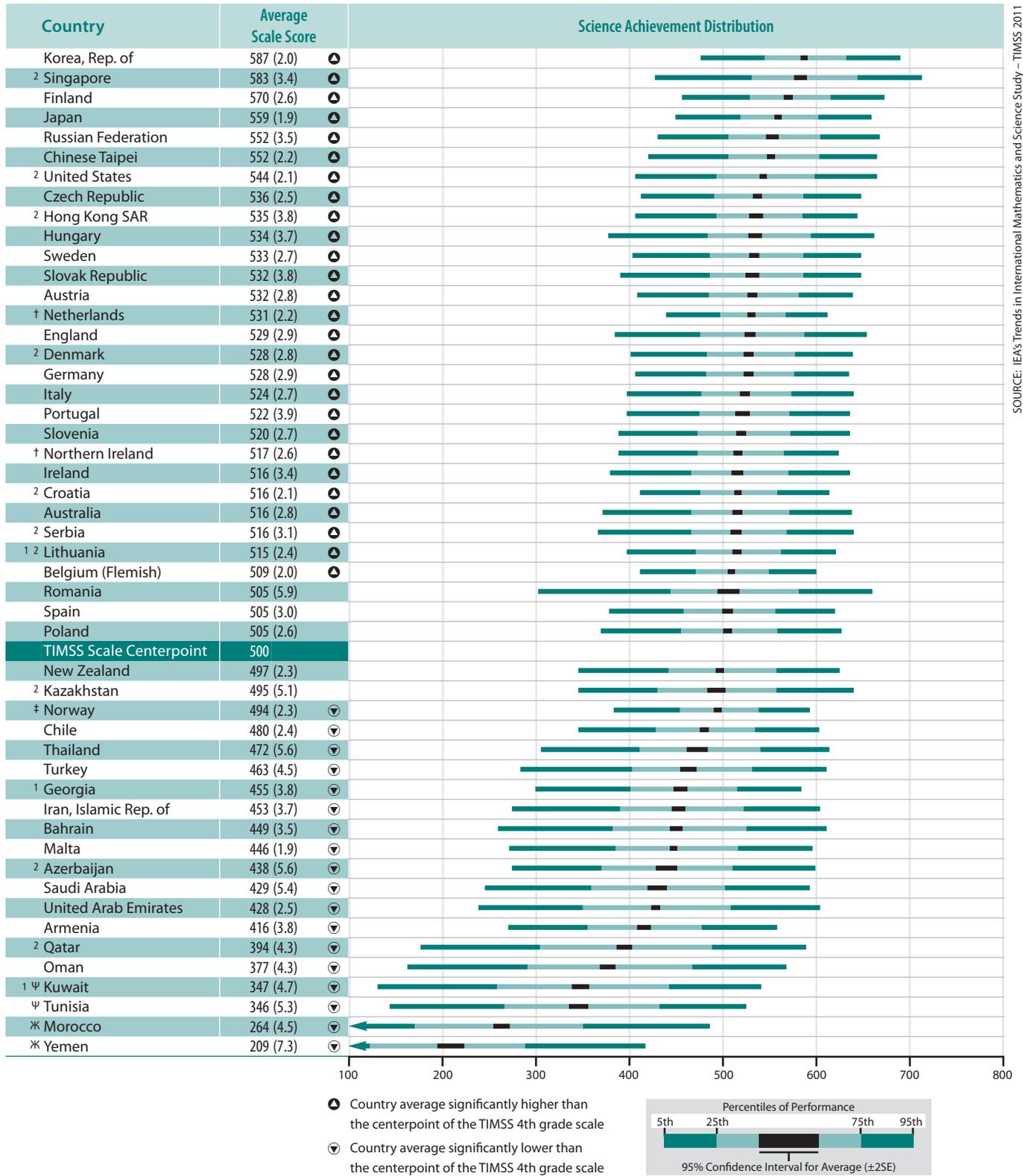
While there were small differences from country to country, there was a substantial range in performance from the top-performing to the lower-performing countries. Eighteen countries had average achievement below the TIMSS centerpoint of 500. For the most part, these countries had average achievement above the Low (400) International Benchmark.

### *Very Low Performance on TIMSS 2011*

It is a well-known principle of educational measurement that the difficulty of the items used to assess student achievement should match the ability of the students taking the assessment. In the context of assessing science achievement, measurement is most efficient when there is a reasonable match between the science ability level of the student population being assessed and the difficulty of the assessment items. The greater the mismatch, the more difficult it becomes to achieve reliable measurement. In particular, when the assessment tasks are much too challenging for most students, to the extent that many students are responding at chance level, it is extremely difficult to achieve acceptable measurement quality.

Monitoring trends over time is particularly problematic for a country with a high degree of mismatch between assessment difficulty and student

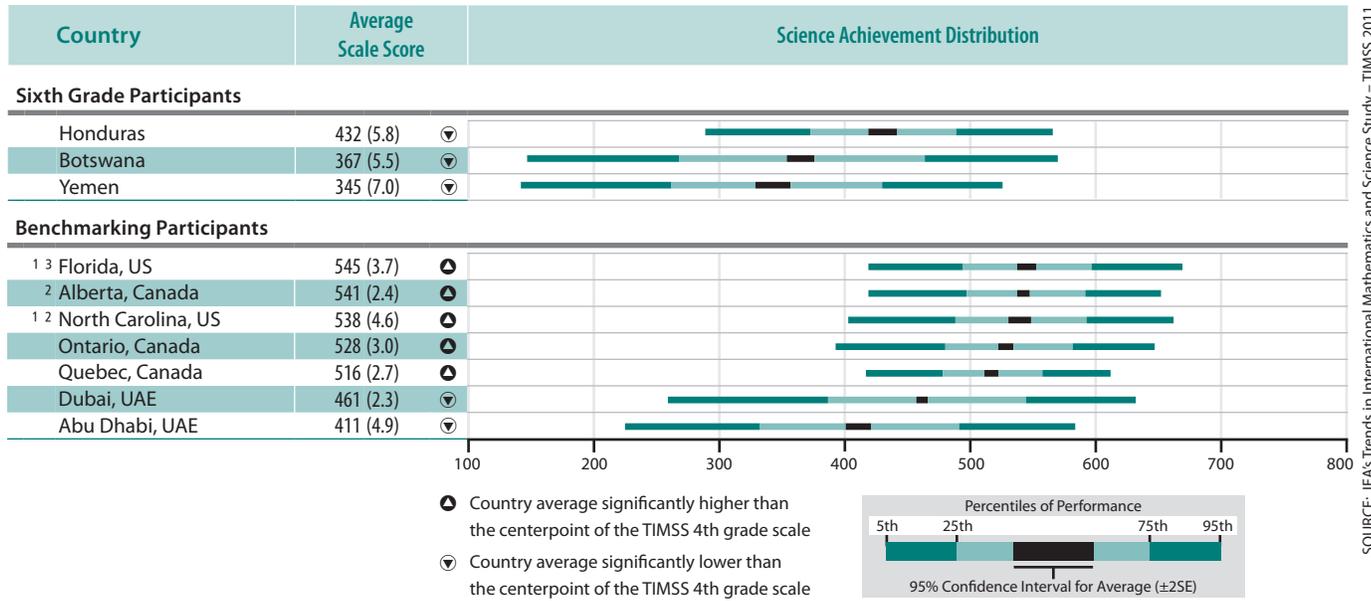
**Exhibit 1.1: Distribution of Science Achievement**



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

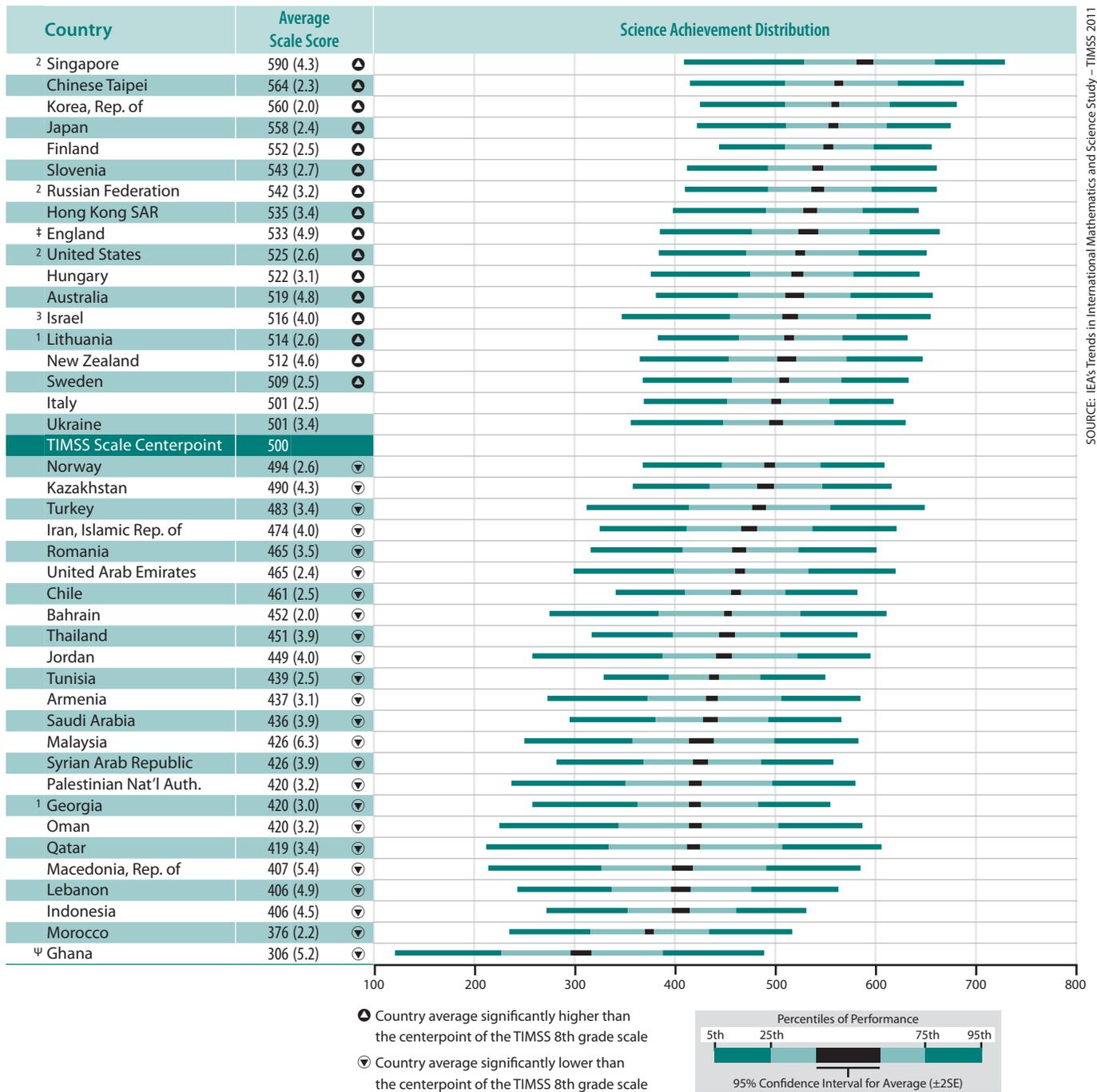
✱ Average achievement not reliably measured because the percentage of students with achievement too low for estimation exceeds 25%.  
 Ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.  
 See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.  
 ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

**Exhibit 1.1: Distribution of Science Achievement (Continued)**



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

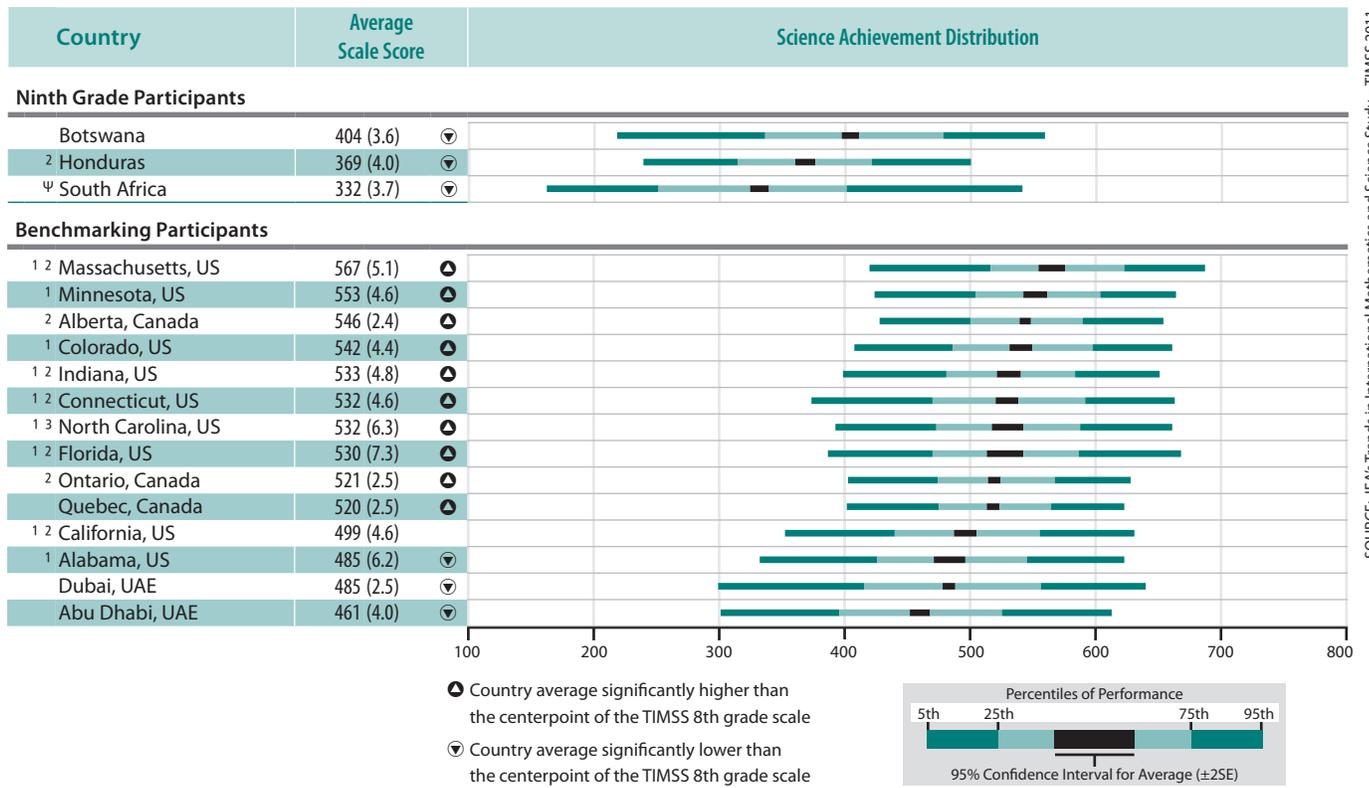
**Exhibit 1.2: Distribution of Science Achievement**



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%. See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.  
 ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

**Exhibit 1.2: Distribution of Science Achievement (Continued)**



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 1.3: Multiple Comparisons of Average Science Achievement**

Instructions: Read across the row for a country to compare performance with the countries listed along the top of the chart. The symbols indicate whether the average achievement of the country in the row is significantly lower than that of the comparison country, significantly higher than that of the comparison country, or if there is no statistically significant difference between the average achievement of the two countries.

Country	Average Scale Score	Korea, Rep. of	Singapore	Finland	Japan	Russian Federation	Chinese Taipei	United States	Czech Republic	Hong Kong SAR	Hungary	Sweden	Slovak Republic	Austria	Netherlands	England	Denmark	Germany	Italy	Portugal	Slovenia	Northern Ireland	Ireland	Croatia	Australia	Serbia	Lithuania	Belgium (Flemish)	Romania	Spain	Poland
Korea, Rep. of	587 (2.0)																														
Singapore	583 (3.4)																														
Finland	570 (2.6)	▼	▼																												
Japan	559 (1.9)	▼	▼	▼																											
Russian Federation	552 (3.5)	▼	▼	▼	▼																										
Chinese Taipei	552 (2.2)	▼	▼	▼	▼																										
United States	544 (2.1)	▼	▼	▼	▼	▼																									
Czech Republic	536 (2.5)	▼	▼	▼	▼	▼	▼																								
Hong Kong SAR	535 (3.8)	▼	▼	▼	▼	▼	▼																								
Hungary	534 (3.7)	▼	▼	▼	▼	▼	▼																								
Sweden	533 (2.7)	▼	▼	▼	▼	▼	▼																								
Slovak Republic	532 (3.8)	▼	▼	▼	▼	▼	▼																								
Austria	532 (2.8)	▼	▼	▼	▼	▼	▼																								
Netherlands	531 (2.2)	▼	▼	▼	▼	▼	▼																								
England	529 (2.9)	▼	▼	▼	▼	▼	▼	▼																							
Denmark	528 (2.8)	▼	▼	▼	▼	▼	▼	▼																							
Germany	528 (2.9)	▼	▼	▼	▼	▼	▼	▼																							
Italy	524 (2.7)	▼	▼	▼	▼	▼	▼	▼	▼																						
Portugal	522 (3.9)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Slovenia	520 (2.7)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Northern Ireland	517 (2.6)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Ireland	516 (3.4)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Croatia	516 (2.1)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Australia	516 (2.8)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Serbia	516 (3.1)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Lithuania	515 (2.4)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Belgium (Flemish)	509 (2.0)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Romania	505 (5.9)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Spain	505 (3.0)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Poland	505 (2.6)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
New Zealand	497 (2.3)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Kazakhstan	495 (5.1)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Norway	494 (2.3)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Chile	480 (2.4)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Thailand	472 (5.6)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Turkey	463 (4.5)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Georgia	455 (3.8)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Iran, Islamic Rep. of	453 (3.7)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Bahrain	449 (3.5)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Malta	446 (1.9)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Azerbaijan	438 (5.6)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Saudi Arabia	429 (5.4)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
United Arab Emirates	428 (2.5)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Armenia	416 (3.8)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Qatar	394 (4.3)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Oman	377 (4.3)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Kuwait	347 (4.7)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Tunisia	346 (5.3)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Morocco	264 (4.5)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Yemen	209 (7.3)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Honduras (6)	432 (5.8)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Botswana (6)	367 (5.5)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Yemen (6)	345 (7.0)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
<b>Benchmarking Participants</b>																															
Florida, US	545 (3.7)	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Alberta, Canada	541 (2.4)	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
North Carolina, US	538 (4.6)	▼	▼	▼	▼	▼	▼																								
Ontario, Canada	528 (3.0)	▼	▼	▼	▼	▼	▼	▼																							
Quebec, Canada	516 (2.7)	▼	▼	▼	▼	▼	▼	▼	▼																						
Dubai, UAE	461 (2.3)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					
Abu Dhabi, UAE	411 (4.9)	▼	▼	▼	▼	▼	▼	▼	▼	▼																					

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Significance tests were not adjusted for multiple comparisons. Five percent of the comparisons would be statistically significant by chance alone.  
 (1) Standard errors appear in parentheses. Because of rounding some results may





**Exhibit 1.4: Multiple Comparisons of Average Science Achievement (Continued)**

Average achievement significantly higher than comparison country										Average achievement significantly lower than comparison country											
Benchmarking Participants										Benchmarking Participants										Average Scale Score	Country
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	590 (4.3)	Singapore
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	564 (2.3)	Chinese Taipei
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	560 (2.0)	Korea, Rep. of
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	558 (2.4)	Japan
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	552 (2.5)	Finland
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	543 (2.7)	Slovenia
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	542 (3.2)	Russian Federation
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	535 (3.4)	Hong Kong SAR
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	533 (4.9)	England
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	525 (2.6)	United States
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	522 (3.1)	Hungary
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	519 (4.8)	Australia
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	516 (4.0)	Israel
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	514 (2.6)	Lithuania
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	512 (4.6)	New Zealand
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	509 (2.5)	Sweden
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	501 (2.5)	Italy
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	501 (3.4)	Ukraine
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	494 (2.6)	Norway
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	490 (4.3)	Kazakhstan
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	483 (3.4)	Turkey
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	474 (4.0)	Iran, Islamic Rep. of
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	465 (3.5)	Romania
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	465 (2.4)	United Arab Emirates
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	461 (2.5)	Chile
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	452 (2.0)	Bahrain
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	451 (3.9)	Thailand
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	449 (4.0)	Jordan
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	439 (2.5)	Tunisia
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	437 (3.1)	Armenia
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	436 (3.9)	Saudi Arabia
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	426 (6.3)	Malaysia
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	426 (3.9)	Syrian Arab Republic
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	420 (3.2)	Palestinian Nat'l Auth.
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	420 (3.0)	Georgia
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	420 (3.2)	Oman
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	419 (3.4)	Qatar
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	407 (5.4)	Macedonia, Rep. of
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	406 (4.9)	Lebanon
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	406 (4.5)	Indonesia
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	376 (2.2)	Morocco
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	306 (5.2)	Ghana
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	404 (3.6)	Botswana (9)
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	369 (4.0)	Honduras (9)
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	332 (3.7)	South Africa (9)
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	567 (5.1)	Massachusetts, US
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	553 (4.6)	Minnesota, US
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	546 (2.4)	Alberta, Canada
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	542 (4.4)	Colorado, US
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	533 (4.8)	Indiana, US
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	532 (4.6)	Connecticut, US
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	532 (6.3)	North Carolina, US
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	530 (7.3)	Florida, US
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	521 (2.5)	Ontario, Canada
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	520 (2.5)	Quebec, Canada
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	499 (4.6)	California, US
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	485 (6.2)	Alabama, US
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	485 (2.5)	Dubai, UAE
⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	⬆	461 (4.0)	Abu Dhabi, UAE

Significance tests were not adjusted for multiple comparisons. Five percent of the comparisons would be statistically significant by chance alone.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

achievement. If there are substantial numbers of students with very low scores, their achievement is likely to be overestimated and consequently the overall achievement distribution becomes biased upwards. Educators and policy makers may work hard and make real strides in improving education from this assessment cycle to the next. However, because the achievement distribution at the earlier cycle was overestimated to begin with, the country would not see evidence of this improvement in the assessment results. The apparently poor return for all of the effort could be very disheartening to those who worked so hard and could prove a disincentive to further investment and effort.

Having substantial numbers of students with very low scores in a country also makes it difficult to estimate performance separately for the science content and cognitive domains. The items comprising the science reasoning scale were particularly difficult for such countries.

To identify countries where performance is deemed too low to provide reliable measurement of achievement and meaningful trend comparisons, the TIMSS & PIRLS International Study Center conducted extensive investigations to detect when the quality of measurement erodes (Martin, Mullis, & Foy, in press). The proportion of students unable to respond to any items on the assessment was selected as the best indicator of degree of mismatch between students' skills and those demanded by the assessment. Although the absolute lower limit would be no items answered correctly, about half the items were in multiple-choice format and guessing on these was possible. Thus, beginning in 2011, the criterion for having achievement too low for estimation was established based on the percentage of the students having a score no higher than what a student would achieve by guessing on all the multiple-choice questions—essentially the percentage of students performing below chance.

For each country, Appendix D shows the percentage of students with achievement too low for estimation (Exhibit D.1 for the fourth grade and D.2 for the eighth grade). When, as in Morocco and Yemen at the fourth grade, the percentage of students with achievement too low for estimation exceeded 25 percent, the country was annotated with the symbol  $\mathcal{K}$ . Achievement trends are not reported for these countries because of concerns about bias in the estimation of achievement for the student population. When, as in Kuwait and Tunisia, the percentage of students with achievement too low for estimation exceeded 15 percent but did not exceed 25 percent, the country was annotated with the symbol  $\Psi$ , indicating reservations about the reliability of the achievement estimates.

### *Achievement in TIMSS 2011 at the Sixth Grade*

As a group, the countries assessing their sixth grade students had average achievement between 345 and 432. This level of achievement is comparable to that of most of the lower performing countries at the fourth grade. Despite the low average achievement of the sixth grade students in Yemen, it is noteworthy that it exceeded the average achievement of Yemen's fourth grade students by more than 130 points.

### *Achievement in TIMSS 2011 at the Eighth Grade*

The results in Exhibit 1.2 (first page) show that 16 countries had higher achievement than the scale centerpoint of 500 and five countries had average achievement above the High International Benchmark of 550—Singapore, Chinese Taipei, Korea, Japan, and Finland.

Looking at the results in Exhibit 1.2 and taking into account the information in Exhibit 1.4, which shows whether or not the differences in average achievement among the countries are statistically significant, it can be seen that Singapore had the highest average achievement, and had higher achievement than all other countries. The next highest-performing countries—Chinese Taipei, Korea, and Japan—had higher achievement than all other countries except Singapore. Also included in the top nine high-achieving countries were Finland, Slovenia, the Russian Federation, Hong Kong SAR, and England.

Several benchmarking participants had average science achievement close to the High International Benchmark (550). The state of Massachusetts was outperformed only by the top-performing country of Singapore, and the state of Minnesota was outperformed only by Singapore and Chinese Taipei, although both had achievement similar to a number of other countries.

While there were small differences from country to country, there was a substantial range in performance from the top-performing to the lower-performing countries. Twenty-four countries had average achievement below the scale centerpoint, mostly falling above the Low (400) International Benchmark. Among the eighth grade participating countries, only Ghana had many low performing students, with a percentage of students with achievement too low for estimation between 15 and 25 percent.

### *Achievement in TIMSS 2011 at the Ninth Grade*

As a group, the countries assessing their ninth grade students had average achievement between 332 and 404, at or below the Low International Benchmark (400) for eighth grade students. There was evidence of many very low performing ninth grade students in South Africa, with the percentage of students with achievement too low for estimation between 15 percent and 25 percent.

### Trends in Science Achievement

Exhibits 1.5 and 1.6 display changes in average science achievement at the fourth and eighth grades, respectively, for the countries and benchmarking participants that have comparable data from previous TIMSS assessments. For the fourth grade, there are 29 countries and four benchmarking participants having data from 1995, 2003, or 2007 that can be compared to 2011.<sup>3</sup> Twelve countries and two benchmarking participants have trend data from all four TIMSS fourth grade assessments. For the eighth grade (and Finland at the seventh grade), there are 35 countries and nine benchmarking participants having data from 1995, 1999, 2003, or 2007 that can be compared to 2011, including eleven countries and two benchmarking participants that have data from all five TIMSS eighth grade assessments. With the participants shown in alphabetical order, Exhibits 1.5 and 1.6 show average achievement for each assessment year, as well as achievement differences between years, with an indication of statistical significance. The science achievement distributions also are shown for each assessment year.

At the fourth grade, there are 17 countries and three benchmarking participants that have comparable data from 1995 and 2011 providing trends over the past 16 years. Exhibit 1.7 shows these countries ordered from most to least growth in achievement over this period, to focus on educational progress across the TIMSS assessment years and complement the complete detail in Exhibit 1.5. Exhibit 1.7 presents for the fourth grade a country-by-country graphical depiction of change in average science achievement from 1995 to 2011, with growth curves aligned country by country to facilitate comparisons of change from assessment to assessment. That is, the same scale is used for each country (10-point intervals), but the part of the scale shown differs according to each countries' average achievement. To complement Exhibit 1.6 and focus on long-term educational progress at the eighth grade, Exhibit 1.8 presents for the eighth grade a similar depiction of change in average achievement from 1995

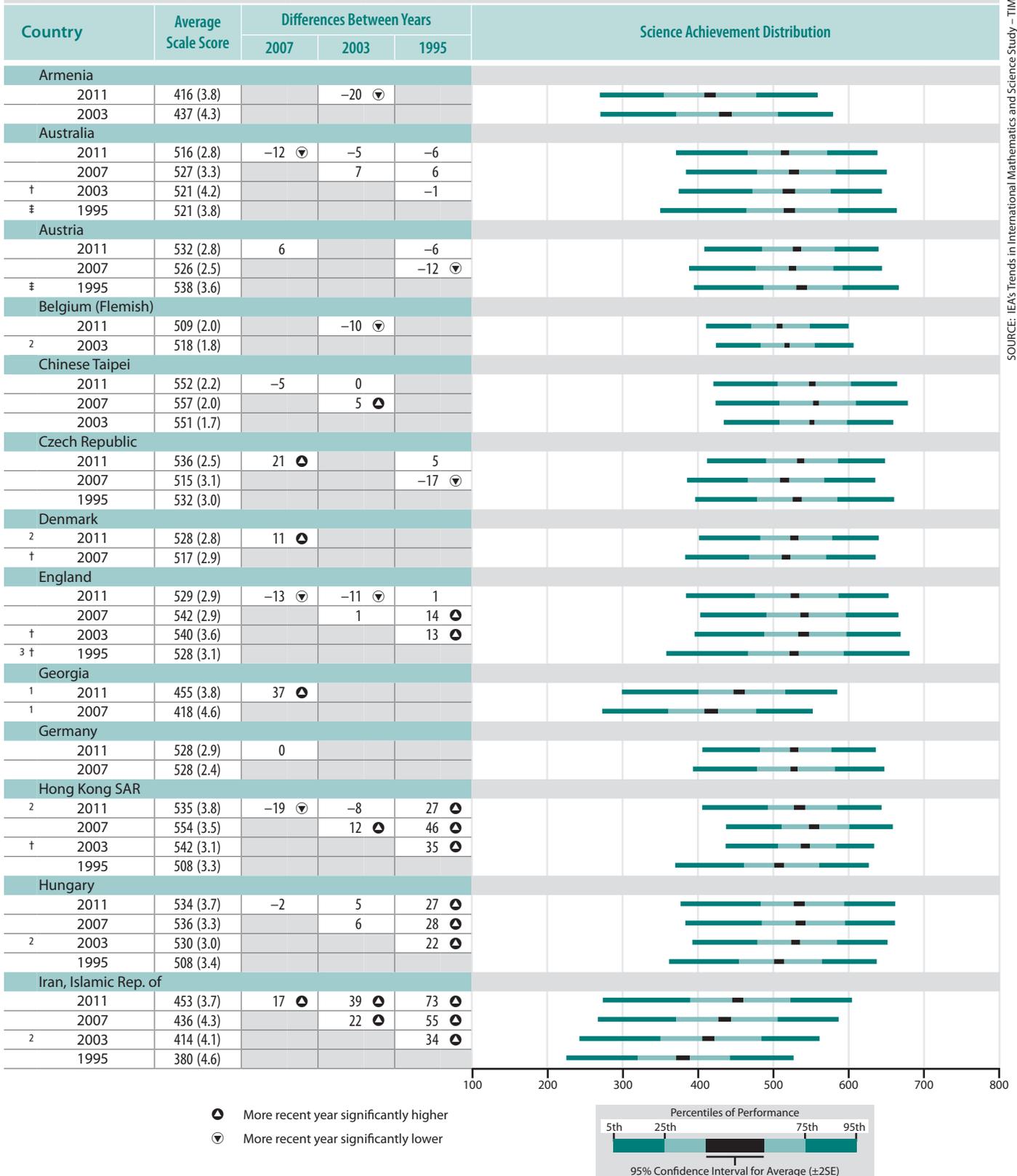
3 TIMSS 1999 did not include a fourth grade assessment.

(or 1999) to 2011 for the 25 countries and eight benchmarking participants that have comparable data from these assessment years.

It is particularly interesting to consider the TIMSS 2011 achievement results in light of the information countries provided in the *TIMSS 2011 Encyclopedia*. Many countries are engaged in implementing important structural, curricular, and instructional reforms and are using the TIMSS results across the assessment years to monitor the impact on achievement of these reforms. Looking at the trends in fourth grade science achievement during the 1995–2011 period, there have been more countries with increases than with decreases. Of the 17 countries and three benchmarking participants with data spanning this period (see Exhibit 1.7), eight countries and one benchmarking participant had increases in average achievement, one country and one benchmarking participant had decreases, and eight countries and one benchmarking participants had no difference. Among the countries with the greatest increase from 1995 to 2011 were Iran, Portugal, Singapore, and Slovenia, with average achievement increases of 56 points or more. Hong Kong SAR and Hungary also both had substantial increases. Among benchmarking participants, Ontario's average achievement increased, while the average achievement decreased in Québec.

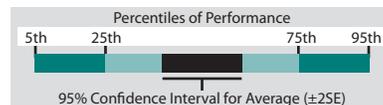
**Exhibit 1.5: Trends in Science Achievement**

Instructions: Read across the row to determine if the performance in the row year is significantly higher (▲) or significantly lower (▼) than the performance in the column year.



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

▲ More recent year significantly higher  
▼ More recent year significantly lower



ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%. Such annotations in exhibits with trend data began in 2011, so data from assessments prior to 2011 are not annotated for reservations.

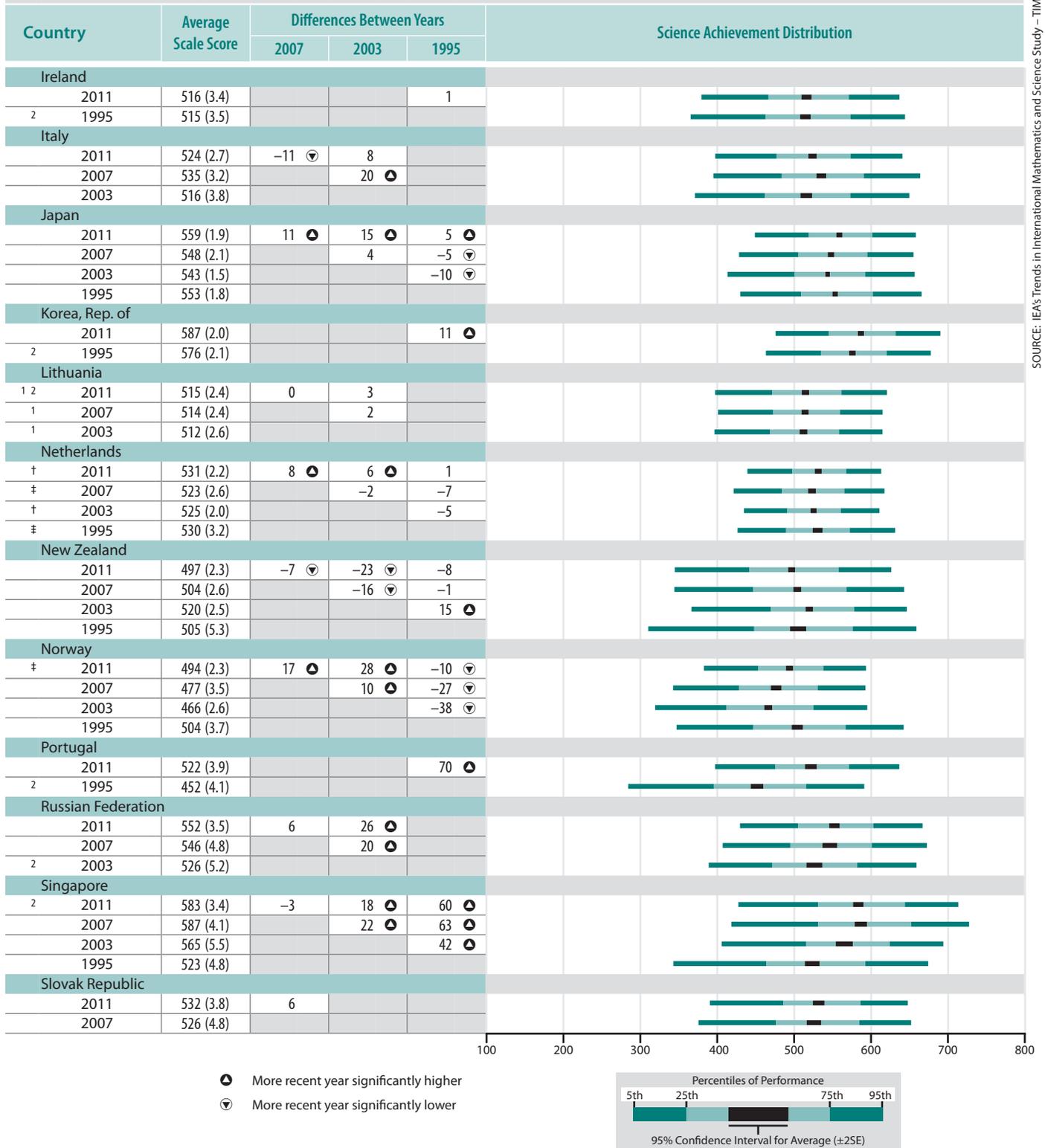
See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.

♣ Tested the same cohort of students as other countries, but later in the assessment year at the beginning of the next school year.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

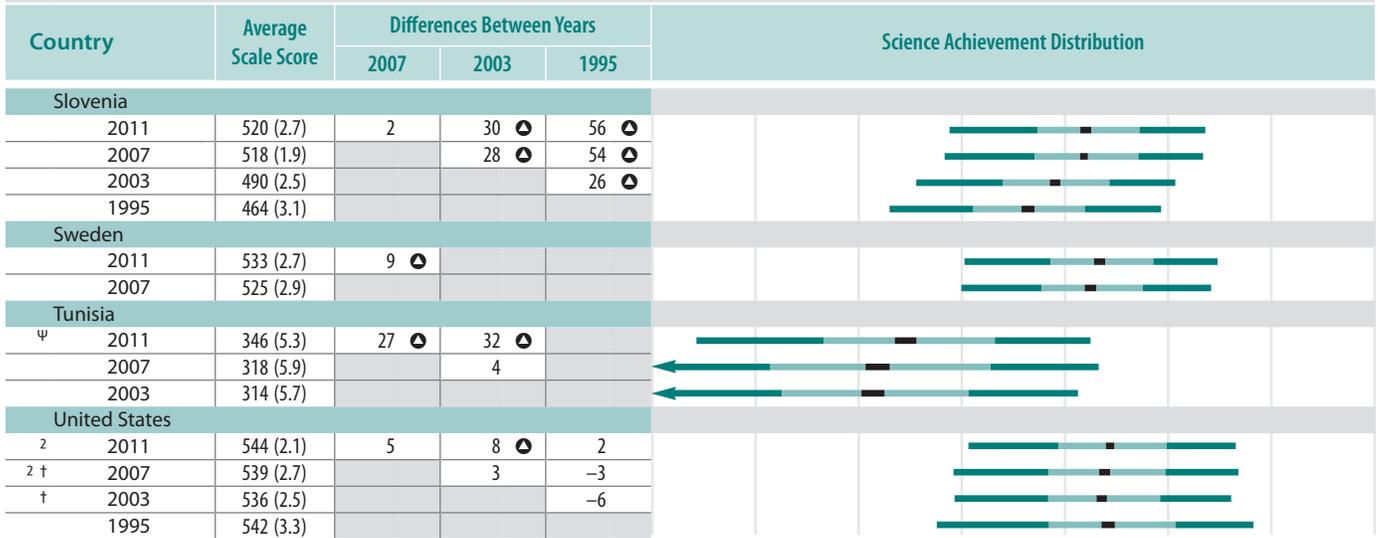
### Exhibit 1.5: Trends in Science Achievement (Continued)

Instructions: Read across the row to determine if the performance in the row year is significantly higher (▲) or significantly lower (▼) than the performance in the column year.



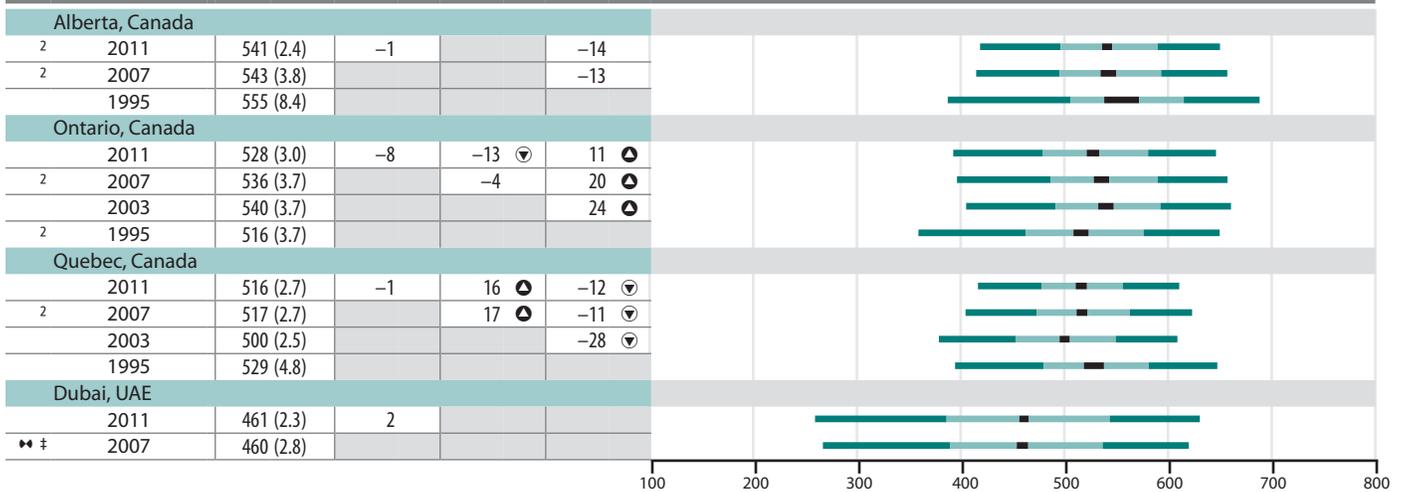
**Exhibit 1.5: Trends in Science Achievement (Continued)**

Instructions: Read across the row to determine if the performance in the row year is significantly higher (▲) or significantly lower (▼) than the performance in the column year.

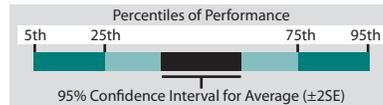


SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Benchmarking Participants**



- ▲ More recent year significantly higher
- ▼ More recent year significantly lower

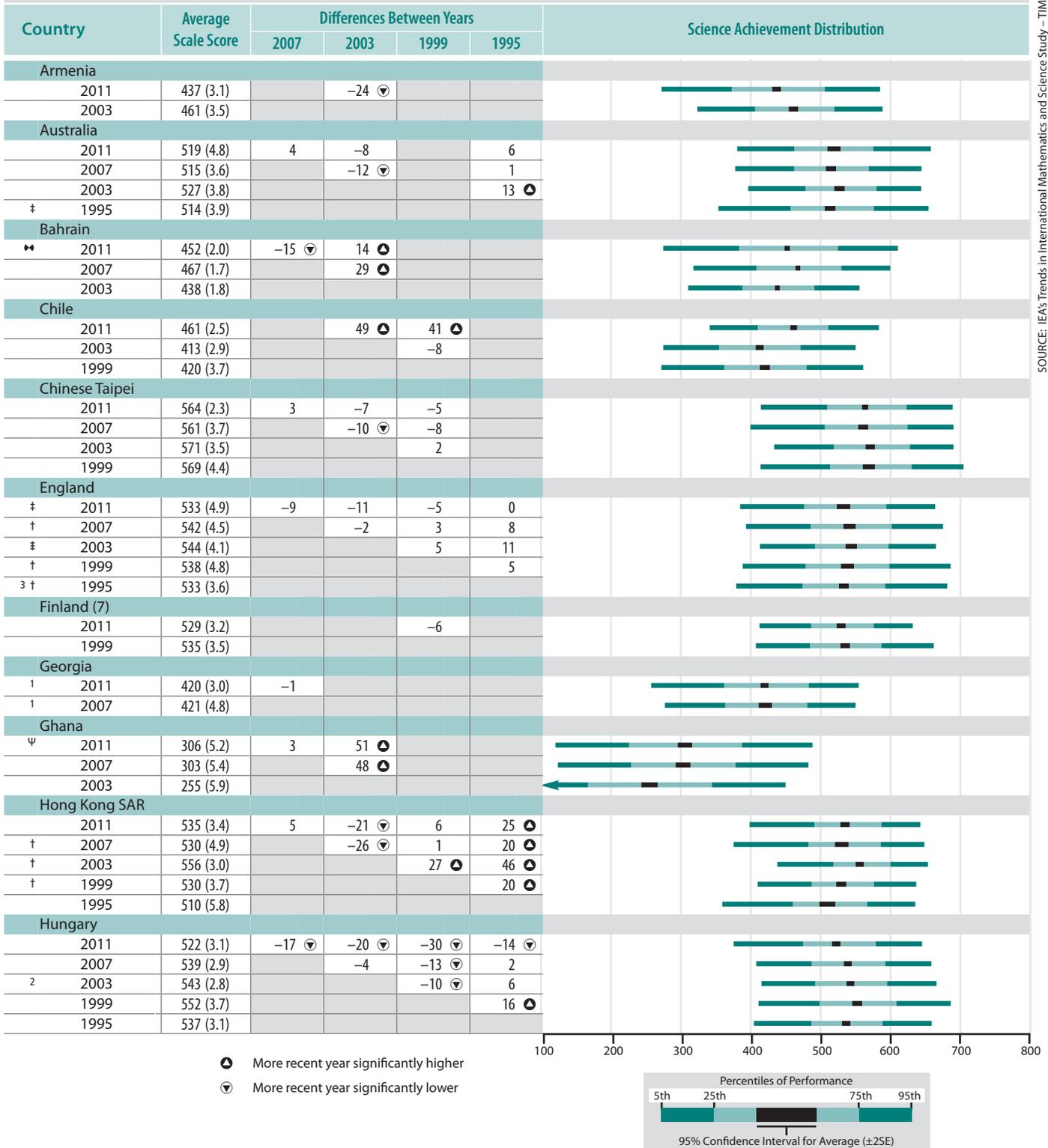


At the eighth grade, there was great variability among countries in changes in average science achievement between 1995 or 1999 and 2011, with some countries showing large improvements and others showing large declines. Of the 16 countries and four benchmarking participants with comparable data spanning the 1995 to 2011 period, seven countries and one benchmarking participant showed increases in average achievement, three countries and no benchmarking participants showed decreases, and six countries and three benchmarking participants showed no difference. The countries with the greatest increases in average science achievement between 1995 and 2011 at the eighth grade were Lithuania (50 points), Slovenia (29 points), Hong Kong SAR (25 points), and the Russian Federation (20 points); Ontario also had a similarly large increase during this period (25 points). Countries with the greatest decreases in average achievement between 1995 and 2011 were Sweden (43 points) and Norway (20 points).

For the nine countries and four benchmarking participants that did not participate in TIMSS 1995, but did participate in TIMSS 1999, two countries and two benchmarking participants showed an increase in average achievement from 1999 to 2011: Chile (41 points) and Tunisia (9 points), as well as the states of Massachusetts and North Carolina (34 and 24 points, respectively). Three countries showed a decrease in average achievement over this period, among which Macedonia and Malaysia showed the largest decreases (51 and 66 points, respectively). Four countries and two benchmarking participants showed no difference.

**Exhibit 1.6: Trends in Science Achievement**

Instructions: Read across the row to determine if the performance in the row year is significantly higher (▲) or significantly lower (▼) than the performance in the column year.



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%. Such annotations in exhibits with trend data began in 2011, so data from assessments prior to 2011 are not annotated for reservations.

Trend Notes: Trend results for Finland are based on 7th grade data from 1999 and 2011, and so Finland's 2011 results differ from Exhibit 1.1.

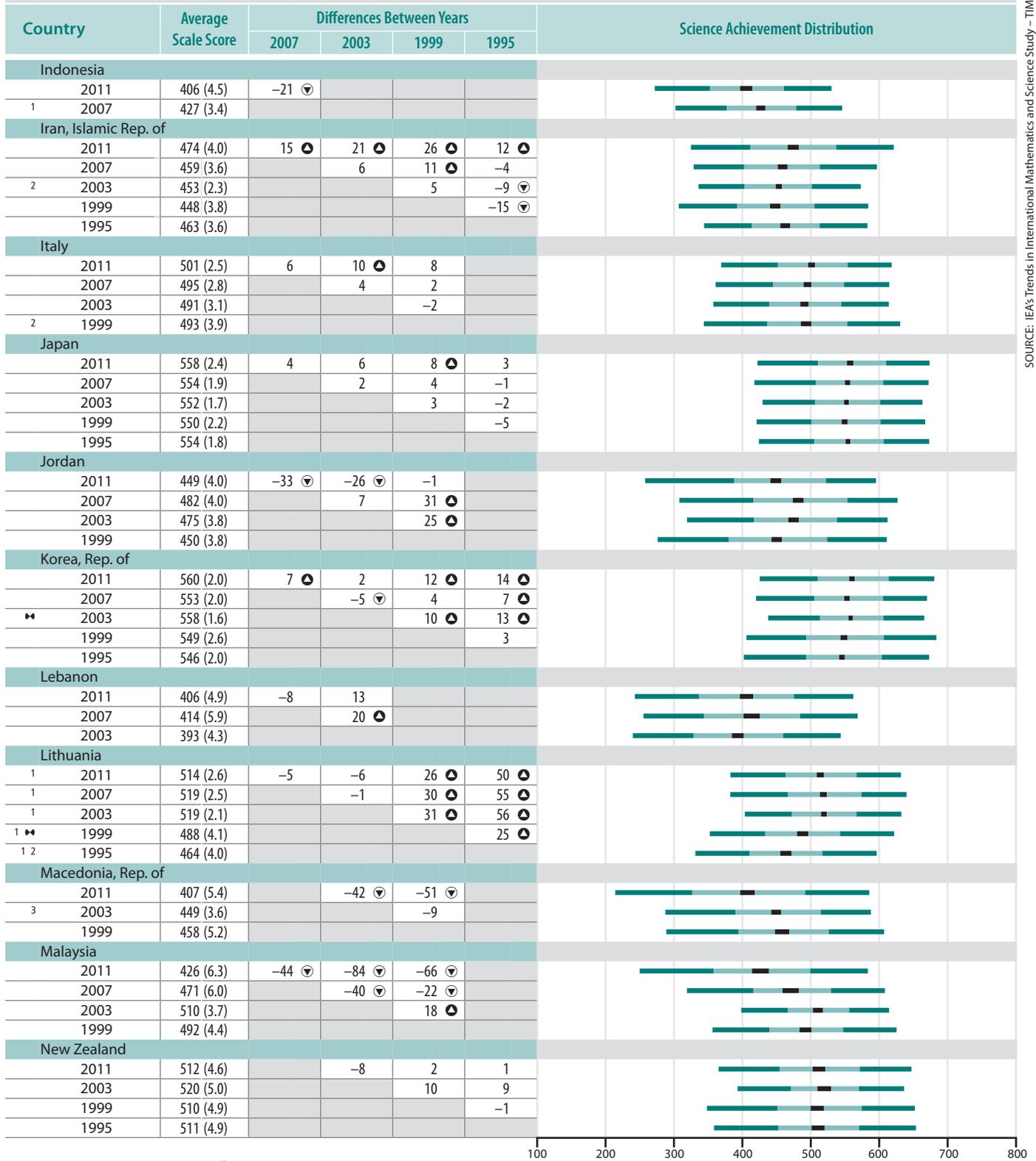
See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.

♦♦ Tested the same cohort of students as other countries, but later in the assessment year at the beginning of the next school year.

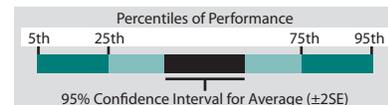
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

**Exhibit 1.6: Trends in Science Achievement (Continued)**

Instructions: Read across the row to determine if the performance in the row year is significantly higher (▲) or significantly lower (▼) than the performance in the column year.

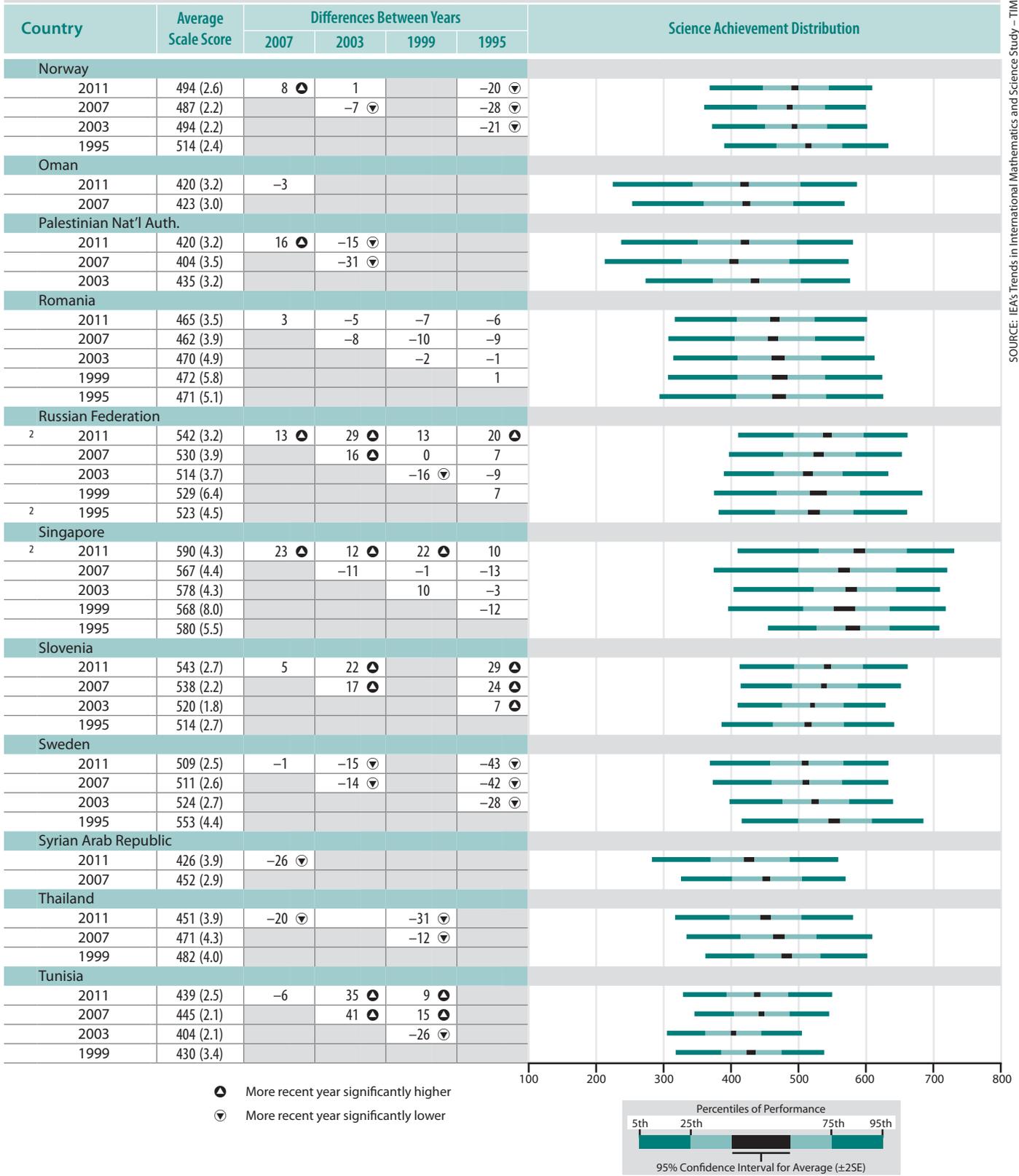


▲ More recent year significantly higher  
▼ More recent year significantly lower



**Exhibit 1.6: Trends in Science Achievement (Continued)**

Instructions: Read across the row to determine if the performance in the row year is significantly higher (▲) or significantly lower (▼) than the performance in the column year.



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 1.6: Trends in Science Achievement (Continued)**

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

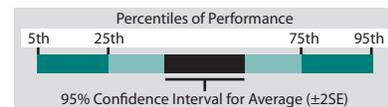
Instructions: Read across the row to determine if the performance in the row year is significantly higher (▲) or significantly lower (▼) than the performance in the column year.

Country	Average Scale Score	Differences Between Years				Science Achievement Distribution
		2007	2003	1999	1995	
<b>Ukraine</b>						
2011	501 (3.4)	16 ▲				
2007	485 (3.5)					
<b>United States</b>						
<sup>2</sup> 2011	525 (2.6)	5	-3	10	12 ▲	
<sup>2 †</sup> 2007	520 (2.9)		-7	5	7	
<sup>‡</sup> 2003	527 (3.1)			12 ▲	15 ▲	
1999	515 (4.6)				2	
<sup>†</sup> 1995	513 (5.6)					

**Benchmarking Participants**

<b>Alberta, Canada</b>						
<sup>2</sup> 2011	546 (2.4)			-13	-4	
1999	559 (7.5)				9	
1995	550 (4.8)					
<b>Ontario, Canada</b>						
<sup>2</sup> 2011	521 (2.5)	-5	-12 ▼	3	25 ▲	
<sup>2</sup> 2007	526 (3.6)		-7	8	30 ▲	
<sup>2</sup> 2003	533 (2.7)			15 ▲	37 ▲	
1999	518 (3.1)				22 ▲	
1995	496 (3.7)					
<b>Quebec, Canada</b>						
2011	520 (2.5)	13 ▲	-11 ▼	-21 ▼	10	
<sup>3</sup> 2007	507 (3.1)		-24 ▼	-34 ▼	-3	
2003	531 (3.0)			-9	21 ▲	
1999	540 (4.8)				30 ▲	
1995	510 (6.9)					
<b>Dubai, UAE</b>						
2011	485 (2.5)	-4				
<sup>♦ ‡</sup> 2007	489 (2.8)					
<b>Connecticut, US</b>						
<sup>1</sup> 2011	532 (4.6)			2		
1999	529 (10.4)					
<b>Indiana, US</b>						
<sup>1 2</sup> 2011	533 (4.8)		2	-1		
<sup>2</sup> 2003	531 (4.8)			-4		
<sup>2 †</sup> 1999	534 (7.0)					
<b>Massachusetts, US</b>						
<sup>1 2</sup> 2011	567 (5.1)	11		34 ▲		
<sup>2</sup> 2007	556 (4.6)			23 ▲		
1999	533 (7.4)					
<b>Minnesota, US</b>						
<sup>1</sup> 2011	553 (4.6)	15 ▲			10	
<sup>2 †</sup> 2007	539 (4.8)				-5	
<sup>†</sup> 1995	544 (7.9)					
<b>North Carolina, US</b>						
<sup>1 3</sup> 2011	532 (6.3)			24 ▲		
1999	508 (6.5)					

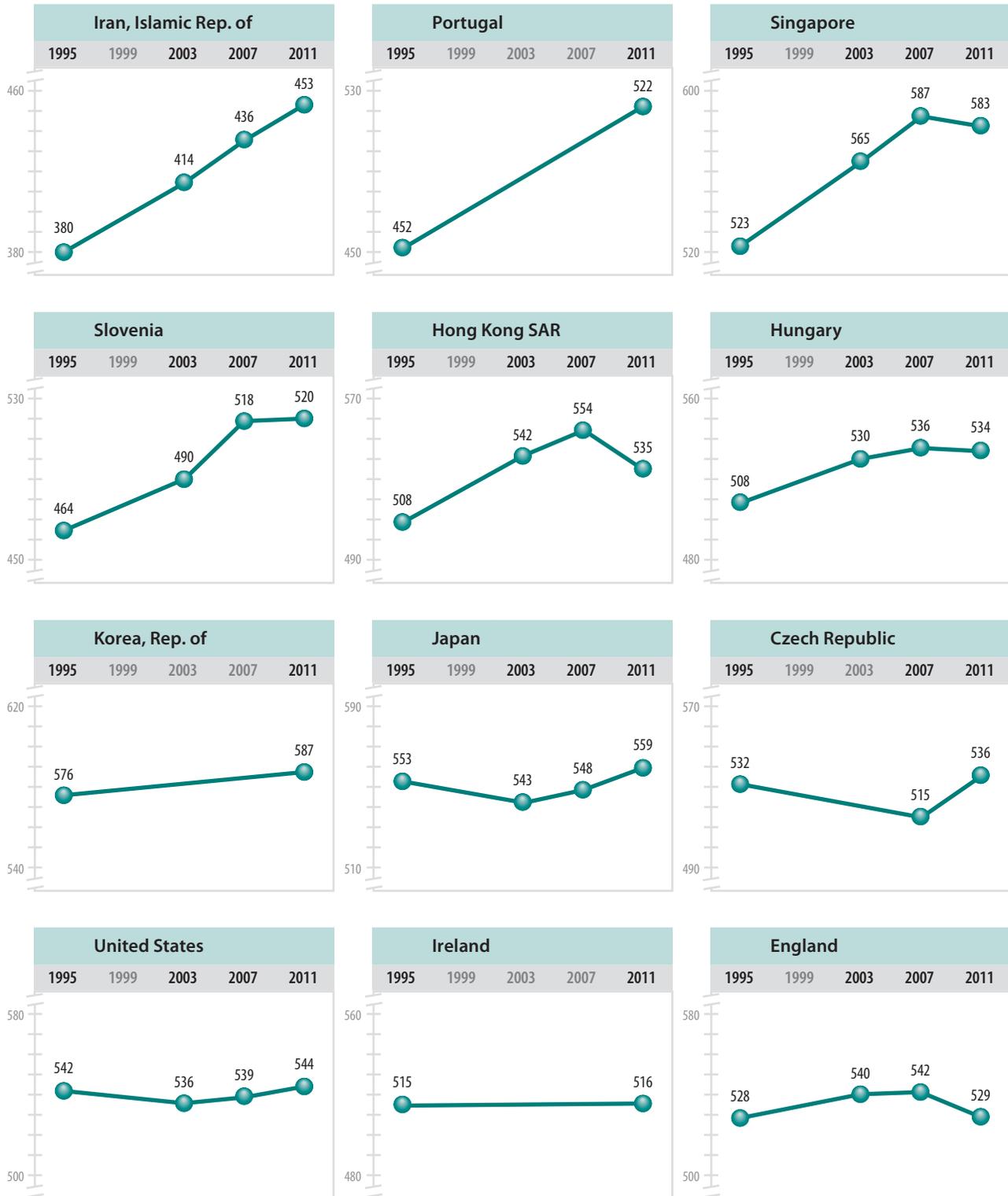
- ▲ More recent year significantly higher
- ▼ More recent year significantly lower



100 200 300 400 500 600 700 800

**Exhibit 1.7: Trends in Science Achievement – 1995 Through 2011\***

Includes only 2011 participants with comparable long term trend data beginning in 1995, ordered by most to least improvement in average achievement. Exhibit 1.5 provides details including statistical significance.

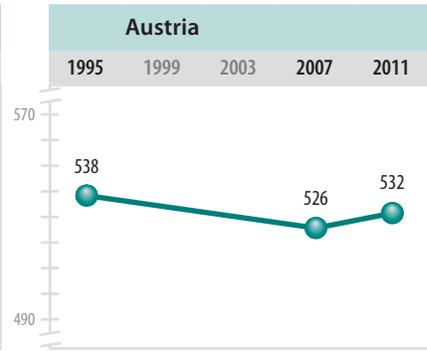
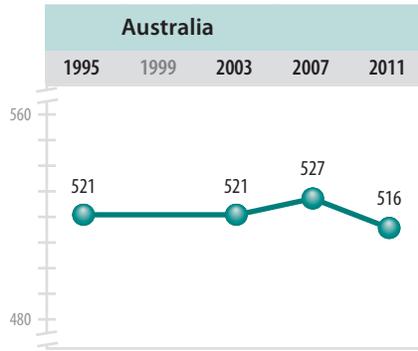


SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

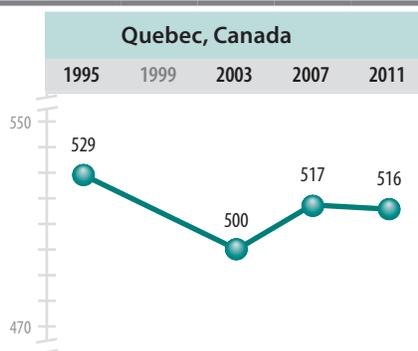
\* No fourth-grade assessment in 1999.

Scale interval is 10 points for each country, but the part of the scale shown differs according to each country's average achievement.

**Exhibit 1.7: Trends in Science Achievement – 1995 Through 2011\* (Continued)**



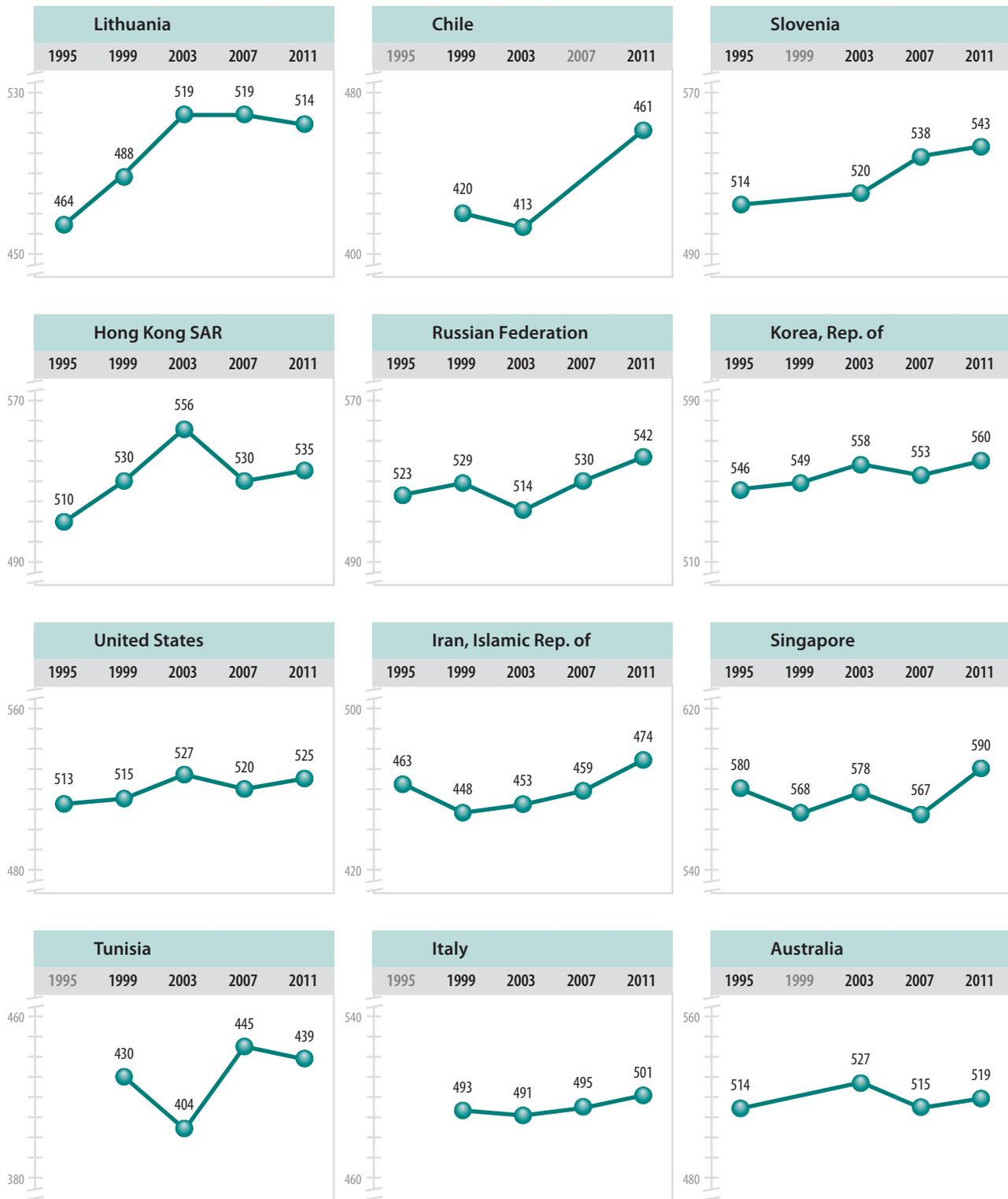
**Benchmarking Participants**



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 1.8: Trends in Science Achievement – 1995 Through 2011**

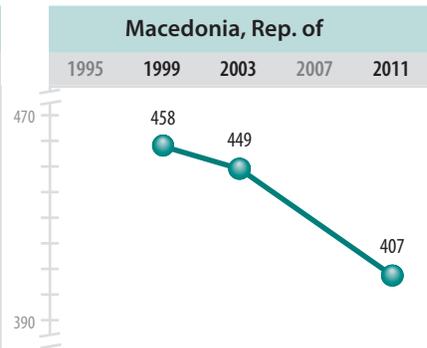
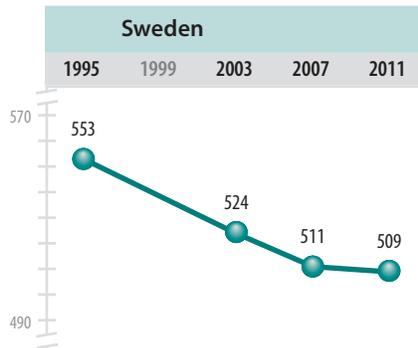
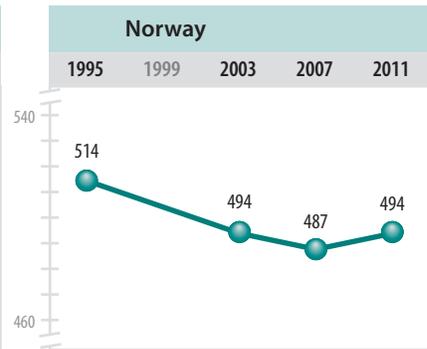
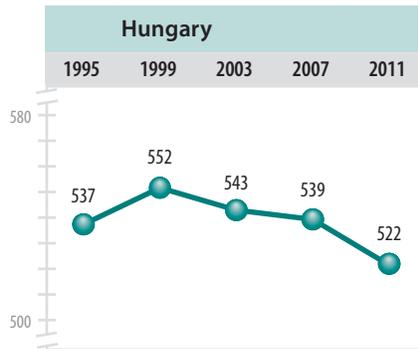
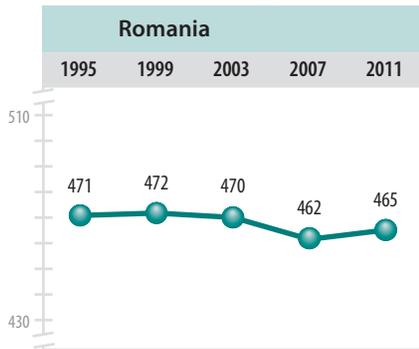
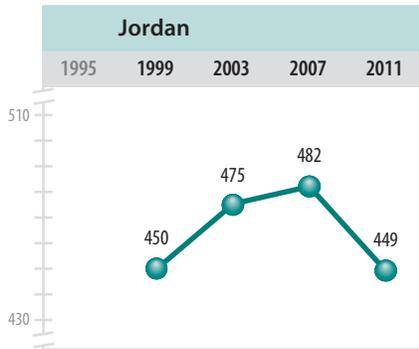
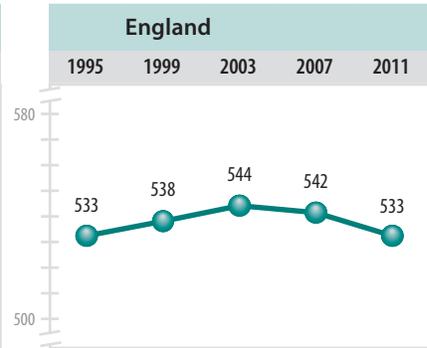
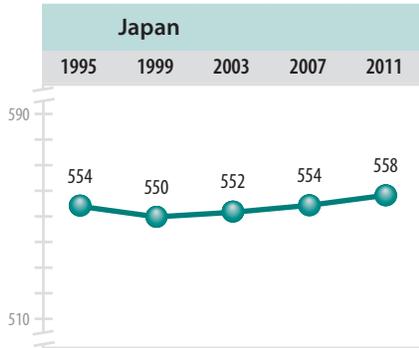
Includes only 2011 participants with comparable long term trend data beginning in either 1995 or 1999, ordered by most to least improvement in average achievement. Exhibit 1.6 provides details including statistical significance.



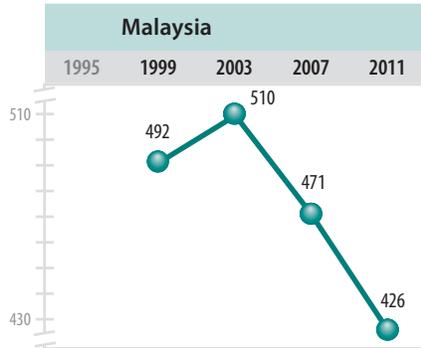
SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Scale interval is 10 points for each country, but the part of the scale shown differs according to each country's average achievement.

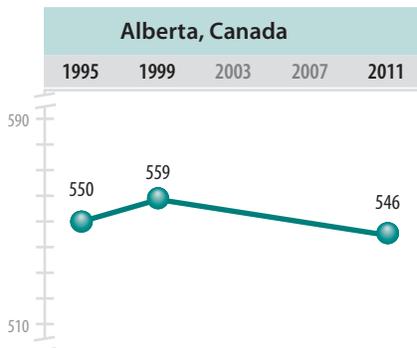
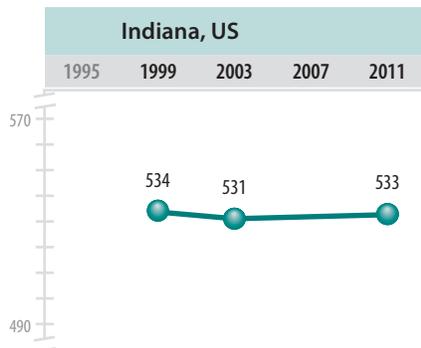
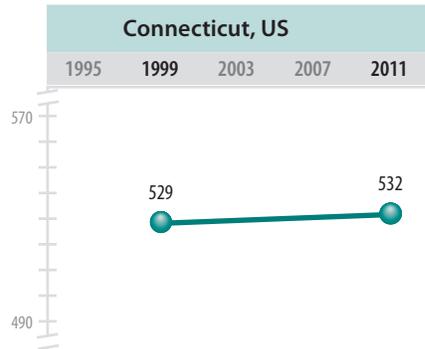
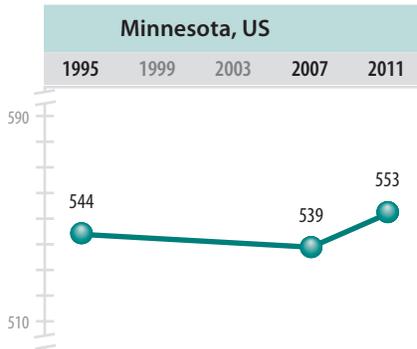
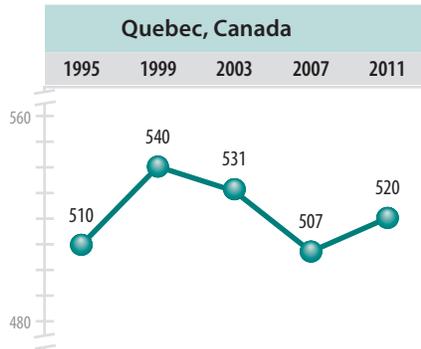
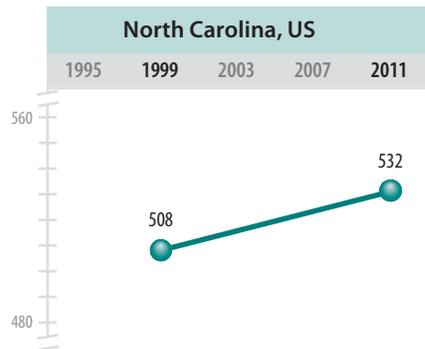
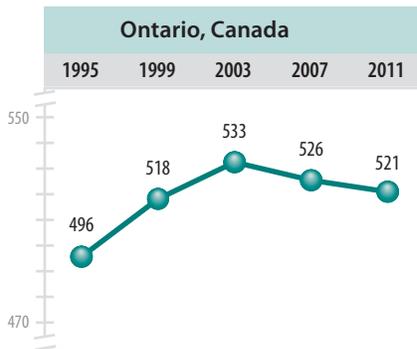
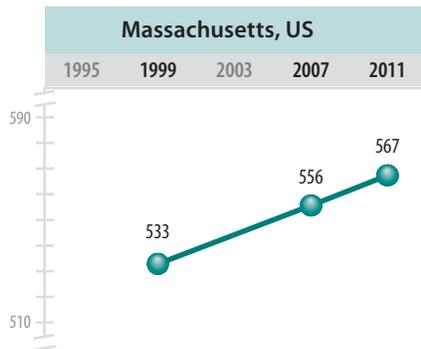
**Exhibit 1.8: Trends in Science Achievement – 1995 Through 2011 (Continued)**



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



Benchmarking Participants



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

### *Trends Across Grades: Fourth to Eighth Grade Cohort Analysis*

Because TIMSS is conducted on a four-year cycle, the cohort of students that was assessed in the fourth grade in 2007 had reached the eighth grade by 2011, and thus was assessed at the eighth grade in 2011. This enables the 17 countries and three benchmarking participants that assessed both grades in both assessment years to examine how their performance relative to each other changed as the fourth grade students of 2007 became the eighth grade students of 2011. The results are presented in Exhibit 1.9, which shows average science achievement as a difference from the TIMSS scale centerpoint (500) for the fourth grade students in 2007 (upper-left panel) and in 2011 (upper-right panel). The exhibit also shows achievement for the eighth grade students in 2007 (lower-left panel) and in 2011 (lower-right panel). The trends for the fourth and eighth grades (indicated by the gray horizontal arrows), however, were presented more fully in Exhibits 1.5 and 1.6, respectively. The purpose of Exhibit 1.9 is to provide information about relative progress across grades as the cohort of students assessed at the fourth grade in 2007 moved to the eighth grade four years later in 2011. That is, to compare relative performance at the fourth grade in 2007 (upper-left panel) to relative performance at the eighth grade in 2011 (lower-right panel) as indicated by the darker arrow pointing diagonally downward.

Twelve countries—Singapore, Chinese Taipei, Hong Kong SAR, Japan, the Russian Federation, England, the United States, Hungary, Australia, Sweden, Slovenia, and Lithuania—and the Canadian provinces of Ontario and Québec performed above the scale centerpoint at the fourth grade in 2007 and again at the eighth grade in 2011 (although not in the same order of average achievement). Slovenia showed a particularly notable increase, with average achievement moving from 18 points above the centerpoint at the fourth grade in 2007 to 43 points above the centerpoint at the eighth grade in 2011. Norway, Iran, Georgia, Tunisia, and the UAE emirate of Dubai performed below the scale centerpoint in the fourth grade in 2007 and again at the eighth grade in 2011. Italy moved from above the centerpoint in the fourth grade in 2007 to the centerpoint at the eighth grade in 2011.

### *Gender Differences in Science Achievement*

Previous TIMSS assessments have shown gender differences in science achievement to be smaller on average at the fourth grade than at the eighth grade, although the situation varies considerably from country to country.

**Exhibit 1.9: Relative Achievement of 2007 Fourth Grade Cohort as Eighth Grade Students in 2011**

2007 – Fourth Grade		
Country	Achievement Difference from TIMSS Scale Centerpoint (500)	
Singapore	87 (4.1)	▲
Chinese Taipei	57 (2.0)	▲
Hong Kong SAR	54 (3.5)	▲
Japan	48 (2.1)	▲
Russian Federation	46 (4.8)	▲
England	42 (2.9)	▲
United States	39 (2.7)	▲
Hungary	36 (3.3)	▲
Italy	35 (3.2)	▲
Australia	27 (3.3)	▲
Sweden	25 (2.9)	▲
Slovenia	18 (1.9)	▲
Lithuania	14 (2.4)	▲
Norway	-23 (3.5)	▼
Iran, Islamic Rep. of	-64 (4.3)	▼
Georgia	-82 (4.6)	▼
Tunisia	-182 (5.9)	▼
<b>Benchmarking Participants</b>		
Ontario, Canada	36 (3.7)	▲
Quebec, Canada	17 (2.7)	▲
Dubai, UAE	-40 (2.8)	▼

2011 – Fourth Grade		
Country	Achievement Difference from TIMSS Scale Centerpoint (500)	
Singapore	83 (3.4)	▲
Japan	59 (1.9)	▲
Russian Federation	52 (3.5)	▲
Chinese Taipei	52 (2.2)	▲
United States	44 (2.1)	▲
Hong Kong SAR	35 (3.8)	▲
Hungary	34 (3.7)	▲
Sweden	33 (2.7)	▲
England	29 (2.9)	▲
Italy	24 (2.7)	▲
Slovenia	20 (2.7)	▲
Australia	16 (2.8)	▲
Lithuania	15 (2.4)	▲
Norway	-6 (2.3)	▼
Georgia	-45 (3.8)	▼
Iran, Islamic Rep. of	-47 (3.7)	▼
Tunisia	-154 (5.3)	▼
<b>Benchmarking Participants</b>		
Ontario, Canada	28 (3.0)	▲
Quebec, Canada	16 (2.7)	▲
Dubai, UAE	-39 (2.3)	▼

2007 – Eighth Grade		
Country	Achievement Difference from TIMSS Scale Centerpoint (500)	
Singapore	67 (4.4)	▲
Chinese Taipei	61 (3.7)	▲
Japan	54 (1.9)	▲
England	42 (4.5)	▲
Hungary	39 (2.9)	▲
Slovenia	38 (2.2)	▲
Hong Kong SAR	30 (4.9)	▲
Russian Federation	30 (3.9)	▲
United States	20 (2.9)	▲
Lithuania	19 (2.5)	▲
Australia	15 (3.6)	▲
Sweden	11 (2.6)	▲
Italy	-5 (2.8)	
Norway	-13 (2.2)	▼
Iran, Islamic Rep. of	-41 (3.6)	▼
Tunisia	-55 (2.1)	▼
Georgia	-79 (4.8)	▼
<b>Benchmarking Participants</b>		
Ontario, Canada	26 (3.6)	▲
Quebec, Canada	7 (3.1)	▲
Dubai, UAE	-11 (2.8)	▼

2011 – Eighth Grade		
Country	Achievement Difference from TIMSS Scale Centerpoint (500)	
Singapore	90 (4.3)	▲
Chinese Taipei	64 (2.3)	▲
Japan	58 (2.4)	▲
Slovenia	43 (2.7)	▲
Russian Federation	42 (3.2)	▲
Hong Kong SAR	35 (3.4)	▲
England	33 (4.9)	▲
United States	25 (2.6)	▲
Hungary	22 (3.1)	▲
Australia	19 (4.8)	▲
Lithuania	14 (2.6)	▲
Sweden	9 (2.5)	▲
Italy	1 (2.5)	
Norway	-6 (2.6)	▼
Iran, Islamic Rep. of	-26 (4.0)	▼
Tunisia	-61 (2.5)	▼
Georgia	-80 (3.0)	▼
<b>Benchmarking Participants</b>		
Ontario, Canada	21 (2.5)	▲
Quebec, Canada	20 (2.5)	▲
Dubai, UAE	-15 (2.5)	▼

- ▲ Country average significantly higher than the centerpoint of the TIMSS scale
- ▼ Country average significantly lower than the centerpoint of the TIMSS scale

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

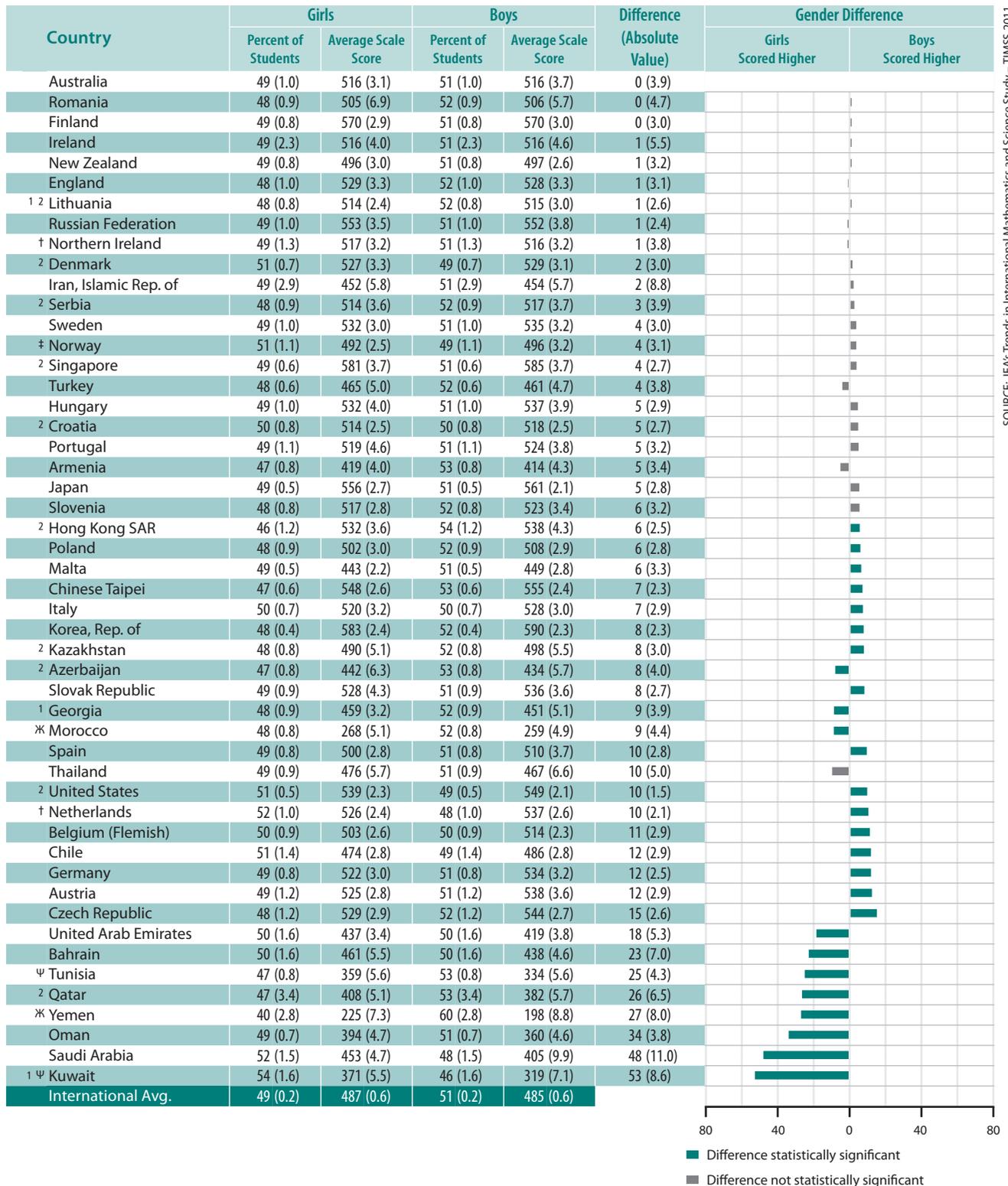
Exhibit 1.10 presents the TIMSS 2011 fourth grade results for gender differences in science achievement. For the TIMSS 2011 countries at the fourth grade, at sixth grade, and the benchmarking participants, it presents girls' average achievement, boys' average achievement, and the difference between the two averages. The bar graph shows the size of the achievement difference between boys and girls and whether that difference is statistically significant (as indicated by a darkened bar). International averages also are shown (averages across the mean scores for girls in each of the countries and the mean scores for boys in each of the countries). Exhibit 1.11 presents corresponding results for the TIMSS 2011 eighth grade assessment.

In each section of Exhibit 1.10, participants are shown in order by the increasing size of the difference between girls and boys in average science achievement. Overall, there was little achievement difference between girls and boys (International Average: 487 vs. 485). Of the 50 countries at the fourth grade, 23 had no significant gender difference in science achievement. Of the 27 remaining countries, 16 had relatively small differences favoring boys, and three had relatively small differences favoring girls. Eight countries had relatively larger differences favoring girls (the United Arab Emirates, Bahrain, Tunisia, Qatar, Yemen, Oman, Saudi Arabia, and Kuwait).

At the sixth grade, there was a significant achievement difference favoring girls in Botswana. Among benchmarking participants, boys had higher average science achievement than girls in Québec, Alberta, Florida, and North Carolina. Girls had higher achievement than boys in Abu Dhabi, UAE.

As shown in Exhibit 1.11, gender differences in science achievement at the eighth grade were larger, on average, than at the fourth grade, with the difference favoring girls (International Average: 480 vs. 474). Similar to the fourth grade, the gender difference varied across countries, with no difference in 17 of the 42 eighth grade countries, a difference favoring boys in ten countries, and a difference favoring girls in the remaining 15 countries. As at the fourth grade, and consistent with findings from TIMSS 2007, the largest achievement differences favoring girls at the eighth grade were in Arabic-speaking countries from the Middle East (the United Arab Emirates, Qatar, Saudi Arabia, the Palestinian National Authority, Jordan, Bahrain, and Oman). Among countries that assessed their ninth grade students, girls had higher science achievement than boys in Botswana and boys had higher achievement than girls in Honduras. Among the 14 benchmarking participants, boys performed better than girls in six US states and the Canadian province of Alberta and girls performed better than boys (by a large margin) in Dubai, UAE.

**Exhibit 1.10: Average Science Achievement by Gender**



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

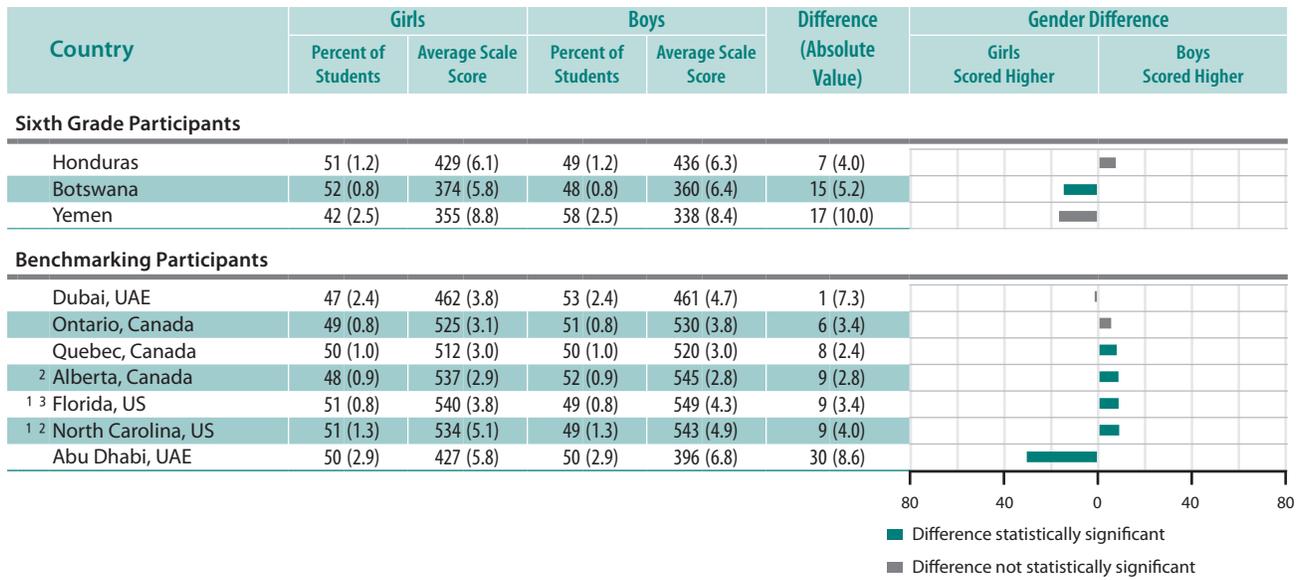
\* Average achievement not reliably measured because the percentage of students with achievement too low for estimation exceeds 25%.

‡ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.

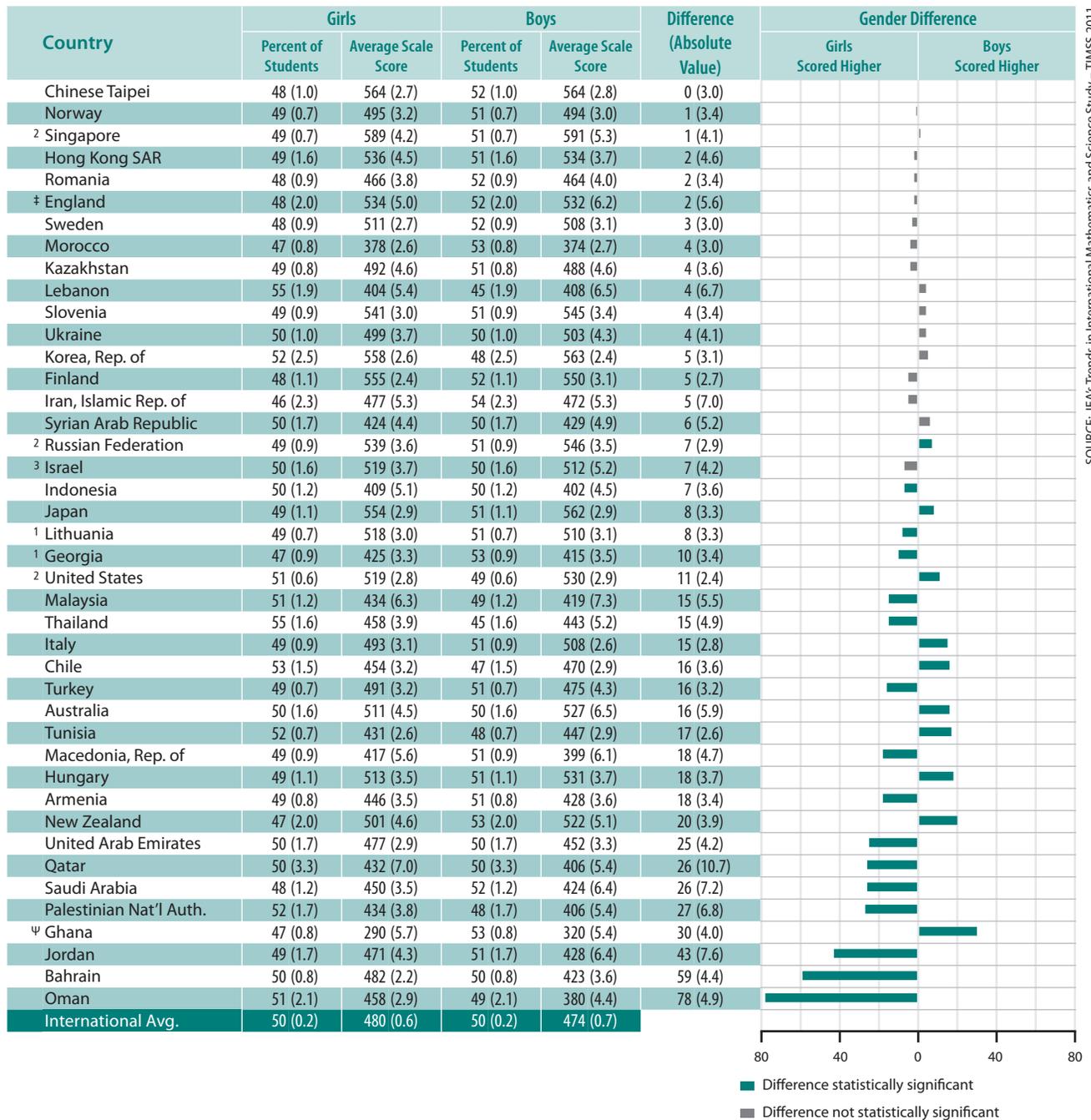
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

**Exhibit 1.10: Average Science Achievement by Gender (Continued)**



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

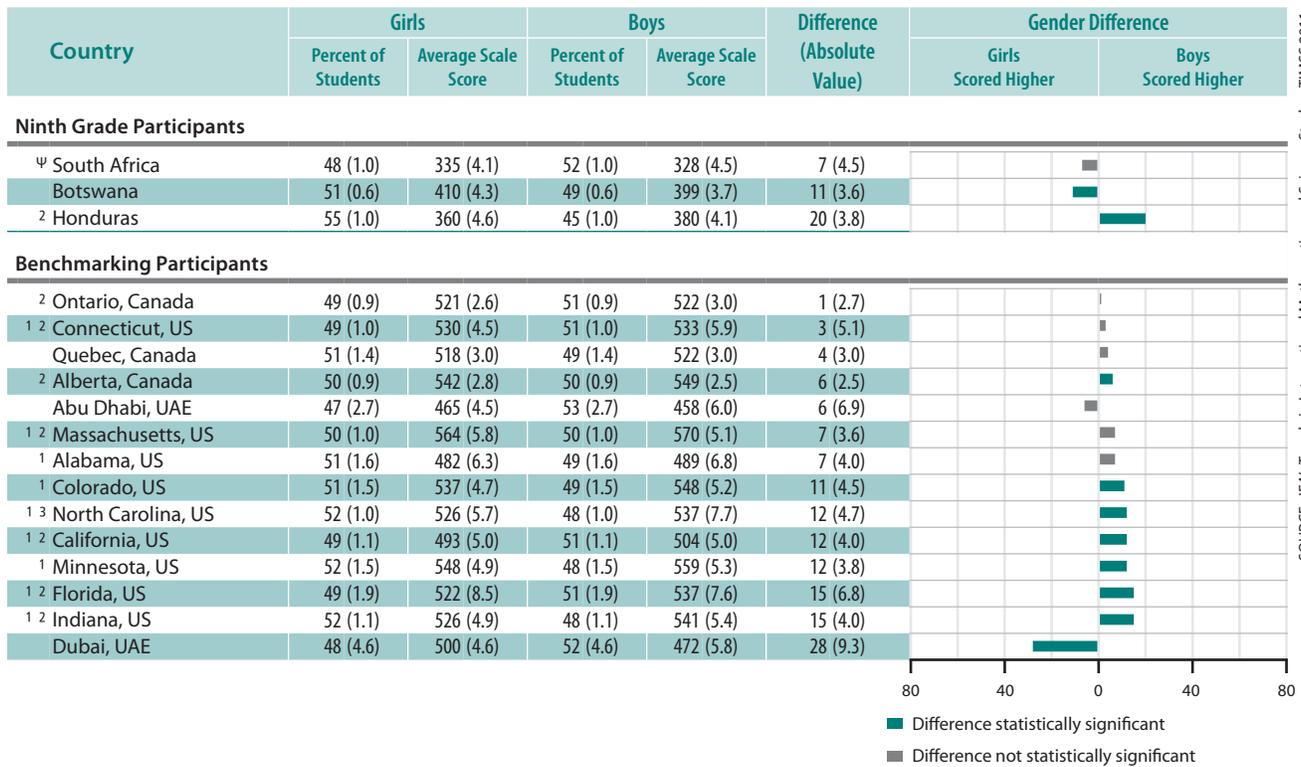
**Exhibit 1.11: Average Science Achievement by Gender**



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

<sup>ψ</sup> Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%. See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.  
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

**Exhibit 1.11: Average Science Achievement by Gender (Continued)**



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

### *Trends in Science Achievement by Gender*

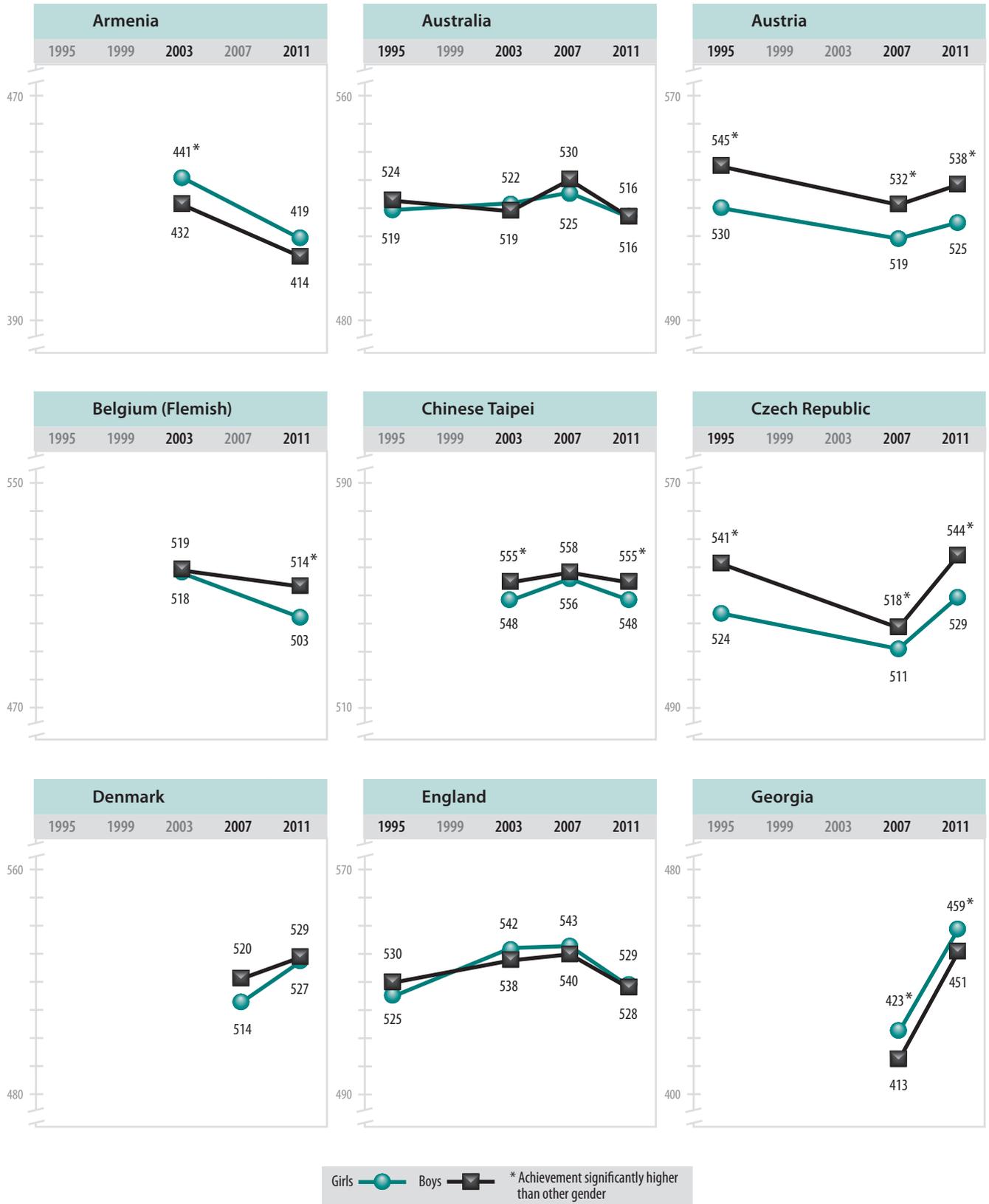
Exhibits 1.12 and 1.13 show graphic representations across the TIMSS assessments in science achievement of boys and girls for the fourth and eighth grades, respectively. For each country that participated in one or more of the previous TIMSS assessments, these displays show how trends in science achievement have been influenced by differential performance by boys and girls. Because there are many different patterns across countries, the countries are presented in alphabetical order. The scale interval is the same for each country (10 points) to permit comparisons, although the part of scale shown differs according to each country's average achievement. For countries with gender differences in science achievement, the displays reveal progress (or lack thereof) over time toward gender equity.

As described in the previous section, at the fourth grade, there is already gender equity in science achievement in many countries, but there are also countries where overall achievement is less than it might be if both boys and girls performed at the same high level. Countries in which fourth grade girls performed consistently below boys (i.e., in 2011 and on at least two other TIMSS assessments) include Austria, the Czech Republic, the Netherlands, and the United States. In Germany, Italy, and the Slovak Republic, boys had higher average achievement than girls on the two most recent assessments (2007 and 2011); while in Georgia and Tunisia, girls had higher achievement than boys on these two assessments. Armenia, Hungary, Iran, Japan, New Zealand, Norway, and Slovenia had gender differences in earlier assessments but not in TIMSS 2011.

At the eighth grade, with greater gender differences among countries than at the fourth grade, and data from across five TIMSS assessments, trends in science achievement for boys and girls follow a variety of paths. Boys consistently had higher achievement than girls (i.e., in 2011 and in one or more previous assessments) in nine countries: Australia, Chile, Ghana, Hungary, Italy, Japan, the Russian Federation, Tunisia, and the United States. A similar pattern of boys outperforming girls also occurred in four benchmarking participants: the states of Indiana, Minnesota, and North Carolina, and the province of Alberta. Conversely, in eight countries—Armenia, Bahrain, Georgia, Jordan, Macedonia, Oman, the Palestinian National Authority, and Thailand—girls had higher achievement than boys in 2011 and in one or more prior assessments; and twelve countries and four benchmarking participants showed no gender difference in 2011, despite having gender differences on one or more previous assessments. Gender differences in average science achievement followed a different pattern in Lithuania and Malaysia; in these countries, girls outperformed boys in 2011 although boys had outperformed girls in at least one prior assessment.

**Exhibit 1.12: Trends in Science Achievement by Gender<sup>◇</sup>**

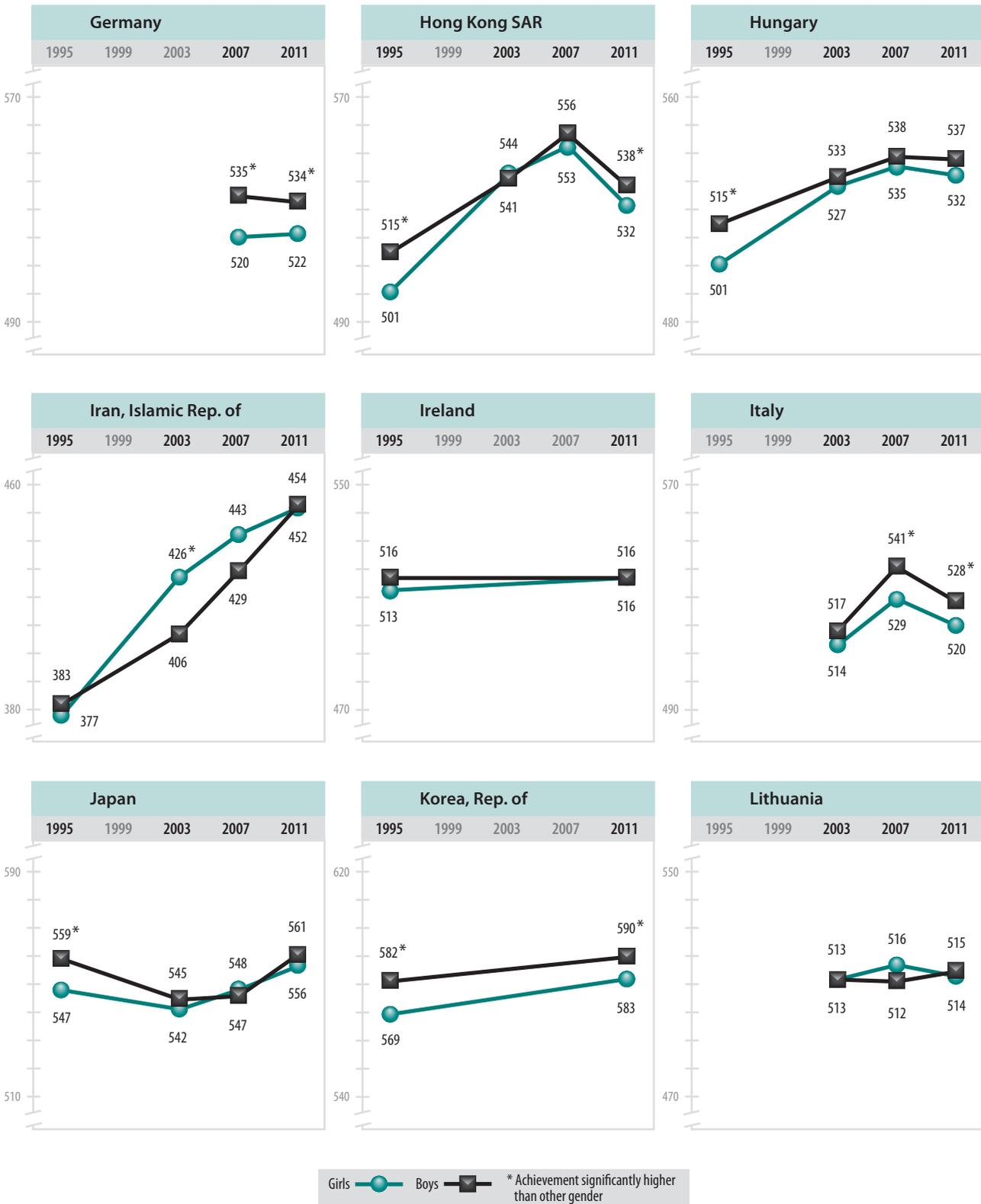
SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



<sup>◇</sup> No fourth-grade assessment in 1999.

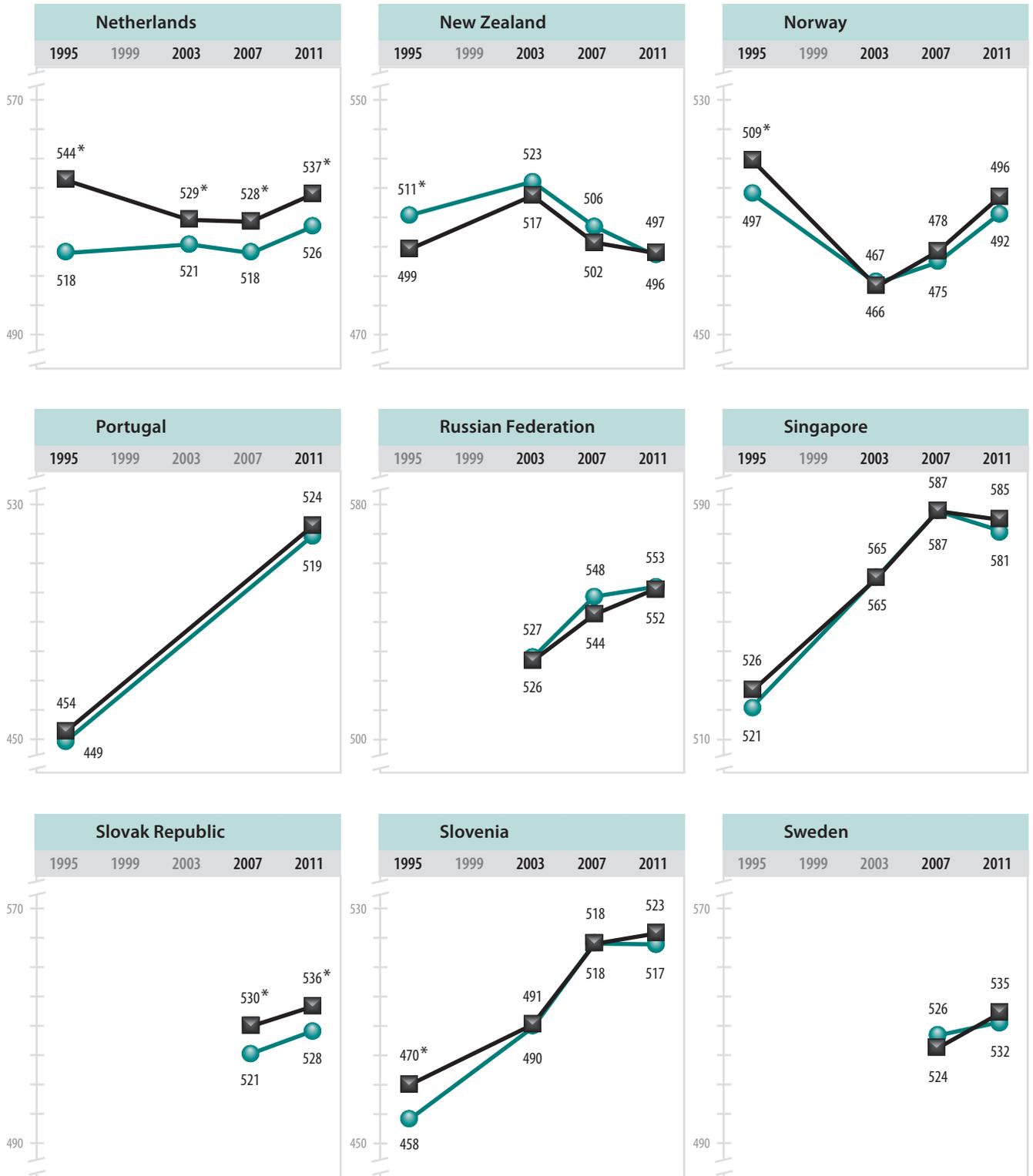
Scale interval is 10 points for each country, but the part of the scale shown differs according to each country's average achievement.

Exhibit 1.12: Trends in Science Achievement by Gender<sup>o</sup> (Continued)



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 1.12: Trends in Science Achievement by Gender<sup>o</sup> (Continued)

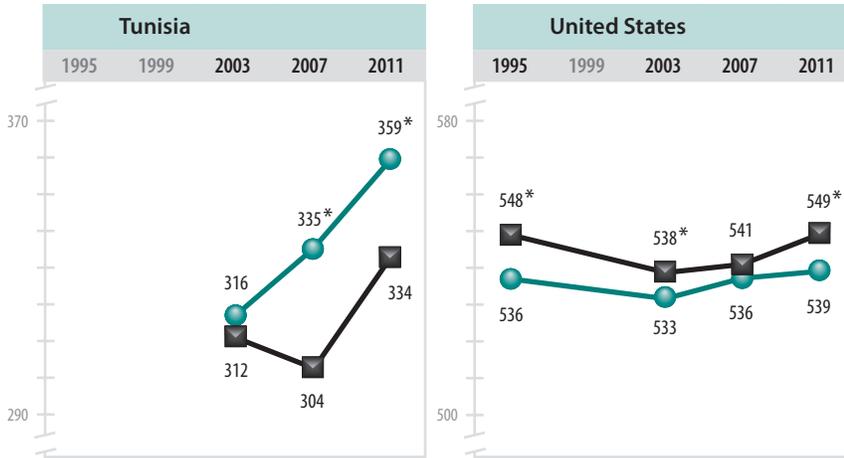


SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

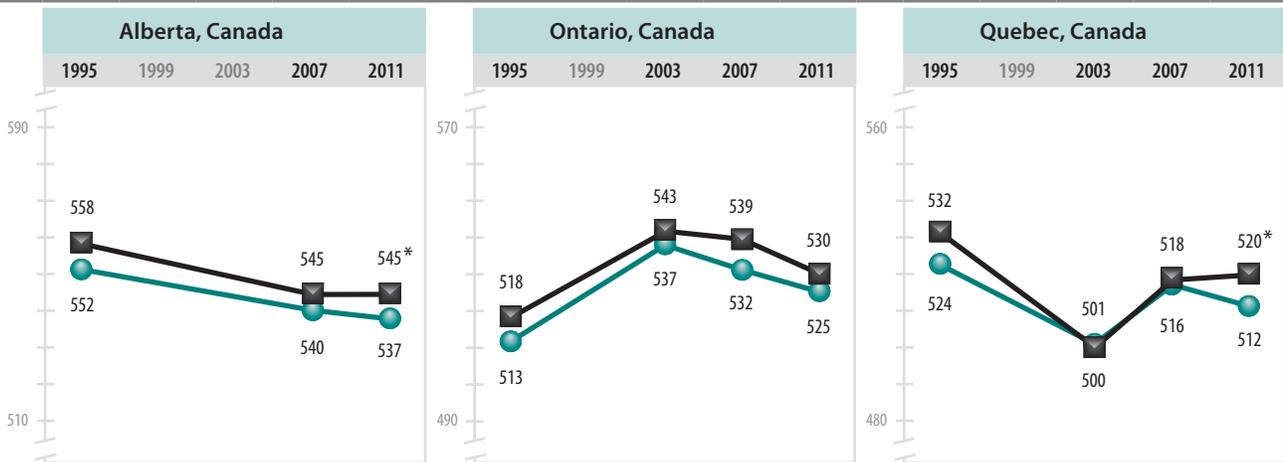
Girls ● Boys ■ \* Achievement significantly higher than other gender

**Exhibit 1.12: Trends in Science Achievement by Gender<sup>a</sup> (Continued)**

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



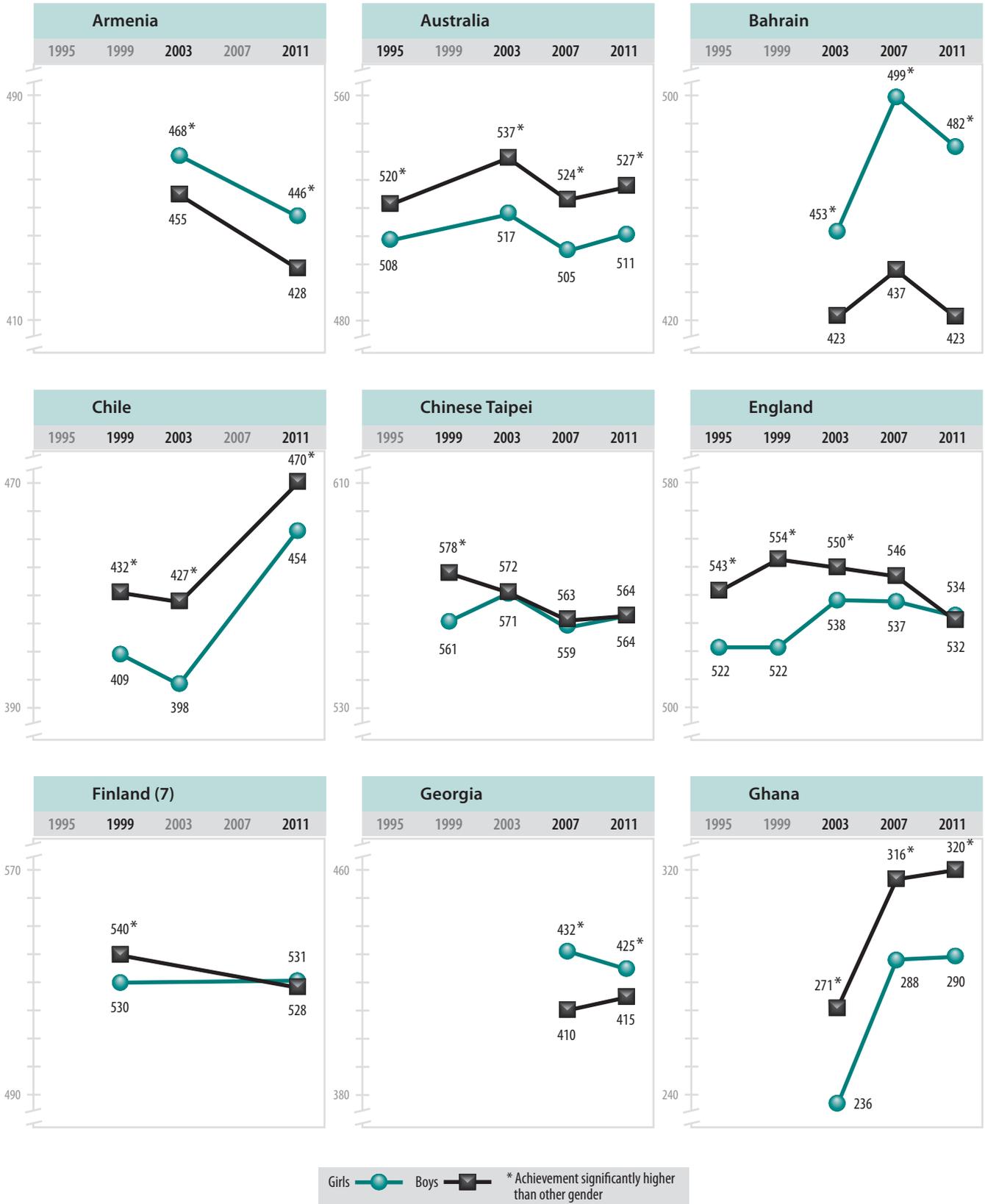
**Benchmarking Participants**



Girls ● Boys ■ \* Achievement significantly higher than other gender

**Exhibit 1.13: Trends in Science Achievement by Gender**

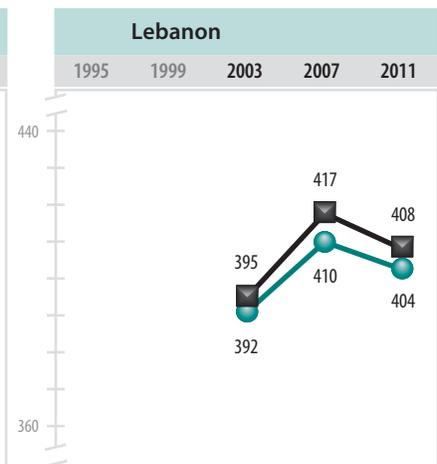
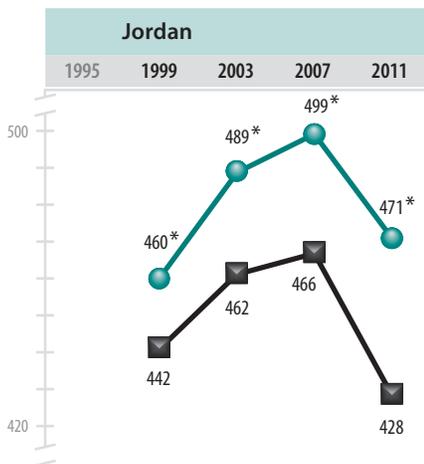
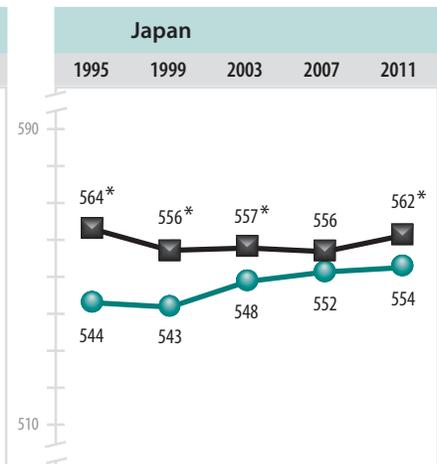
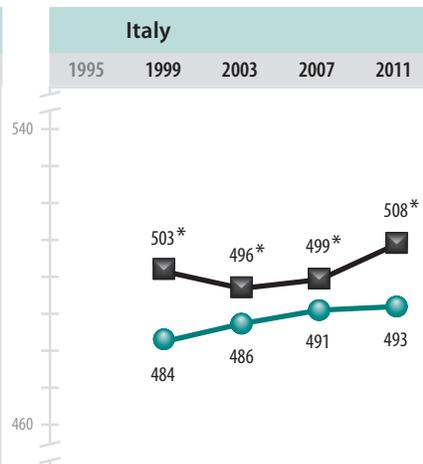
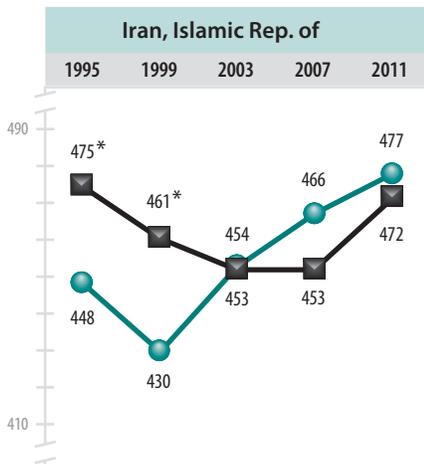
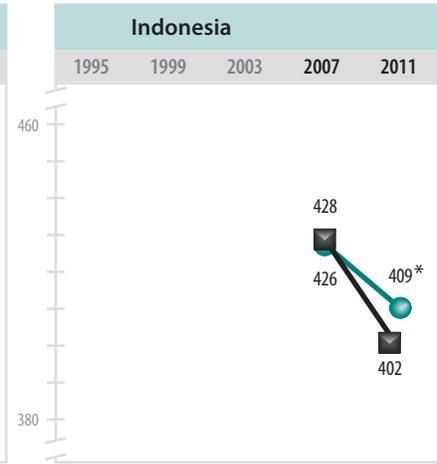
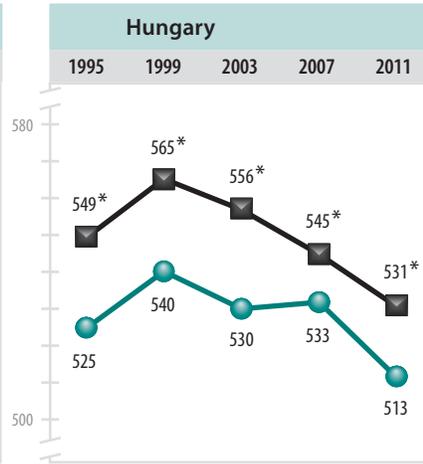
SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



Scale interval is 10 points for each country, but the part of the scale shown differs according to each country's average achievement.

**Exhibit 1.13: Trends in Science Achievement by Gender (Continued)**

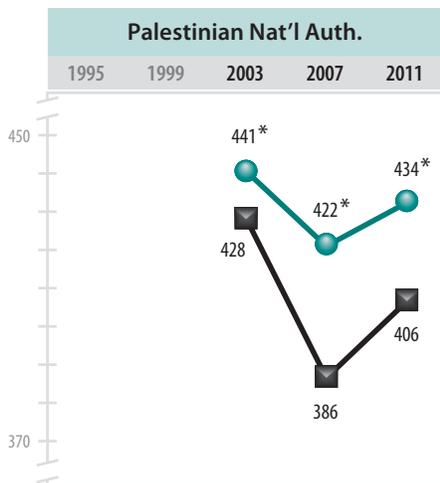
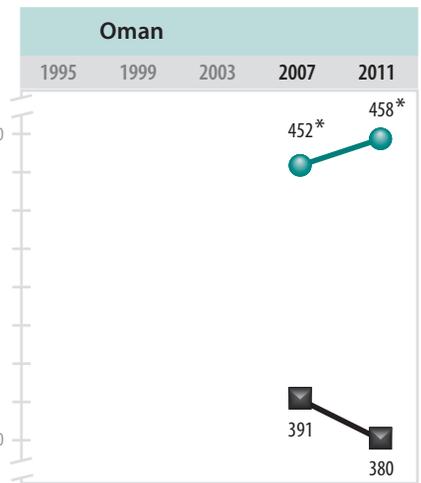
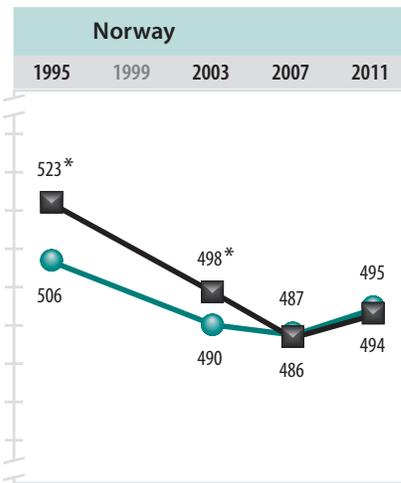
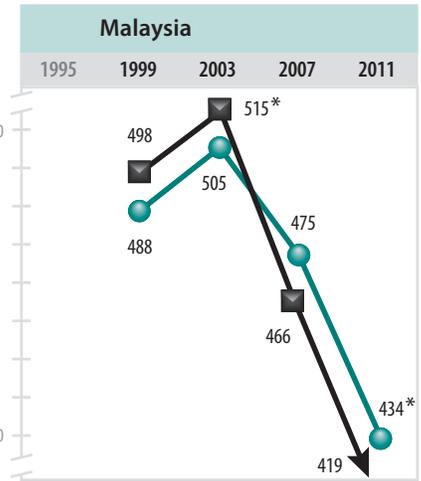
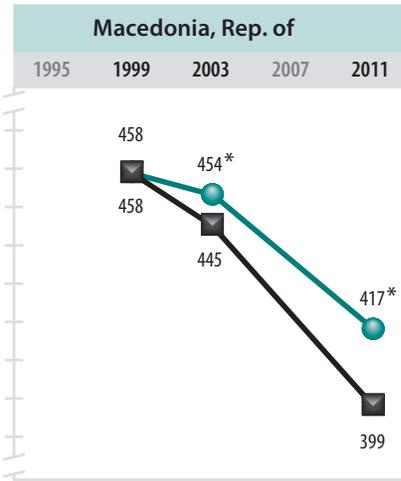
SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



Girls —●— Boys —■— \* Achievement significantly higher than other gender

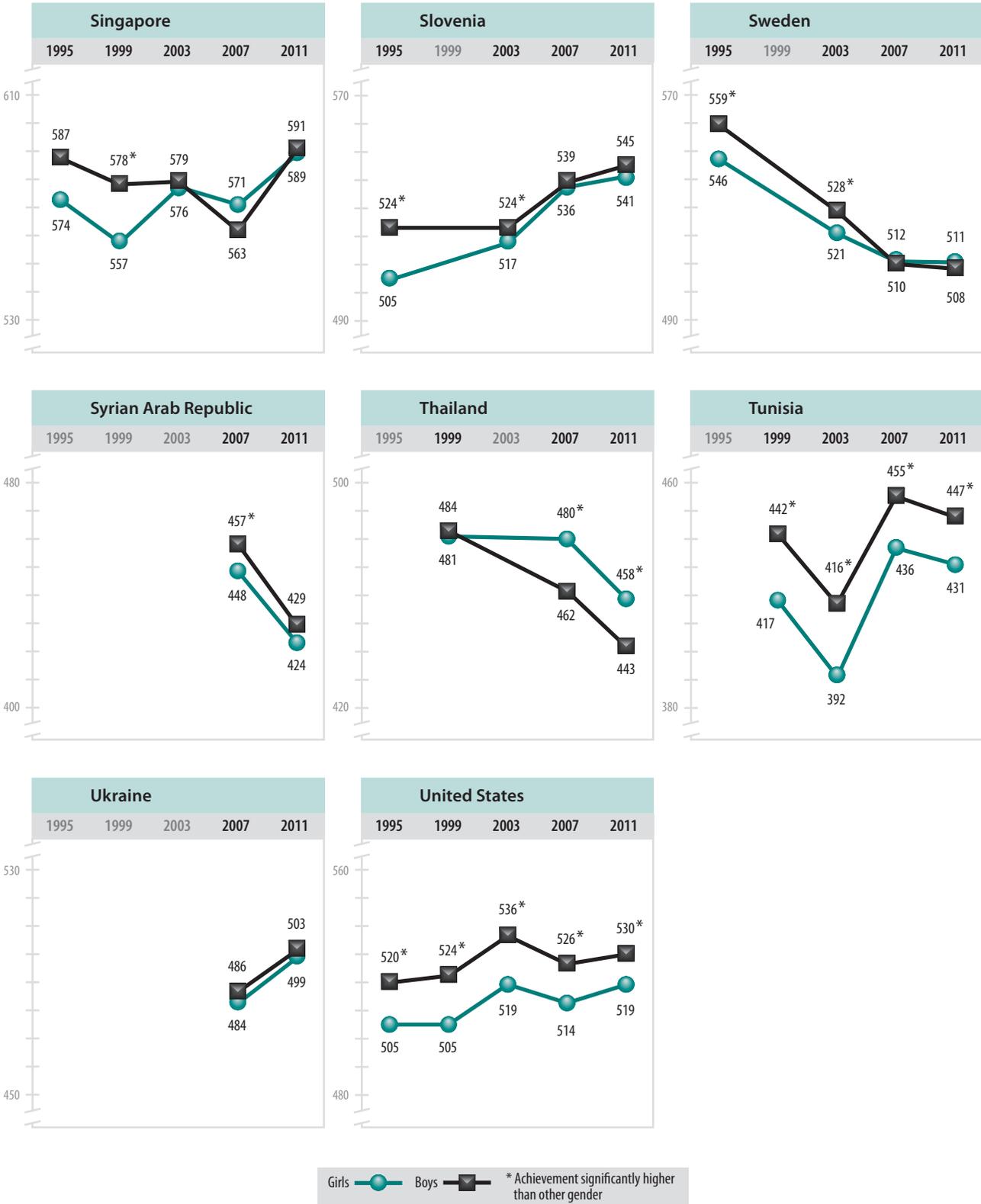
**Exhibit 1.13: Trends in Science Achievement by Gender (Continued)**

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



Girls —●— Boys —■— \* Achievement significantly higher than other gender

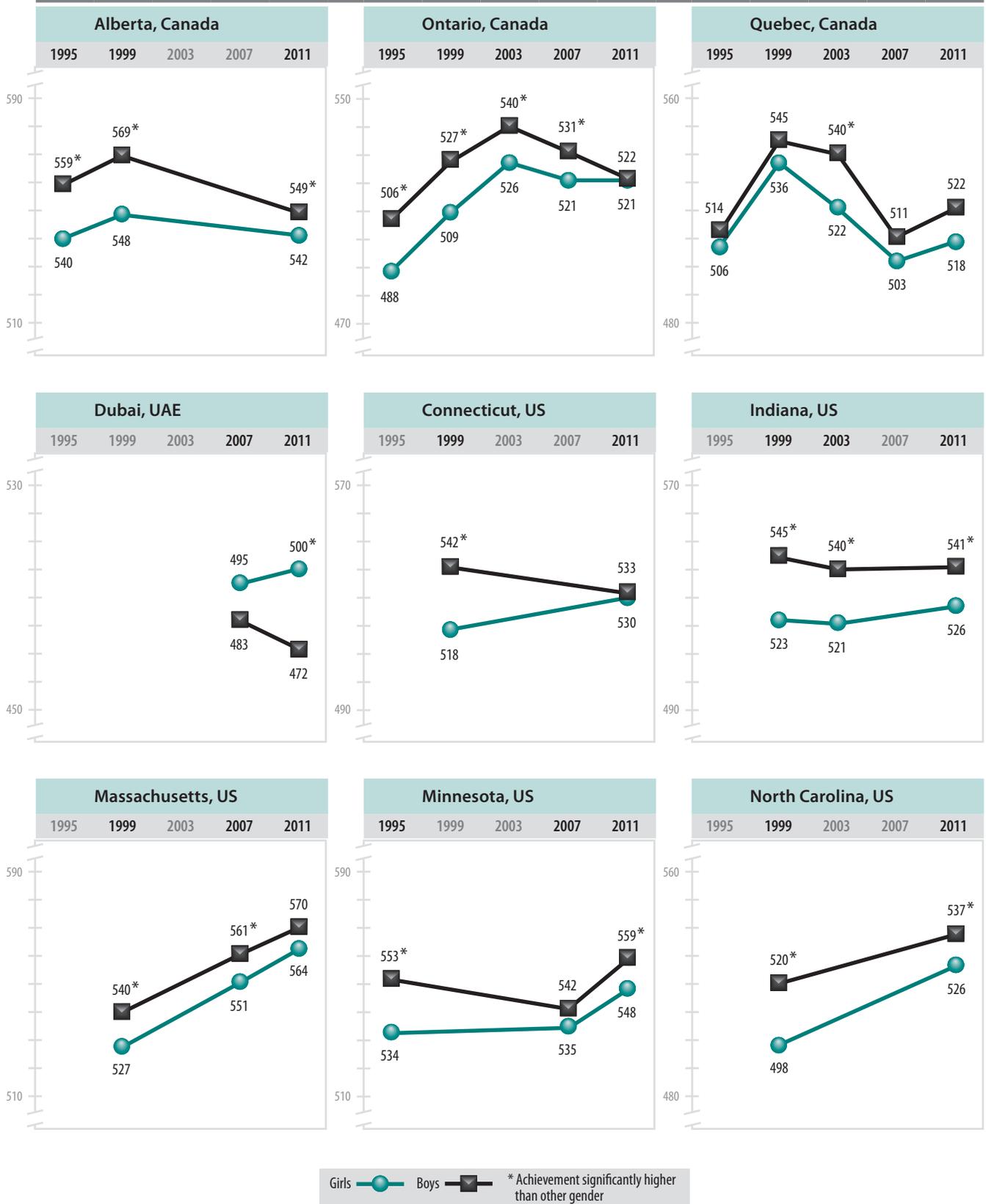
Exhibit 1.13: Trends in Science Achievement by Gender (Continued)



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 1.13: Trends in Science Achievement by Gender (Continued)

Benchmarking Participants



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



# Chapter 2

## Performance at the TIMSS 2011 International Benchmarks

One-third of the Singaporean students reached the fourth grade Advanced International Benchmark, as did 29 percent of students in Korea (median percentage across countries: 5%). At the eighth grade, four East Asian countries had the largest percentages of students reaching this advanced level of performance (18–40%).

Six countries raised achievement across their entire fourth grade student distribution, from low to high performers, and showed improvement across all four international benchmarks over the past decade. At the eighth grade, only three countries showed improvement across all benchmarks, and three had declines.

**TIMSS Science Benchmarks:**

**Advanced International Benchmark 625**

**High International Benchmark 550**

**Intermediate International Benchmark 475**

**Low International Benchmark 400**

The TIMSS achievement scale summarizes student performance on test items designed to measure breadth of knowledge in science content domains, as well as a range of cognitive processes within the knowing, applying, and reasoning domains. TIMSS reports achievement at four points along the scale as international benchmarks: Advanced International Benchmark (625), High International Benchmark (550), Intermediate International Benchmark (475), and Low International Benchmark (400).

This chapter presents the science results at the TIMSS 2011 International Benchmarks. To interpret achievement at the benchmarks, the TIMSS & PIRLS International Study Center worked with the TIMSS 2011 Science and Mathematics Item Review Committee (SMIRC) to conduct a detailed scale anchoring analysis to describe science achievement at the benchmarks. The chapter presents those descriptions along with a number of example items and related student performance data to illustrate performance at each of the benchmarks.

*TIMSS 2011 Science Framework*

The items used in TIMSS 2011 were selected and developed based on the TIMSS 2011 Science Framework contained in the *TIMSS 2011 Assessment Frameworks*. The science assessments at the fourth and eighth grade each were organized around two dimensions: a content dimension specifying the subject matter or content domains to be assessed, and a cognitive dimension specifying the thinking processes that students are likely to use as they engage with the content. As illustrated below, the fourth grade has three content domains: life science, physical science, and earth science. Life science received 45 percent of the assessment emphasis, physical science, 35 percent, and earth science, 20 percent. At the eighth grade, there are four content domains: biology, chemistry, physics, and earth science. Biology received 35 percent of

the assessment emphasis and physics received 25 percent and physics received 25 percent, while chemistry and earth science each received 20 percent. The same three cognitive domains—knowing, applying, and reasoning—were used at both the fourth and eighth grades, although there was a little less emphasis on knowing at eighth grade and somewhat more emphasis on reasoning.

Fourth Grade Content Domains	Eighth Grade Content Domains
45% Life Science	35% Biology
35% Physical Science	20% Chemistry
20% Earth Science	25% Physics
	20% Earth Science

Fourth Grade Cognitive Domains	Eighth Grade Cognitive Domains
40% Knowing	35% Knowing
40% Applying	35% Applying
20% Reasoning	30% Reasoning

● **Advanced International Benchmark**

**625** *Students apply knowledge and understanding of scientific processes and relationships and show some knowledge of the process of scientific inquiry.* Students communicate their understanding of characteristics and life processes of organisms, reproduction and development, ecosystems and organisms' interactions with the environment, and factors relating to human health. They demonstrate understanding of properties of light and relationships among physical properties of materials, apply and communicate their understanding of electricity and energy in practical contexts, and demonstrate an understanding of magnetic and gravitational forces and motion. Students communicate their understanding of the solar system and of Earth's structure, physical characteristics, resources, processes, cycles, and history. They have a beginning ability to interpret results in the context of a simple experiment, reason and draw conclusions from descriptions and diagrams, and evaluate and support an argument.

○ **High International Benchmark**

**550** *Students apply their knowledge and understanding of the sciences to explain phenomena in everyday and abstract contexts.* Students demonstrate some understanding of plant and animal structure, life processes, life cycles, and reproduction. They also demonstrate some understanding of ecosystems and organisms' interactions with their environment, including understanding of human responses to outside conditions and activities. Students demonstrate understanding of some properties of matter, electricity and energy, and magnetic and gravitational forces and motion. They show some knowledge of the solar system, and of Earth's physical characteristics, processes, and resources. Students demonstrate elementary knowledge and skills related to scientific inquiry. They compare, contrast, and make simple inferences, and provide brief descriptive responses combining knowledge of science concepts with information from both everyday and abstract contexts.

● **Intermediate International Benchmark**

**475** *Students have basic knowledge and understanding of practical situations in the sciences.* Students recognize some basic information related to characteristics of living things, their reproduction and life cycles, and their interactions with the environment, and show some understanding of human biology and health. They also show some knowledge of properties of matter and light, electricity and energy, and forces and motion. Students know some basic facts about the solar system and show an initial understanding of Earth's physical characteristics and resources. They demonstrate ability to interpret information in pictorial diagrams and apply factual knowledge to practical situations.

○ **Low International Benchmark**

**400** *Students show some elementary knowledge of life, physical, and earth sciences.* Students demonstrate knowledge of some simple facts related to human health, ecosystems, and the behavioral and physical characteristics of animals. They also demonstrate some basic knowledge of energy and the physical properties of matter. Students interpret simple diagrams, complete simple tables, and provide short written responses to questions requiring factual information.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

## Fourth Grade Results for the TIMSS 2011 International Benchmarks in Science

### *Fourth Grade TIMSS 2011 International Benchmarks of Science Achievement*

Exhibit 2.1 summarizes what fourth grade students scoring at the TIMSS International Benchmarks typically know and can do in science. Detailed descriptions of each benchmark level are presented together with example items in subsequent sections of the chapter.

There was substantial variation in performance between students achieving at the Advanced International Benchmark and the Low International Benchmark. At the fourth grade, students at the Advanced International Benchmark applied their knowledge and understanding of scientific processes and relationships across the four content domains, and showed some knowledge of the process of scientific inquiry. They had a beginning ability to interpret results in the context of a simple experiment, reason and draw conclusions from descriptions and diagrams, and evaluate and support an argument. Students at the High International Benchmark applied their knowledge and understanding of the sciences to explain phenomena in everyday and abstract contexts. They demonstrated elementary knowledge and skills related to scientific inquiry, and compared, contrasted, and made simple inferences. At the Intermediate International Benchmark, students had basic knowledge and understanding of practical situations in the sciences, and they demonstrated ability to interpret information in pictorial diagrams and applied factual knowledge to practical situations. Students at the Low International Benchmark had some elementary knowledge of life, physical, and earth sciences, and interpreted simple diagrams, completed simple tables, and provided short written responses to questions requiring factual information.

### *Fourth Grade Achievement at the TIMSS 2011 International Benchmarks of Science Achievement*

Exhibit 2.2 presents the percentage of students reaching each TIMSS 2011 International Benchmark for countries participating in the fourth grade assessment. The results are presented in descending order based on the percentage of students reaching the Advanced International Benchmark, first for fourth grade countries, followed by sixth grade countries and benchmarking participants on the second page. The percentage of students reaching the Advanced Benchmark is indicated in the bar graph with a black dot. Because students who reached the Advanced Benchmark also reached the other

benchmarks, the percentages illustrated in the graph and shown in the columns to the right are cumulative.

At the fourth grade, the countries with the largest percentages of students reaching the Advanced International Benchmark also were the countries with the highest average science achievement (see Chapter 1). The two countries with the highest achievement—Singapore and Korea—had the largest percentages of students reaching the Advanced International Benchmark. One-third of the Singaporean fourth grade students reached the Advanced Benchmark, as did 29 percent of the Korean students. Twenty percent of the students in Finland reached this level, followed by the Russian Federation (16%), Chinese Taipei (15%), the United States (15%), and Japan (14%).

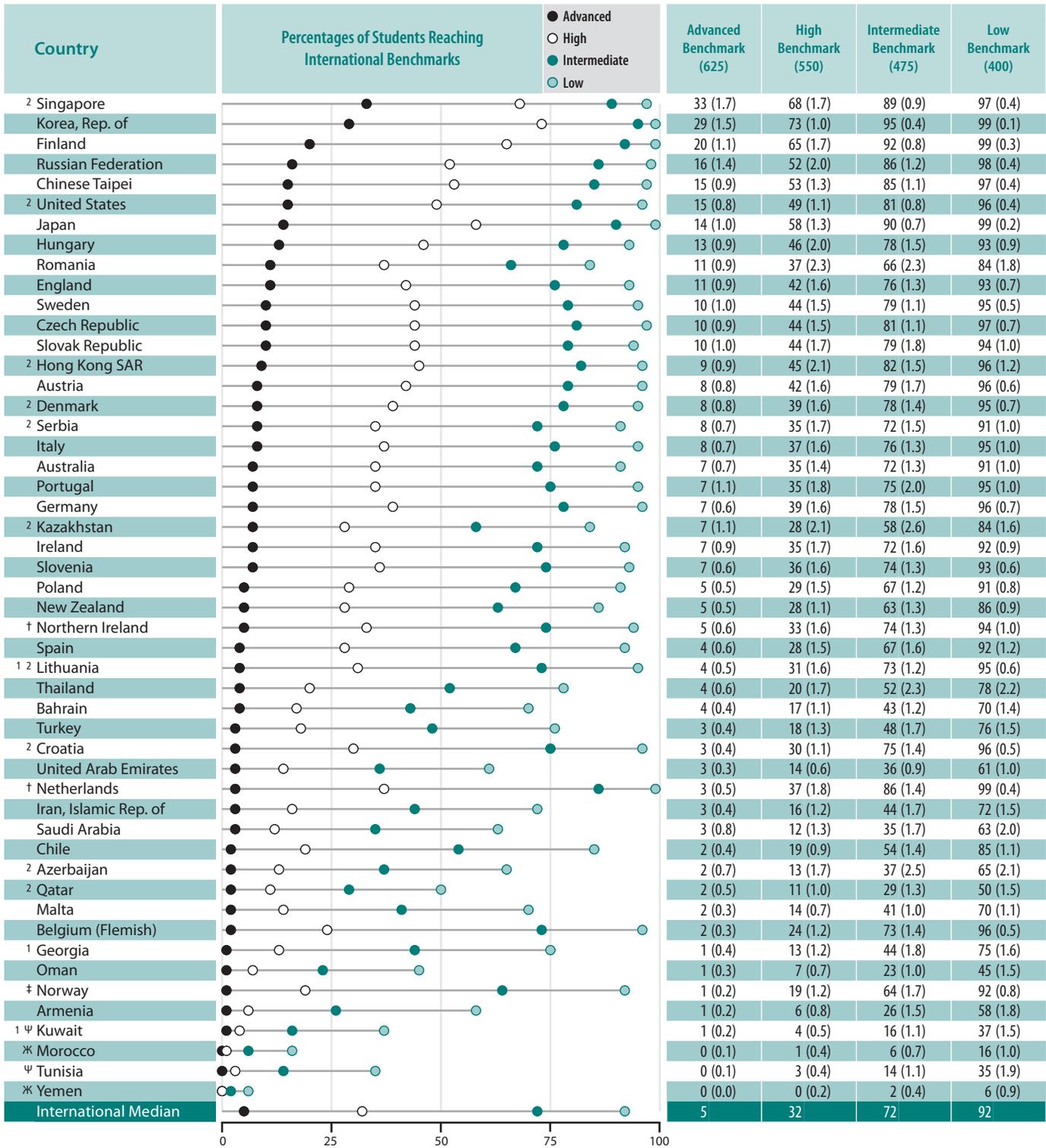
Exhibit 2.2 also provides useful information about the distribution of achievement in each country. For example, even though the Netherlands had many fewer students (3%) reaching the advanced level than did the top-performing countries, the percentages of fourth grade students from the Netherlands reaching the intermediate level (86%) and low level (99%) were comparable to the percentages reaching these levels among the highest-performing countries.

As a point of reference, Exhibit 2.2 provides the median for each of the benchmarks at the bottom of each of the four right hand columns. By definition, half of the countries will have a percentage in the column above the median and half will be below the median. The median percentages of students reaching the International Benchmarks were as follows: Advanced—5 percent, High—32 percent, Intermediate—72 percent, and Low—92 percent. The high median percentage of students reaching the low level indicates that many countries are able to educate almost all of their fourth grade students to a basic level of science achievement.

#### *Fourth Grade Trends in Performance at the TIMSS 2011 International Benchmarks of Science Achievement*

Exhibit 2.3 shows the changes in percentages of fourth grade students reaching the four benchmarks for countries and benchmarking participants that also participated in TIMSS 1995, 2003, and/or 2007. An up arrow indicates that the percentage of students reaching a benchmark is higher in 2011 than in the past cycle, and a down arrow indicates that the percentage is lower in 2011. The patterns in this exhibit generally mirror the trends in average achievement discussed in Chapter 1, and can provide further information about countries' improvement or decline over time.

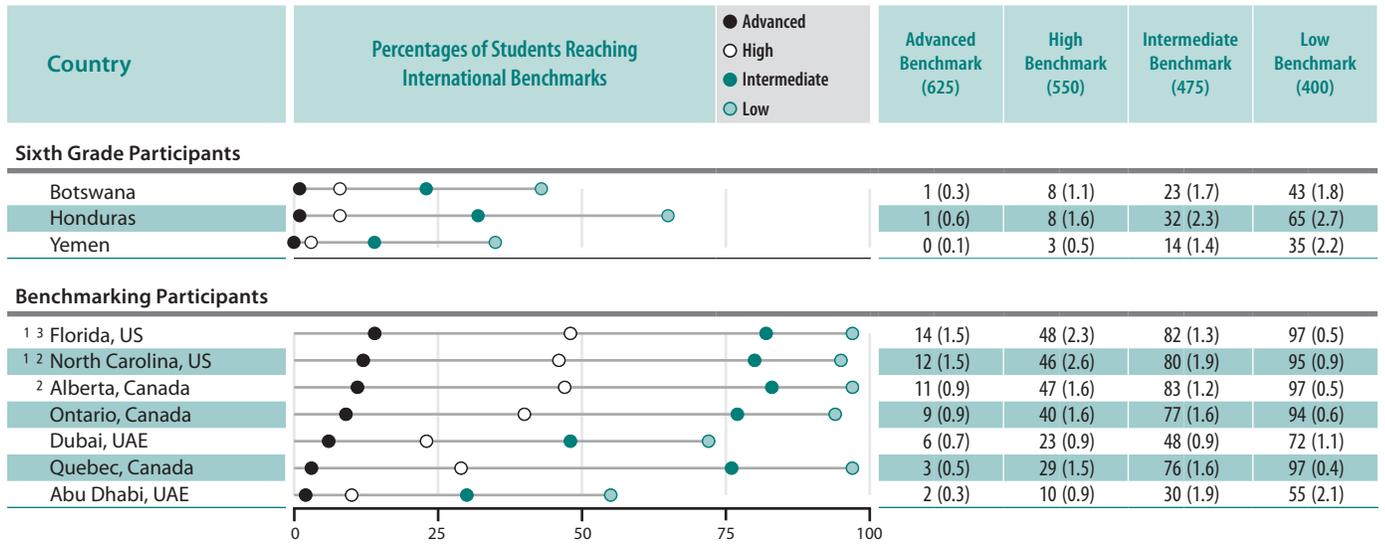
**Exhibit 2.2: Performance at the International Benchmarks of Science Achievement**



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

⌘ Average achievement not reliably measured because the percentage of students with achievement too low for estimation exceeds 25%.  
 Ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.  
 See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.  
 (†) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

**Exhibit 2.2: Performance at the International Benchmarks of Science Achievement (Continued)**



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 2.3: Trends in Percentages of Students Reaching the International Benchmarks of Science Achievement**

Country	Advanced International Benchmark (625)				High International Benchmark (550)			
	Percent of Students				Percent of Students			
	2011	2007	2003	1995	2011	2007	2003	1995
Singapore	33	36	25 ▲	14 ▲	68	68	61 ▲	42 ▲
Korea, Rep. of	29			22 ▲	73			67 ▲
Russian Federation	16	16	11 ▲		52	49	39 ▲	
Chinese Taipei	15	19 ▼	14		53	55	52	
United States	15	15	13	19 ▼	49	47	45 ▲	50
Japan	14	12	12	15	58	51 ▲	49 ▲	54 ▲
Hungary	13	13	10 ▲	7 ▲	46	47	42	32 ▲
England	11	14 ▼	15 ▼	15 ▼	42	48 ▼	47 ▼	42
Sweden	10	8			44	37 ▲		
Czech Republic	10	7 ▲		12	44	33 ▲		42
Slovak Republic	10	11			44	42		
Hong Kong SAR	9	14 ▼	7	5 ▲	45	55 ▼	47	30 ▲
Austria	8	9		13 ▼	42	39		45
Denmark	8	7			39	35 ▲		
Italy	8	13 ▼	9		37	44 ▼	35	
Australia	7	10 ▼	9	13 ▼	35	41 ▼	38	40 ▼
Portugal	7			2 ▲	35			13 ▲
Germany	7	10 ▼			39	41		
Ireland	7			8	35			36
Slovenia	7	6	3 ▲	2 ▲	36	36	22 ▲	14 ▲
New Zealand	5	8 ▼	9 ▼	11 ▼	28	32 ▼	38 ▼	35 ▼
Lithuania	4	3	3		31	30	30	
Netherlands	3	4	3	6 ▼	37	34	32 ▲	38
Iran, Islamic Rep. of	3	2 ▲	1 ▲	0 ▲	16	12 ▲	7 ▲	3 ▲
Belgium (Flemish)	2		2		24		28 ▼	
Georgia	1	1			13	5 ▲		
Norway	1	1	2	8 ▼	19	17	15 ▲	32 ▼
Armenia	1		2		6		10 ▼	
Ψ Tunisia	0	0	0		3	3	2	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Benchmarking Participants**

Alberta, Canada	11	12		21 ▼	47	48		57 ▼
Ontario, Canada	9	12	13 ▼	10	40	45 ▼	47 ▼	37
Dubai, UAE	6	4			23	21 ▲		
Quebec, Canada	3	5 ▼	3	9 ▼	29	32	25 ▲	40 ▼

- ▲ 2011 percent significantly higher
- ▼ 2011 percent significantly lower

Ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%. Such annotations in exhibits with trend data began in 2011, so data from assessments prior to 2011 are not annotated for reservations. An empty cell indicates a country did not participate in that year's assessment.

**Exhibit 2.3: Trends in Percentages of Students Reaching the International Benchmarks of Science Achievement (Continued)**

Country	Intermediate International Benchmark (475)				Low International Benchmark (400)			
	Percent of Students				Percent of Students			
	2011	2007	2003	1995	2011	2007	2003	1995
Singapore	89	88	86	71 ▲	97	96	95	89 ▲
Korea, Rep. of	95			93 ▲	99			99
Russian Federation	86	82	74 ▲		98	96 ▲	93 ▲	
Chinese Taipei	85	86	87		97	97	98 ▼	
United States	81	78 ▲	78 ▲	78 ▲	96	94 ▲	94 ▲	92 ▲
Japan	90	86 ▲	84 ▲	87 ▲	99	97 ▲	96 ▲	97 ▲
Hungary	78	78	76	67 ▲	93	93	94	90
England	76	81 ▼	79	72	93	95 ▼	94	90 ▲
Sweden	79	76			95	95		
Czech Republic	81	72 ▲		77 ▲	97	93 ▲		95 ▲
Slovak Republic	79	75			94	92		
Hong Kong SAR	82	88 ▼	87 ▼	69 ▲	96	98	98 ▼	91 ▲
Austria	79	76		79	96	93 ▲		94
Denmark	78	72 ▲			95	93 ▲		
Italy	76	78	70 ▲		95	94	91 ▲	
Australia	72	76 ▼	74	72	91	93	92	89
Portugal	75			43 ▲	95			73 ▲
Germany	78	76			96	94 ▲		
Ireland	72			70	92			91
Slovenia	74	74	61 ▲	45 ▲	93	93	87 ▲	79 ▲
New Zealand	63	65	73 ▼	66	86	87	91 ▼	85
Lithuania	73	74	73		95	95	95	
Netherlands	86	79 ▲	83	82 ▲	99	97	99	98
Iran, Islamic Rep. of	44	36 ▲	28 ▲	15 ▲	72	65 ▲	58 ▲	42 ▲
Belgium (Flemish)	73		79 ▼		96		98 ▼	
Georgia	44	26 ▲			75	59 ▲		
Norway	64	54 ▲	49 ▲	65	92	84 ▲	79 ▲	88 ▲
Armenia	26		38 ▼		58		66 ▼	
Ψ Tunisia	14	14	10 ▲		35	32	27 ▲	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Benchmarking Participants**

Alberta, Canada	83	82		84	97	96		94
Ontario, Canada	77	79	81 ▼	71 ▲	94	95	96	90 ▲
Dubai, UAE	48	48			72	72		
Quebec, Canada	76	74	66 ▲	77	97	96	91 ▲	94 ▲

▲ 2011 percent significantly higher

▼ 2011 percent significantly lower

In general, there were more improvements across the International Benchmarks in 2011 than there were declines. Six countries have improved since 1995 at all four benchmarks: Singapore, Korea (with a ceiling effect at the Low Benchmark), Hong Kong SAR, Portugal, Slovenia, and Iran. Since 1995, Japan had gains at all except the Advanced Benchmark, and Hungary had gains at all except the Low Benchmark. The United States, the Czech Republic, and the Canadian province of Ontario improved at the two lower benchmarks, although the United States also showed a decline in the percentage of students reaching the Advanced Benchmark since 1995.

No countries or benchmarking participants showed declines in the percentages of students at the intermediate or low levels since 1995. However, in addition to the United States, six other countries showed declines at the advanced level (England, Austria, Australia, New Zealand, the Netherlands, and Norway), and three of these also showed declines at the high level (Australia, New Zealand, and Norway).

#### *Fourth Grade TIMSS 2011 Low International Benchmark*

Exhibit 2.4 presents the detailed description of student achievement at the Low International Benchmark. At this benchmark, students had some elementary knowledge of life, physical, and earth sciences, and interpreted simple diagrams, completed simple tables, and provided short written responses to questions requiring factual information.

As specified in the TIMSS 2011 Science Framework, almost half of the fourth grade assessment (45%) was devoted to items in the life science domain. Several items answered correctly by students achieving at the lower scale levels assessed knowledge of characteristics and life processes of living things, one of the topics in the TIMSS Framework. Exhibit 2.5 presents Example Item 1, a question requiring students to apply elementary knowledge about the physical characteristics of animals and illustrating performance at the Low International Benchmark. With an international average of 83 percent correct across the fourth grade countries, this item was relatively easy for students in most countries.

Exhibit 2.6 presents Example Item 2, in which students must interpret a simple diagram and recognize that an iron nail completes an electric circuit. This elementary knowledge of physical science exemplifies the Low International Benchmark, where students demonstrated some basic knowledge of physical properties of matter. The international average was 71 percent correct, and this item was relatively easy for students in many countries.

● **Low International Benchmark**

**400**

**Summary**

*Students show some elementary knowledge of life, physical, and earth sciences. Students demonstrate knowledge of some simple facts related to human health, ecosystems, and the behavioral and physical characteristics of animals. They also demonstrate some basic knowledge of energy and the physical properties of matter. Students interpret simple diagrams, complete simple tables, and provide short written responses to questions requiring factual information.*

In life science, students demonstrate knowledge of some simple facts related to human health. For example, they state one effect the Sun can have on unprotected skin and name one thing humans can do to maintain good physical health. They also demonstrate some knowledge of behavioral and physical characteristics of animals. Students recognize that fat layers help keep some animals warm, that wings are common to birds, bats, and butterflies, and that birds sit on their eggs to keep them warm. Students exhibit an elementary understanding of ecosystems. They recognize a predator in a list of animals and match animals to their ecosystems.

In physical science, students demonstrate some basic knowledge of energy and the physical properties of matter. For example, they recognize that an iron nail can complete an electrical circuit and allow a light bulb to glow, and they identify wind as the cause of movement in a sail boat. Students recognize that the vibrations that produce sound in a guitar start with the strings and, from a diagram, recognize which of a set of thermometer readings shows the hottest water.

In earth science, students identify one way people use air and they identify a planet other than Earth that orbits the Sun.

Students interpret simple diagrams, complete simple tables, and provide short written responses to questions requiring factual information.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 2.5: Low International Benchmark – Example Item 1**

Country	Percent Correct
Korea, Rep. of	99 (0.3) ▲
<sup>2</sup> United States	96 (0.5) ▲
<sup>2</sup> Croatia	95 (0.9) ▲
<sup>2</sup> Singapore	95 (0.7) ▲
Finland	95 (0.9) ▲
Sweden	95 (0.9) ▲
Ireland	95 (0.9) ▲
Austria	94 (0.9) ▲
England	94 (1.4) ▲
‡ Norway	93 (1.3) ▲
Germany	93 (1.1) ▲
New Zealand	93 (1.2) ▲
Portugal	92 (1.3) ▲
Russian Federation	92 (1.0) ▲
Australia	92 (1.5) ▲
Slovenia	91 (1.3) ▲
† Netherlands	91 (1.5) ▲
† Northern Ireland	91 (2.0) ▲
<sup>2</sup> Denmark	91 (1.3) ▲
<sup>2</sup> Serbia	91 (1.4) ▲
Czech Republic	90 (1.6) ▲
Poland	90 (1.4) ▲
Slovak Republic	89 (1.5) ▲
Italy	89 (1.6) ▲
<sup>1 2</sup> Lithuania	89 (1.4) ▲
Belgium (Flemish)	88 (1.4) ▲
Spain	87 (1.3) ▲
Japan	87 (1.5) ▲
Thailand	86 (1.5)
<sup>1</sup> Georgia	86 (2.1)
Hungary	84 (1.6)
Chile	84 (1.5)
<b>International Avg.</b>	<b>83 (0.2)</b>
Armenia	83 (1.7)
Chinese Taipei	83 (1.5)
Romania	83 (2.7)
Malta	82 (1.6)
<sup>2</sup> Hong Kong SAR	79 (2.1)
<sup>2</sup> Kazakhstan	79 (1.8) ▼
Turkey	79 (1.5) ▼
Bahrain	75 (2.1) ▼
<sup>2</sup> Azerbaijan	75 (2.1) ▼
United Arab Emirates	74 (1.1) ▼
Saudi Arabia	70 (1.9) ▼
Iran, Islamic Rep. of	62 (2.1) ▼
<sup>2</sup> Qatar	62 (2.1) ▼
Tunisia	61 (2.7) ▼
Oman	61 (1.6) ▼
<sup>1</sup> Kuwait	54 (2.1) ▼
Morocco	47 (2.3) ▼
Yemen	31 (2.3) ▼

**Content Domain: Life Science**  
**Cognitive Domain: Applying**  
**Description: Recognizes that wings are common to birds, bats, and butterflies**

What do birds, bats and butterflies have in common?

(A) feathers  
 (B) hair  
 (C) internal skeleton  
 wings

Country	Percent Correct
<b>Sixth Grade Participants</b>	
Honduras	77 (2.2) ▼
Botswana	52 (2.0) ▼
Yemen	52 (2.3) ▼

Country	Percent Correct
<b>Benchmarking Participants</b>	
<sup>1 3</sup> Florida, US	97 (1.0) ▲
<sup>2</sup> Alberta, Canada	96 (0.9) ▲
<sup>1 2</sup> North Carolina, US	95 (1.2) ▲
Ontario, Canada	93 (1.0) ▲
Quebec, Canada	92 (1.5) ▲
Dubai, UAE	79 (1.6) ▼
Abu Dhabi, UAE	70 (2.3) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and †. ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 2.6: Low International Benchmark – Example Item 2**

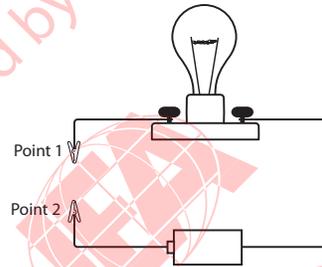
Country	Percent Correct
Japan	94 (1.1) ▲
Chinese Taipei	94 (1.1) ▲
<sup>2</sup> Singapore	94 (1.0) ▲
Austria	89 (1.3) ▲
Germany	88 (1.4) ▲
Slovak Republic	87 (1.7) ▲
Finland	86 (1.8) ▲
<sup>2</sup> United States	84 (1.2) ▲
<sup>2</sup> Hong Kong SAR	84 (1.6) ▲
England	84 (1.7) ▲
Korea, Rep. of	83 (1.6) ▲
Iran, Islamic Rep. of	82 (1.8) ▲
Sweden	79 (2.0) ▲
Portugal	79 (2.1) ▲
Belgium (Flemish)	78 (1.8) ▲
Czech Republic	77 (2.2) ▲
Slovenia	76 (2.3) ▲
Ireland	76 (2.0) ▲
<sup>2</sup> Serbia	76 (2.2) ▲
<sup>†</sup> Northern Ireland	75 (2.2)
<sup>2</sup> Denmark	75 (2.1)
Malta	75 (2.1)
Romania	74 (2.2)
Poland	74 (2.1)
<sup>1 2</sup> Lithuania	74 (2.0)
New Zealand	74 (1.7)
Australia	74 (1.9)
Hungary	73 (2.1)
<sup>2</sup> Croatia	73 (1.9)
Russian Federation	72 (2.2)
<b>International Avg.</b>	<b>71 (0.3)</b>
Spain	71 (2.2)
Oman	68 (1.8)
Thailand	68 (2.5)
<sup>‡</sup> Norway	67 (2.2)
Turkey	63 (1.5) ▼
<sup>2</sup> Kazakhstan	62 (2.7) ▼
Italy	62 (2.7) ▼
<sup>†</sup> Netherlands	62 (2.4) ▼
<sup>2</sup> Qatar	61 (2.1) ▼
United Arab Emirates	61 (1.4) ▼
Armenia	60 (2.4) ▼
Chile	59 (1.9) ▼
<sup>2</sup> Azerbaijan	57 (3.3) ▼
Bahrain	57 (2.0) ▼
<sup>1</sup> Georgia	56 (2.2) ▼
Saudi Arabia	53 (2.8) ▼
Tunisia	46 (2.6) ▼
Morocco	43 (2.3) ▼
Yemen	36 (1.9) ▼
<sup>1</sup> Kuwait	34 (2.0) ▼

**Content Domain: Physical Science**

**Cognitive Domain: Applying**

**Description: From a simple circuit diagram, recognizes that an iron nail can complete an electrical circuit**

The following picture shows a lightbulb connected to a battery in an electrical circuit. Which of the following objects connected to Points 1 and 2 will allow the bulb to glow?



- iron nail
- Ⓐ plastic spoon
- Ⓑ rubber band
- Ⓓ wooden stick

Country	Percent Correct
<b>Sixth Grade Participants</b>	
Botswana	68 (2.1)
Yemen	59 (2.5) ▼
Honduras	59 (2.3) ▼

Country	Percent Correct
<b>Benchmarking Participants</b>	
<sup>1 2</sup> North Carolina, US	91 (1.8) ▲
<sup>1 3</sup> Florida, US	80 (2.0) ▲
<sup>2</sup> Alberta, Canada	78 (1.8) ▲
Ontario, Canada	76 (1.8) ▲
Quebec, Canada	71 (2.2)
Dubai, UAE	69 (2.3)
Abu Dhabi, UAE	58 (2.7) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.  
 ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

### *Fourth Grade TIMSS 2011 Intermediate International Benchmark*

Exhibit 2.7 provides the detailed description of student achievement at the Intermediate International Benchmark. At this level, students had basic knowledge and understanding of practical situations in the sciences, and they demonstrated ability to interpret information in pictorial diagrams and apply factual knowledge to practical situations. The majority of students in most countries reached this benchmark.

As mentioned in discussing performance at the low level (Example Item 1), characteristics and life processes of living things was a topic in the TIMSS Science Framework. Example Item 3 in Exhibit 2.8 is a slightly more difficult life science item that requires students to pair three animals with their distinguishing biological characteristics. In TIMSS 2011, some of the constructed response items were worth 1 point and some 2 points, and the illustrative answers provided with the example items always show an answer that received full credit. The number of possible points for each constructed response item is indicated across the bottom of the exhibit. In this item, students who correctly identified the monkey, grasshopper, and octopus received the maximum score of 1 point. The international average percent correct was 58 percent, with a considerable range in performance across countries. In Korea, Singapore, and Hungary, the percent correct was 80 percent or more, compared to 16 percent or less in Morocco and Yemen.

Exhibit 2.9 presents Example Item 4, a constructed response item from the domain of earth science exemplifying the basic, practical knowledge that characterizes student performance at the Intermediate Benchmark. Students answering this item correctly stated one form of energy the Earth receives from the sun. On average, across fourth grade countries, 54 percent of students answered correctly.

● Intermediate International Benchmark

475 Summary

*Students have basic knowledge and understanding of practical situations in the sciences.* Students recognize some basic information related to characteristics of living things, their reproduction and life cycles, and their interactions with the environment, and show some understanding of human biology and health. They also show some knowledge of properties of matter and light, electricity and energy, and forces and motion. Students know some basic facts about the solar system and show an initial understanding of Earth's physical characteristics and resources. They demonstrate ability to interpret information in pictorial diagrams and apply factual knowledge to practical situations.

In life science, students demonstrate some knowledge of the characteristics of living things. For example, students can identify a characteristic that all living things share. From pictures of animals, students pair each animal with its distinguishing biological characteristics (skeleton, milk production, number of legs). Students also recognize the stomach as an organ where digestion takes place. Students demonstrate knowledge of the interactions of living things with their environments as well as the impacts humans can have on their environment. They can complete a food chain and distinguish between human activities that have positive or negative effects on the environment. Students show some understanding of the reproduction and life cycles of organisms. They recognize that for mammals, a male and a female are needed to reproduce. Students also know that tadpoles hatch from frogs' eggs and the function of seeds. Students demonstrate knowledge of some basic facts related to human biology and health. They recognize that the body needs more oxygen during exercise. Students recognize common preventative health measures, including how people can protect their teeth from decay and the benefit of hand washing. They also recognize how influenza is transmitted.

In physical science, students show knowledge about some properties of matter and light. For example, from a list of common materials, students indicate which of them will burn; recognize the order of ice, liquid water, and steam from coldest to hottest; and recognize that salt water is a mixture. Students also recognize that an image of the sun in a lake results from sunlight reflecting off of water. Students show knowledge about some facts of electricity and energy and apply their knowledge to practical situations. Students identify electricity as the energy source for household objects. They recognize that a metal object can complete an electric circuit (e.g., in a flashlight) or could be the unknown, hidden component in a complete electric circuit. Students show and apply introductory knowledge of forces and motion. They state a reason why two objects of identical size and shape can travel different distances after a push and, from a diagram, they identify the direction of the force of Earth's gravity.

In earth science, students show an initial understanding of Earth's physical characteristics and resources. For example, they provide evidence for the existence of air by considering an inflated balloon, match a list of landscape features to their descriptions, and describe one thing people can do to avoid wasting water. In addition, students know some basic facts about the solar system. They can state one form of energy Earth receives from the Sun and state two planets other than Earth that orbit the Sun.

Students interpret information in pictorial diagrams, apply factual knowledge to everyday situations, and provide simple explanations for biological and physical phenomena.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent Full Credit
Korea, Rep. of	88 (1.4) ▲
<sup>2</sup> Singapore	83 (1.4) ▲
Hungary	80 (1.8) ▲
Italy	79 (1.9) ▲
<sup>2</sup> Denmark	76 (1.8) ▲
Slovak Republic	75 (1.9) ▲
Portugal	74 (2.0) ▲
Russian Federation	72 (2.5) ▲
Japan	70 (1.8) ▲
Australia	70 (2.0) ▲
<sup>2</sup> United States	69 (1.3) ▲
Chinese Taipei	69 (2.0) ▲
<sup>2</sup> Hong Kong SAR	69 (2.1) ▲
England	67 (2.4) ▲
Belgium (Flemish)	66 (1.8) ▲
Germany	66 (2.3) ▲
† Northern Ireland	66 (2.5) ▲
Sweden	65 (2.4) ▲
<sup>2</sup> Croatia	65 (2.0) ▲
Thailand	64 (3.3) ▲
Spain	64 (2.3) ▲
Poland	64 (1.9) ▲
Finland	64 (2.4) ▲
‡ Norway	63 (2.2) ▲
Czech Republic	63 (2.5) ▲
Austria	63 (2.3) ▲
<sup>1 2</sup> Lithuania	63 (2.4) ▲
† Netherlands	60 (2.5) ▲
Chile	60 (2.2) ▲
New Zealand	59 (1.9) ▲
Slovenia	58 (2.5) ▲
<b>International Avg.</b>	<b>58 (0.3)</b>
Ireland	58 (2.0) ▲
<sup>2</sup> Kazakhstan	57 (2.8) ▲
Malta	54 (2.1) ▲
Romania	53 (2.9) ▲
Turkey	53 (1.6) ▼
<sup>2</sup> Serbia	51 (2.6) ▼
Iran, Islamic Rep. of	50 (1.8) ▼
Bahrain	49 (2.5) ▼
<sup>2</sup> Azerbaijan	47 (2.7) ▼
United Arab Emirates	45 (1.2) ▼
<sup>1</sup> Georgia	44 (2.5) ▼
Armenia	38 (2.6) ▼
<sup>2</sup> Qatar	38 (2.3) ▼
Saudi Arabia	33 (2.6) ▼
Oman	31 (1.5) ▼
<sup>1</sup> Kuwait	29 (1.6) ▼
Tunisia	26 (2.0) ▼
Morocco	16 (1.6) ▼
Yemen	14 (1.4) ▼

Content Domain: Life Science

Cognitive Domain: Applying

Description: Pairs pictures of three animals with their distinguishing biological characteristics (skeleton, milk production, number of legs)

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Answer the following questions using the animals shown above. Write the name for the correct animal in the spaces below.

Which animal has an internal skeleton and produces milk for its young?  
monkey

Which animal has an external skeleton and three pairs of legs?  
grasshopper

Which animal has a soft body and no skeleton?  
octopus

The answer shown illustrates the type of student response that was given 1 of 1 points.

Country	Percent Full Credit
<b>Sixth Grade Participants</b>	
Honduras	56 (3.1)
Botswana	36 (2.3) ▼
Yemen	29 (2.1) ▼

Country	Percent Full Credit
<b>Benchmarking Participants</b>	
<sup>1 2</sup> North Carolina, US	74 (3.6) ▲
<sup>1 3</sup> Florida, US	72 (2.8) ▲
Quebec, Canada	68 (2.3) ▲
<sup>2</sup> Alberta, Canada	66 (2.4) ▲
Ontario, Canada	63 (2.3) ▲
Dubai, UAE	48 (1.9) ▼
Abu Dhabi, UAE	41 (2.2) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §. ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Country	Percent Full Credit
<sup>2</sup> Singapore	82 (1.5) ▲
Korea, Rep. of	79 (1.7) ▲
Slovak Republic	75 (1.9) ▲
<sup>2</sup> Hong Kong SAR	73 (1.9) ▲
Russian Federation	73 (2.0) ▲
<sup>†</sup> Northern Ireland	69 (2.4) ▲
<sup>†</sup> Netherlands	69 (2.4) ▲
Italy	68 (1.8) ▲
Romania	68 (2.7) ▲
Ireland	68 (2.4) ▲
England	66 (2.6) ▲
Austria	64 (2.5) ▲
Australia	63 (2.3) ▲
<sup>2</sup> United States	63 (1.4) ▲
<sup>2</sup> Kazakhstan	62 (2.5) ▲
Portugal	62 (2.5) ▲
<sup>2</sup> Croatia	62 (2.4) ▲
<sup>2</sup> Serbia	61 (2.1) ▲
Chinese Taipei	61 (2.1) ▲
<sup>2</sup> Denmark	61 (2.2) ▲
Japan	59 (2.0) ▲
Czech Republic	59 (2.5) ▲
<sup>1</sup> Georgia	59 (2.6)
Belgium (Flemish)	59 (1.9) ▲
<sup>‡</sup> Norway	57 (3.1)
New Zealand	56 (2.0)
Turkey	55 (1.3)
Finland	55 (2.5)
International Avg.	54 (0.3)
Hungary	54 (2.0)
Iran, Islamic Rep. of	54 (2.4)
Slovenia	53 (3.2)
Chile	53 (1.9)
<sup>1 2</sup> Lithuania	53 (2.2)
Thailand	52 (2.3)
Spain	51 (2.3)
Germany	48 (2.1) ▼
Bahrain	47 (2.4) ▼
Saudi Arabia	47 (2.3) ▼
United Arab Emirates	46 (1.4) ▼
Poland	45 (1.7) ▼
Sweden	44 (2.3) ▼
<sup>2</sup> Qatar	40 (1.8) ▼
Malta	38 (2.3) ▼
<sup>2</sup> Azerbaijan	37 (3.0) ▼
Armenia	35 (2.1) ▼
<sup>1</sup> Kuwait	29 (1.9) ▼
Tunisia	29 (2.2) ▼
Oman	24 (1.4) ▼
Yemen	12 (1.3) ▼
Morocco	9 (1.7) ▼

Content Domain: Earth Science  
Cognitive Domain: Knowing  
Description: States one form of energy Earth receives from the sun

Write down one form of energy Earth receives from the sun.

Light

The answer shown illustrates the type of student response that was given 1 of 1 points.

Country	Percent Full Credit
<b>Sixth Grade Participants</b>	
Botswana	42 (2.4) ▼
Yemen	40 (2.4) ▼
Honduras	31 (3.1) ▼

Country	Percent Full Credit
<b>Benchmarking Participants</b>	
<sup>1 3</sup> Florida, US	67 (2.6) ▲
<sup>2</sup> Alberta, Canada	64 (2.3) ▲
<sup>1 2</sup> North Carolina, US	62 (3.0) ▲
Ontario, Canada	60 (2.0) ▲
Quebec, Canada	57 (2.2)
Dubai, UAE	56 (1.7)
Abu Dhabi, UAE	44 (2.5) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.  
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

### *Fourth Grade TIMSS 2011 High International Benchmark*

Exhibit 2.10 presents the description of achievement at the High International Benchmark. Students at this level have extended the breadth of their knowledge in the science content domains and applied their knowledge and understanding to explain phenomena in everyday and abstract contexts. They also demonstrated elementary knowledge and skills related to scientific inquiry, and compared, contrasted, and made simple inferences.

Exhibit 2.11 presents Example Item 5, which requires students to reason through a problem situation and justify their reasoning based on their knowledge of physical phenomena. This constructed response item exemplifies the type of brief descriptive response students scoring at the High Benchmark provided, using their knowledge of a science concept applied to an everyday context. On average internationally, 42 percent of students received full credit for this item, with a very wide range across countries (0–74%).

○ High International Benchmark

550 Summary

*Students apply their knowledge and understanding of the sciences to explain phenomena in everyday and abstract contexts.* Students demonstrate some understanding of plant and animal structure, life processes, life cycles, and reproduction. They also demonstrate some understanding of ecosystems and organisms' interactions with their environment, including understanding of human responses to outside conditions and activities. Students demonstrate understanding of some properties of matter, electricity and energy, and magnetic and gravitational forces and motion. They show some knowledge of the solar system, and of Earth's physical characteristics, processes, and resources. Students demonstrate elementary knowledge and skills related to scientific inquiry. They compare, contrast, and make simple inferences, and provide brief descriptive responses combining knowledge of science concepts with information from both everyday and abstract contexts.

In life science, students demonstrate an understanding of plant and animal structure and life processes. For example, they have some knowledge of the parts and functions of a flowering plant and can distinguish living from nonliving things and animals with backbones from those without backbones. Students demonstrate some understanding of reproduction and life cycles of organisms. They know that if the only remaining members of a species of mammal are female, they will not be able to reproduce, and can distinguish inherited from non-inherited features. Students demonstrate an understanding of ecosystems and can reason about organisms' interactions with their environment. They can identify a predator-prey relationship and human activities which have positive or negative effects on the environment. Students also understand that plants make food using energy from the Sun and recognize some plant and animal features that provide advantages in a given environment (the shape of leaves, animal coloration). Students demonstrate understanding of human responses to outside conditions and activities. They recognize the effect of light on pupil size and changes in the body during exercise.

In physical science, students demonstrate basic understanding of some properties of matter. For example, students can justify that objects with more volume do not necessarily weigh more. They explain that heat transferred through metal reaches a point that is closer to the heat source in a shorter time. They connect the color change and surface roughening of a metal object to the process of rusting, and also, in the context of an investigation, explain that solids (e.g., candy) dissolve faster in hot water than in cold water. Students also show a basic understanding of the properties of shadows. They recognize what causes a shadow to be formed and deduce the direction it is cast. Students show knowledge of electricity and energy and apply their knowledge to practical situations. Given a list of everyday objects, they identify which ones conduct electricity and which do not and they identify sources of energy and specify which can be used to produce electricity. Students apply some knowledge to and reason about gravitational and magnetic forces and motion. They recognize that gravity causes an object to fall to the ground, recognize that two metal bars that repel each other must be magnets, and identify the orientation of the poles of repelling magnets.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

○ High International Benchmark

550

In earth science, students demonstrate a basic understanding of Earth's physical characteristics and resources. For example, they recognize that when water disappears from a surface, it goes into the air. They can, from a table showing location, temperature, and cloud cover, identify the place where it is most likely to snow. In addition, they can describe one advantage of farming near a river. Students have an understanding of some of Earth's processes, history, and cycles. They recognize that water flows from mountains to oceans via rivers, and that fossils are the best evidence that there were many kinds of animals on Earth that no longer exist today. They also recognize that an observation of low clouds can lead to a conclusion about their composition. Students show some knowledge of the solar system. They recognize that the solar system is made up of the Sun and its planets, identify the Earth, Moon, and Sun in a diagram showing their relative positions and orbits, and recognize that the moon's shape looks different at different times of the month.

Students demonstrate elementary knowledge and skills related to scientific inquiry. For example, from a table showing the results of an experiment, they can identify what was being studied in the experiment. Furthermore, they compare, contrast, and make simple inferences, and provide brief descriptive responses combining knowledge of science concepts with information from both everyday and abstract contexts.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent Full Credit
Chinese Taipei	74 (2.2) ⬆
Austria	74 (1.9) ⬆
<sup>2</sup> Serbia	72 (2.3) ⬆
Russian Federation	71 (1.9) ⬆
Finland	71 (2.3) ⬆
Korea, Rep. of	68 (1.9) ⬆
Hungary	68 (1.9) ⬆
‡ Norway	62 (2.4) ⬆
Portugal	61 (2.4) ⬆
Poland	58 (1.8) ⬆
Sweden	56 (2.8) ⬆
Italy	56 (2.0) ⬆
Czech Republic	55 (2.9) ⬆
<sup>1 2</sup> Lithuania	54 (2.1) ⬆
Slovak Republic	53 (2.2) ⬆
<sup>2</sup> Singapore	52 (2.0) ⬆
Germany	51 (2.2) ⬆
<sup>2</sup> Hong Kong SAR	49 (2.2) ⬆
<sup>2</sup> Croatia	47 (1.8) ⬆
<sup>2</sup> United States	46 (1.5) ⬆
<sup>2</sup> Denmark	46 (2.4) ⬆
Japan	45 (2.3) ⬆
Belgium (Flemish)	45 (2.0) ⬆
<sup>2</sup> Kazakhstan	45 (2.5) ⬆
Slovenia	43 (2.1) ⬆
Australia	43 (2.2) ⬆
Spain	42 (2.1) ⬆
International Avg.	42 (0.3) ⬆
Chile	41 (2.1) ⬆
† Netherlands	40 (2.7) ⬆
† Northern Ireland	40 (2.1) ⬆
Ireland	39 (3.4) ⬆
England	39 (2.7) ⬆
New Zealand	39 (2.2) ⬆
Romania	38 (2.5) ⬆
Turkey	36 (1.5) ⬇
Saudi Arabia	35 (2.4) ⬇
Thailand	30 (2.5) ⬇
Iran, Islamic Rep. of	24 (1.6) ⬇
<sup>1</sup> Kuwait	23 (1.7) ⬇
Oman	21 (1.4) ⬇
United Arab Emirates	19 (1.0) ⬇
<sup>2</sup> Azerbaijan	19 (2.1) ⬇
<sup>1</sup> Georgia	19 (2.0) ⬇
Bahrain	19 (1.9) ⬇
Malta	19 (1.8) ⬇
Armenia	18 (1.8) ⬇
Tunisia	15 (1.5) ⬇
<sup>2</sup> Qatar	12 (1.8) ⬇
Yemen	3 (0.6) ⬇
Morocco	0 (0.2) ⬇

**Content Domain: Physical Science**  
**Cognitive Domain: Reasoning**  
**Description: Justifies that objects with more volume do not necessarily weigh more using a diagram of three objects of different materials ordered by volume**

Jack's teacher places three objects on a table, as shown below. She puts them in order according to their volume.

Jack thinks that objects with more volume weigh more.  
 Do you agree with him?

(Check one box.)  
 Yes  
 No

Explain your answer.

*It depends on what the object is made of. The brick is smaller than the styrofoam block but it is more dense so it probably weighs more.*

The answer shown illustrates the type of student response that was given 1 of 1 points.

Country	Percent Full Credit
<b>Sixth Grade Participants</b>	
Honduras	22 (2.9) ⬇
Yemen	19 (1.9) ⬇
Botswana	6 (1.0) ⬇

Country	Percent Full Credit
<b>Benchmarking Participants</b>	
<sup>2</sup> Alberta, Canada	52 (2.3) ⬆
Ontario, Canada	51 (2.4) ⬆
Quebec, Canada	51 (2.5) ⬆
<sup>1 2</sup> North Carolina, US	49 (3.2) ⬆
<sup>1 3</sup> Florida, US	40 (2.4) ⬆
Dubai, UAE	24 (1.2) ⬇
Abu Dhabi, UAE	18 (2.0) ⬇

- ⬆ Percent significantly higher than international average
- ⬇ Percent significantly lower than international average

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.  
 ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

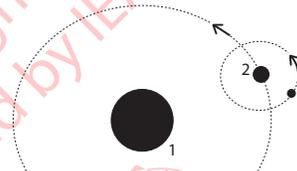
Country	Percent Full Credit
Portugal	78 (2.2) ▲
Russian Federation	74 (2.5) ▲
Korea, Rep. of	73 (1.6) ▲
Slovak Republic	66 (2.4) ▲
<sup>2</sup> United States	65 (1.6) ▲
Finland	65 (2.2) ▲
Sweden	64 (2.7) ▲
England	63 (2.5) ▲
‡ Norway	60 (3.3) ▲
Spain	59 (2.4) ▲
Chile	59 (1.9) ▲
<sup>2</sup> Hong Kong SAR	58 (1.8) ▲
United Arab Emirates	55 (1.2) ▲
Australia	54 (2.5) ▲
<sup>1 2</sup> Lithuania	54 (2.5) ▲
Japan	53 (2.1) ▲
Austria	53 (2.7)
Czech Republic	52 (2.2)
<sup>2</sup> Denmark	52 (2.3)
Chinese Taipei	52 (2.2)
<sup>1</sup> Kuwait	51 (2.4)
Bahrain	51 (2.5)
Hungary	51 (2.2)
Malta	50 (1.9)
Ireland	50 (2.6)
<sup>2</sup> Kazakhstan	49 (2.9)
† Netherlands	49 (2.6)
Poland	49 (2.5)
<b>International Avg.</b>	<b>49 (0.3)</b>
Slovenia	48 (2.3)
Thailand	48 (2.7)
<sup>2</sup> Singapore	48 (1.8)
<sup>2</sup> Qatar	47 (2.4)
Romania	47 (3.0)
Germany	44 (2.4)
Italy	44 (2.3) ▼
New Zealand	44 (2.0) ▼
<sup>2</sup> Croatia	43 (2.1) ▼
Iran, Islamic Rep. of	42 (2.2) ▼
<sup>1</sup> Georgia	40 (2.4) ▼
Saudi Arabia	39 (2.8) ▼
Belgium (Flemish)	39 (2.5) ▼
<sup>2</sup> Azerbaijan	39 (3.0) ▼
<sup>2</sup> Serbia	39 (2.7) ▼
Turkey	38 (1.8) ▼
† Northern Ireland	35 (2.5) ▼
Oman	30 (1.9) ▼
Armenia	27 (2.4) ▼
Tunisia	17 (2.1) ▼
Morocco	16 (2.2) ▼
Yemen	15 (1.7) ▼

Content Domain: Earth Science

Cognitive Domain: Reasoning

Description: Identifies the Earth, Moon, and Sun from a diagram of their orbits

The figure below shows Earth, the Moon, and the Sun. Each body is labeled by a number. The arrows show the direction each body is moving.



Fill in the correct number next to each body (1, 2 or 3).

Earth is body number: 2

The Moon is body number: 3

The Sun is body number: 1

The answer shown illustrates the type of student response that was given 1 of 1 points.

Country	Percent Full Credit
<b>Sixth Grade Participants</b>	
Yemen	29 (2.2) ▼
Botswana	26 (1.8) ▼
Honduras	23 (2.6) ▼

Country	Percent Full Credit
<b>Benchmarking Participants</b>	
<sup>1 3</sup> Florida, US	68 (3.7) ▲
<sup>1 2</sup> North Carolina, US	63 (3.4) ▲
Quebec, Canada	59 (2.3) ▲
Dubai, UAE	58 (2.3) ▲
Abu Dhabi, UAE	54 (2.5) ▲
<sup>2</sup> Alberta, Canada	48 (2.8)
Ontario, Canada	46 (2.5)

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §. ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

According to the TIMSS 2011 Science Framework, fourth grade students are expected to demonstrate some understanding about Earth's place in the solar system. Exhibit 2.12 presents Example Item 6, which exemplifies the type of earth science knowledge exhibited by fourth grade students at the High Benchmark. Students are asked to identify the Earth, Moon, and Sun from a diagram of their orbits. Internationally, on average, 49 percent of the students answered this item correctly.

#### *Fourth Grade TIMSS 2011 Advanced International Benchmark*

Exhibit 2.13, on the following page, describes fourth grade performance at the Advanced International Benchmark. At this benchmark, students applied their knowledge and understanding of scientific processes and relationships across the four content domains, and showed some knowledge of the process of scientific inquiry. They had a beginning ability to interpret results in the context of a simple experiment, reason and draw conclusions from descriptions and diagrams, and evaluate and support an argument.

Example Item 7 in Exhibit 2.14 shows an example of the type of item in the life sciences that fourth grade students at the Advanced International Benchmark could answer correctly. This constructed response item required students to identify four major plant structures in a diagram and describe the function of most of the structures. On average across countries, only 21 percent of the students gained full credit on this item, which was relatively difficult for students in most countries. Eighty percent of students in Singapore gained full credit, but in no other country did more than 42 percent of students answer fully correctly.

In physical science at the Advanced Benchmark level, students demonstrated an understanding of magnetic forces and reasoned to form conclusions about them. Example Item 8 in Exhibit 2.15 is a constructed response item which required students to apply their knowledge of magnetic properties to a set of observations, reason and draw conclusions based on the observations, and provide support for their reasoning. On average internationally, this item also was relatively difficult, with 26 percent of students providing a response that received full credit.

● Advanced International Benchmark

625

Summary

*Students apply knowledge and understanding of scientific processes and relationships and show some knowledge of the process of scientific inquiry.* Students communicate their understanding of characteristics and life processes of organisms, reproduction and development, ecosystems and organisms' interactions with the environment, and factors relating to human health. They demonstrate understanding of properties of light and relationships among physical properties of materials, apply and communicate their understanding of electricity and energy in practical contexts, and demonstrate an understanding of magnetic and gravitational forces and motion. Students communicate their understanding of the solar system and of Earth's structure, physical characteristics, resources, processes, cycles, and history. They have a beginning ability to interpret results in the context of a simple experiment, reason and draw conclusions from descriptions and diagrams, and evaluate and support an argument.

In life science, students show knowledge of characteristics and life processes of a variety of organisms. For example, students identify the body covering that protects a reptile, recognize that muscles move bones, and they know the major parts of a flowering plant and can state their functions. Students show some understanding of reproduction and development of organisms. They recognize, from a list of animals, that the young form of humans looks most like the adult form, recognize examples of animals that take care of their young, and they describe how pollen is spread. Students communicate understanding of relationships in ecosystems and understand how organisms interact with their environment. They describe one physical change that takes place in a mammal as the weather gets cold, how migration increases the survival of birds, and a feature that helps a cactus survive in the desert. They also describe human activities that can lead to the extinction of animals. Students communicate understanding of factors related to human health. They state that calcium is needed for bone growth, explain why people should drink liquids frequently, and that sneezing transmits germs even when a person does not appear to be sick.

In physical science, students show understanding of the relationships among physical properties of materials and of the basic properties of light. For example, students can identify an unknown material as a gas based on its behavior in a closed container and they justify their answer. Given two groups of everyday objects, students recognize which property was used to classify them. In the context of an investigation, students explain what makes a solid dissolve faster in water and what makes a solution more dilute. They recognize that burning results in new substances and that light is made up of different colors. Students apply and communicate their understanding and reason about electricity and energy in practical contexts. They explain that a bulb will not light in an incomplete electrical circuit. They also recognize that heat needs to be supplied for melting and boiling, but not for freezing, and explain how a sweater can keep a bottle of water cold. Students demonstrate an understanding of magnetic and gravitational forces and motion and reason to form conclusions about them. They infer that magnets have different strengths from a diagram of magnets attracting pins from two different distances. Also, based on a series of diagrams providing pairwise information about the weights of cubes, they draw a conclusion about their relative weights. They reason, using diagrams, where children of the same and different weights should sit to balance a seesaw.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

● **Advanced** International Benchmark

625

In earth science, students communicate their understanding of Earth’s structure, physical characteristics, resources, processes, cycles, and history. For example, they state two things that make up the Earth’s crust and recognize that water covers most of Earth’s surface. They describe one disadvantage of farming near a river and recognize that soil rich in decaying matter helps plants grow and that soils can change naturally over time. They also recognize how fish fossils are formed. Students demonstrate an understanding of the Earth in the context of the solar system. They recognize how long it takes for the Earth to orbit the Sun and rotate on its axis as well as describe how that rotation causes day and night. They also explain why the size and shape of a shadow appears different at different times of the day.

Students demonstrate some ability to recognize how a simple experiment should be set up. They have an elementary ability to interpret results, reason and draw conclusions from descriptions and diagrams, and evaluate and support an argument.

SOURCE: IEA’s Trends in International Mathematics and Science Study – TIMSS 2011

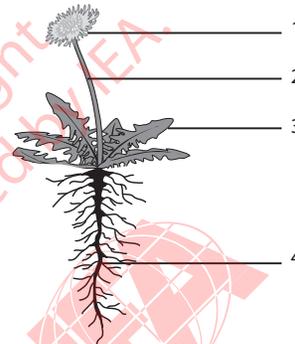
Country	Percent Full Credit
<sup>2</sup> Singapore	80 (1.6) ⬆
Korea, Rep. of	42 (2.2) ⬆
Thailand	40 (2.7) ⬆
Czech Republic	39 (2.8) ⬆
Bahrain	37 (2.7) ⬆
Italy	36 (2.4) ⬆
Romania	35 (2.6) ⬆
Hungary	34 (2.5) ⬆
<sup>2</sup> Croatia	33 (2.2) ⬆
Finland	32 (2.3) ⬆
Portugal	31 (3.0) ⬆
Iran, Islamic Rep. of	28 (2.1) ⬆
<sup>2</sup> Kazakhstan	27 (2.5) ⬆
Chinese Taipei	26 (1.8) ⬆
Austria	25 (2.2) ⬆
Slovak Republic	25 (2.2) ⬆
<sup>2</sup> United States	24 (1.0) ⬆
<sup>2</sup> Serbia	23 (2.0) ⬆
United Arab Emirates	22 (1.3) ⬆
<sup>1 2</sup> Lithuania	21 (1.8) ⬆
England	21 (2.8) ⬆
<b>International Avg.</b>	<b>21 (0.3)</b>
Russian Federation	20 (1.8) ⬆
Japan	20 (1.6) ⬆
Oman	19 (1.7) ⬆
Sweden	18 (1.9) ⬆
<sup>1</sup> Kuwait	18 (1.6) ⬆
Saudi Arabia	16 (2.3) ⬆
<sup>2</sup> Hong Kong SAR	16 (1.5) ⬇
Spain	16 (1.8) ⬇
Slovenia	15 (1.6) ⬇
<sup>2</sup> Denmark	15 (1.6) ⬇
<sup>2</sup> Azerbaijan	15 (2.0) ⬇
<sup>2</sup> Qatar	13 (1.7) ⬇
Chile	13 (1.3) ⬇
Poland	13 (1.8) ⬇
Morocco	12 (1.2) ⬇
Turkey	11 (1.1) ⬇
Ireland	10 (1.9) ⬇
<sup>1</sup> Georgia	10 (1.9) ⬇
Germany	10 (1.2) ⬇
Australia	10 (1.3) ⬇
Armenia	10 (1.7) ⬇
† Northern Ireland	9 (1.4) ⬇
† Netherlands	8 (1.3) ⬇
Belgium (Flemish)	6 (1.0) ⬇
Malta	6 (1.0) ⬇
New Zealand	6 (1.0) ⬇
‡ Norway	4 (1.1) ⬇
Tunisia	2 (0.8) ⬇
Yemen	1 (0.5) ⬇

Content Domain: Life Science

Cognitive Domain: Knowing

Description: From a diagram of a flowering plant, identifies numbered parts and states a function of most of these parts

The diagram shows a flowering plant. Four of its parts are numbered.



In the table below, write the name of each part, and state its function.

Part Number	Name of Part	Function of Part
1	flower	produces seeds
2	stem	transports water and food
3	leaf	makes food for the plant
4	root	absorbs water, minerals, and nutrients into the plant

The answer shown illustrates the type of student response that was given 2 of 2 points.

Country	Percent Full Credit
<b>Sixth Grade Participants</b>	
Honduras	16 (1.7) ⬇
Botswana	4 (0.9) ⬇
Yemen	3 (0.7) ⬇

Country	Percent Full Credit
<b>Benchmarking Participants</b>	
Dubai, UAE	31 (2.0) ⬆
<sup>1 3</sup> Florida, US	24 (2.8) ⬆
Ontario, Canada	22 (1.8) ⬆
<sup>2</sup> Alberta, Canada	21 (2.4) ⬆
Abu Dhabi, UAE	17 (2.1) ⬆
<sup>1 2</sup> North Carolina, US	13 (2.3) ⬇
Quebec, Canada	8 (1.4) ⬇

- ⬆ Percent significantly higher than international average
- ⬇ Percent significantly lower than international average

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.  
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Country	Percent Full Credit
<sup>2</sup> Singapore	66 (2.0) ▲
Japan	50 (1.8) ▲
Chinese Taipei	47 (2.3) ▲
Finland	41 (2.6) ▲
Sweden	37 (2.6) ▲
<sup>2</sup> United States	37 (1.4) ▲
England	35 (2.4) ▲
Portugal	35 (2.1) ▲
Belgium (Flemish)	35 (2.2) ▲
Slovenia	32 (2.2) ▲
† Norway	32 (3.4)
<sup>2</sup> Hong Kong SAR	31 (2.3) ▲
† Northern Ireland	30 (2.3)
† Netherlands	30 (2.1)
<sup>2</sup> Serbia	29 (1.9)
Turkey	29 (1.7)
<sup>2</sup> Denmark	28 (2.0)
Czech Republic	28 (2.4)
Germany	28 (1.7)
Ireland	28 (2.4)
Spain	27 (1.9)
Australia	27 (1.8)
Korea, Rep. of	27 (1.6)
Russian Federation	27 (1.9)
<sup>2</sup> Kazakhstan	27 (2.4)
Poland	26 (1.9)
International Avg.	26 (0.3)
<sup>1</sup> Georgia	26 (2.3)
Iran, Islamic Rep. of	26 (1.7)
Bahrain	26 (1.6)
New Zealand	25 (1.9)
Malta	25 (1.9)
<sup>1 2</sup> Lithuania	24 (1.8)
Romania	23 (2.4) ▼
Thailand	23 (1.7) ▼
Italy	23 (1.9) ▼
Hungary	23 (1.8) ▼
Saudi Arabia	22 (2.1) ▼
Austria	21 (1.7) ▼
Slovak Republic	20 (1.6) ▼
Chile	20 (1.7) ▼
Tunisia	19 (2.1) ▼
United Arab Emirates	19 (1.0) ▼
<sup>2</sup> Qatar	17 (1.9) ▼
<sup>2</sup> Croatia	17 (1.6) ▼
<sup>1</sup> Kuwait	15 (1.5) ▼
Armenia	14 (1.6) ▼
<sup>2</sup> Azerbaijan	12 (1.8) ▼
Oman	6 (0.8) ▼
Morocco	5 (0.7) ▼
Yemen	1 (0.4) ▼

**Content Domain: Physical Science**  
**Cognitive Domain: Reasoning**  
**Description: Infers that magnets have different strengths from an observation of magnets attracting pins from two different distances**

Betty has two magnets (A and B) and two metal pins that are the same. She slides Magnet A along a table until a pin is attracted to the magnet. She slides Magnet B along a table until a pin is attracted to the magnet.

She finds that Magnet A attracts the pin from 15cm and Magnet B attracts the pin from 10cm. Steven says that both magnets are equally strong. Do you agree?

(Check one box.)  
 Yes  
 No

Explain your answer.

magnet A is stronger because it attracted the pin from farther away than magnet B did.

The answer shown illustrates the type of student response that was given 1 of 1 points.

Country	Percent Full Credit
<b>Sixth Grade Participants</b>	
Honduras	19 (2.3) ▼
Botswana	10 (1.5) ▼
Yemen	9 (1.2) ▼

Country	Percent Full Credit
<b>Benchmarking Participants</b>	
Ontario, Canada	39 (2.3) ▲
<sup>1 3</sup> Florida, US	38 (2.6) ▲
<sup>2</sup> Alberta, Canada	34 (2.4) ▲
<sup>1 2</sup> North Carolina, US	34 (3.5) ▲
Quebec, Canada	31 (2.2) ▲
Dubai, UAE	22 (2.2)
Abu Dhabi, UAE	17 (1.9) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.  
 ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Country	Percent Correct
Korea, Rep. of	63 (2.3) ▲
Finland	61 (2.2) ▲
Russian Federation	60 (2.0) ▲
Japan	55 (2.1) ▲
<sup>2</sup> United States	54 (1.6) ▲
<sup>2</sup> Kazakhstan	53 (2.7) ▲
<sup>2</sup> Azerbaijan	52 (2.9) ▲
Slovak Republic	51 (2.2) ▲
Hungary	51 (2.2) ▲
<sup>2</sup> Croatia	48 (2.3) ▲
Turkey	48 (1.7) ▲
Chinese Taipei	48 (2.3) ▲
Slovenia	47 (2.6) ▲
Poland	45 (2.1) ▲
<sup>1 2</sup> Lithuania	44 (2.2) ▲
Australia	44 (2.0) ▲
<sup>2</sup> Hong Kong SAR	44 (2.1) ▲
Italy	43 (2.2) ▲
Czech Republic	41 (2.4)
Sweden	41 (2.4)
Portugal	40 (3.7)
<sup>2</sup> Singapore	40 (1.7)
England	39 (2.5)
<b>International Avg.</b>	<b>39 (0.3)</b>
Romania	39 (2.7)
† Northern Ireland	38 (2.5)
Ireland	37 (3.5)
Belgium (Flemish)	37 (2.1)
New Zealand	36 (1.8)
United Arab Emirates	36 (1.2)
Austria	36 (2.3)
<sup>2</sup> Denmark	35 (2.1)
<sup>1</sup> Georgia	35 (2.6)
<sup>2</sup> Serbia	34 (2.1) ▼
Saudi Arabia	34 (2.4) ▼
† Netherlands	33 (2.2) ▼
Oman	32 (1.4) ▼
Iran, Islamic Rep. of	31 (1.8) ▼
Thailand	30 (2.4) ▼
Spain	30 (2.0) ▼
Bahrain	29 (1.9) ▼
Armenia	29 (2.3) ▼
Chile	28 (1.5) ▼
‡ Norway	28 (2.4) ▼
Malta	27 (2.0) ▼
Germany	26 (1.8) ▼
<sup>2</sup> Qatar	26 (2.7) ▼
<sup>1</sup> Kuwait	22 (1.7) ▼
Morocco	21 (1.7) ▼
Yemen	19 (1.6) ▼
Tunisia	19 (1.6) ▼

**Content Domain: Earth Science**  
**Cognitive Domain: Knowing**  
**Description: Recognizes a soil change due to natural causes**

Which of these soil changes is due only to natural causes?

(A) Loss of minerals due to farming.  
 (B) Deserts forming due to tree cutting.  
 (C) Flooding due to dam construction.  
 (D) Minerals washing out due to heavy rain.

Country	Percent Correct
<b>Sixth Grade Participants</b>	
Yemen	34 (2.2) ▼
Botswana	27 (1.8) ▼
Honduras	23 (2.5) ▼

Country	Percent Correct
<b>Benchmarking Participants</b>	
<sup>1 2</sup> North Carolina, US	51 (3.3) ▲
<sup>1 3</sup> Florida, US	48 (3.3) ▲
Ontario, Canada	43 (2.1) ▲
<sup>2</sup> Alberta, Canada	43 (2.8)
Dubai, UAE	39 (2.4)
Abu Dhabi, UAE	34 (2.1) ▼
Quebec, Canada	29 (2.1) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.  
 ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 2.16 presents Example Item 9, which exemplifies the knowledge of processes in earth science that is typical of students at the Advanced International Benchmark. On average, 39 percent of students internationally answered this item correctly, recognizing the soil change due to natural causes. As with most example items, there was wide variation across countries in the percentage of students correctly answering the item, in this case ranging from 19 percent to 63 percent.

## Eighth Grade Results for the TIMSS 2011 International Benchmarks in Science

### *Eighth Grade TIMSS 2011 International Benchmarks of Science Achievement*

Exhibit 2.17 summarizes what eighth grade students scoring at the TIMSS International Benchmarks typically know and can do in science. Detailed descriptions of each benchmark level are presented along with example items in subsequent sections of the chapter. Similar to the fourth grade, at the eighth grade there was also a considerable difference in performance between students achieving at the Advanced International Benchmark and students at the Low International Benchmark.

Students performing at the Advanced International Benchmark communicated an understanding of complex and abstract concepts in biology, chemistry, physics, and earth science. They also combined information from several sources to solve problems and draw conclusions, and provided written explanations to communicate scientific knowledge. Students at the High International Benchmark demonstrated understanding of concepts related to science cycles, systems, and principles. They also demonstrated some scientific inquiry skills, and combined and interpreted information from various types of diagrams, contour maps, graphs, and tables; selected relevant information, analyzed, and drew conclusions; and provided short explanations conveying scientific knowledge. At the Intermediate International Benchmark, students recognized and applied their understanding of basic scientific knowledge in various contexts. They interpreted information from tables, graphs, and pictorial diagrams, drew conclusions, and communicated their understanding through brief descriptive responses. Students at the Low International Benchmark recognized some basic facts from the life and physical sciences, as well as interpreted simple pictorial diagrams, completed simple tables, and applied their basic knowledge to practical situations.

● **Advanced International Benchmark**

**625** *Students communicate an understanding of complex and abstract concepts in biology, chemistry, physics, and earth science. Students demonstrate some conceptual knowledge about cells and the characteristics, classification, and life processes of organisms. They communicate an understanding of the complexity of ecosystems and adaptations of organisms, and apply an understanding of life cycles and heredity. Students also communicate an understanding of the structure of matter and physical and chemical properties and changes and apply knowledge of forces, pressure, motion, sound, and light. They reason about electrical circuits and properties of magnets. Students apply knowledge and communicate understanding of the solar system and Earth’s processes, structures, and physical features. They understand basic features of scientific investigation. They also combine information from several sources to solve problems and draw conclusions, and they provide written explanations to communicate scientific knowledge.*

○ **High International Benchmark**

**550** *Students demonstrate understanding of concepts related to science cycles, systems, and principles. They demonstrate understanding of aspects of human biology, and of the characteristics, classification, and life processes of organisms. Students communicate understanding of processes and relationships in ecosystems. They show an understanding of the classification and compositions of matter and chemical and physical properties and changes. They apply knowledge to situations related to light and sound and demonstrate basic knowledge of heat and temperature, forces and motion, and electrical circuits and magnets. Students demonstrate an understanding of the solar system and of Earth’s processes, physical features, and resources. They demonstrate some scientific inquiry skills. They also combine and interpret information from various types of diagrams, contour maps, graphs, and tables; select relevant information, analyze, and draw conclusions; and provide short explanations conveying scientific knowledge.*

● **Intermediate International Benchmark**

**475** *Students recognize and apply their understanding of basic scientific knowledge in various contexts. Students apply knowledge and communicate an understanding of human health, life cycles, adaptation, and heredity, and analyze information about ecosystems. They have some knowledge of chemistry in everyday life and elementary knowledge of properties of solutions and the concept of concentration. They are acquainted with some aspects of force, motion, and energy. They demonstrate an understanding of Earth’s processes and physical features, including the water cycle and atmosphere. Students interpret information from tables, graphs, and pictorial diagrams and draw conclusions. They apply knowledge to practical situations and communicate their understanding through brief descriptive responses.*

○ **Low International Benchmark**

**400** *Students can recognize some basic facts from the life and physical sciences. They have some knowledge of biology, and demonstrate some familiarity with physical phenomena. Students interpret simple pictorial diagrams, complete simple tables, and apply basic knowledge to practical situations.*

SOURCE: IEA’s Trends in International Mathematics and Science Study – TIMSS 2011

### *Eighth Grade Achievement at the TIMSS 2011 International Benchmarks of Science Achievement*

Exhibit 2.18 presents the percentage of students reaching each TIMSS 2011 International Benchmark. The results are presented in descending order based on the percentage of students reaching the Advanced International Benchmark, first for countries that tested eighth grade students, and then for ninth grade countries and benchmarking participants on the second page. The percentage of students reaching the Advanced Benchmark is indicated in the bar graph with a black dot. Because students who reached the Advanced Benchmark also reached the other benchmarks, the percentages illustrated in the graph and shown in the columns to the right are cumulative.

At the eighth grade, four East Asian countries had the largest percentages of students reaching the Advanced International Benchmark. Singapore had 40 percent of their students reach this benchmark, followed by Chinese Taipei (24%), Korea (20%), and Japan (18%). Next, the Russian Federation and England had 14 percent of their students reaching the Advanced Benchmark; Slovenia and Finland had 13 percent of their students reaching this level. Several of the US benchmarking states also had similarly high percentages of students at the Advanced Benchmark, including Massachusetts (24%), Minnesota (16%), Colorado (14%), Connecticut (14%), and Florida (13%).

Exhibit 2.18 also provides useful information about the distribution of achievement in each country. For example, Italy and Norway had only 4 and 3 percent of students, respectively, reaching the Advanced Benchmark, but nearly all students (90%) reaching the Low Benchmark.

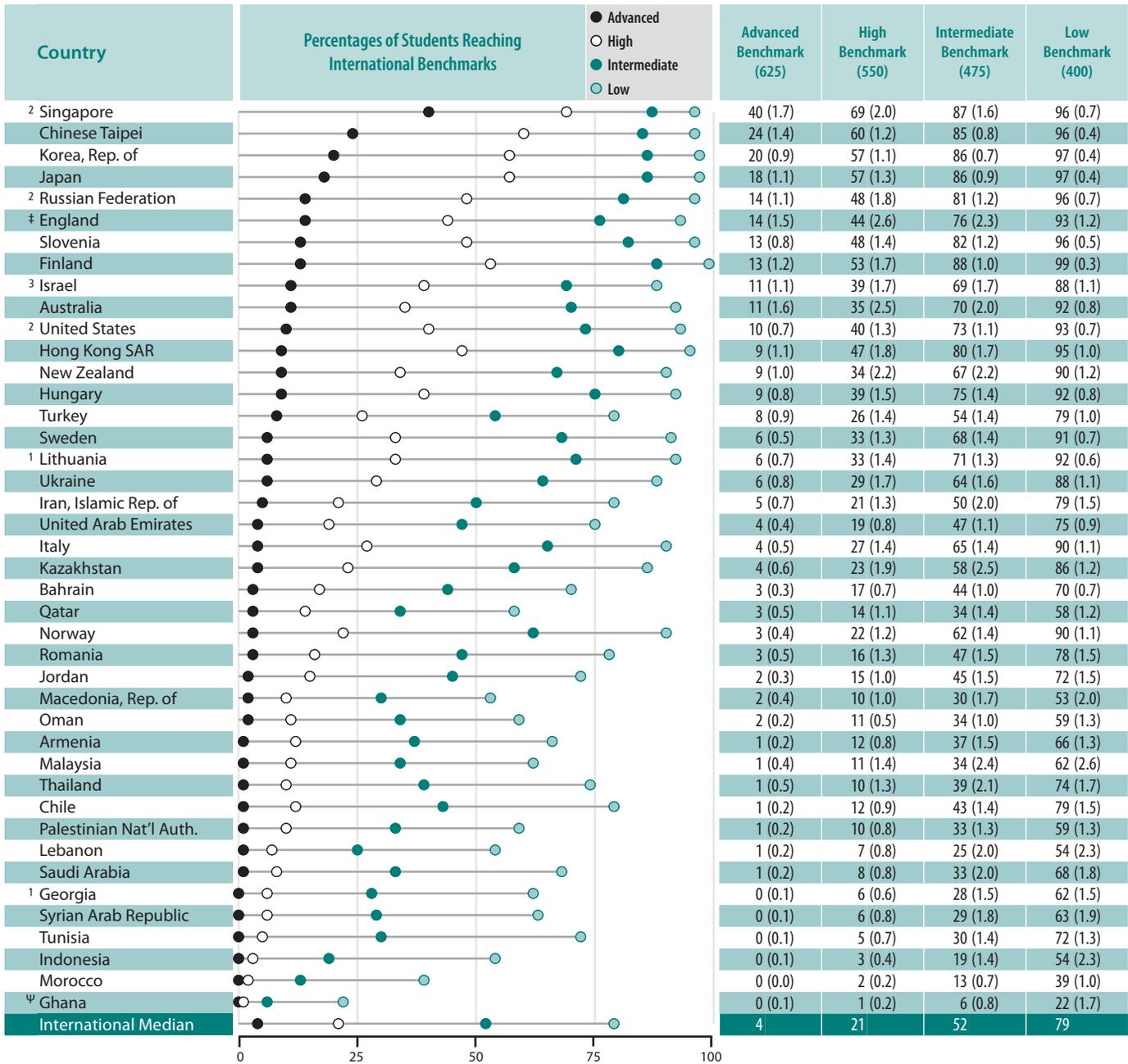
As a point of reference, Exhibit 2.18 provides the median for each of the benchmarks at the bottom of each of the four right hand columns. By definition, half of the countries will have a percentage in the column above the median and half will be below the median. The median percentages of students reaching the International Benchmarks were as follows: Advanced—4 percent, High—21 percent, Intermediate—52 percent, and Low—79 percent. In comparison to the fourth grade, these percentages were lower at each level. On average across countries, nearly half of the eighth grade students did not reach the Intermediate Benchmark, and more than one-fifth did not reach the Low Benchmark, indicating that, compared to the fourth grade, more eighth grade students were being “left behind” their classmates.

### *Eighth Grade Trends in Performance at the TIMSS 2011 International Benchmarks of Science Achievement*

Exhibit 2.19 shows the changes in percentages of eighth grade students reaching the benchmarks for countries and benchmarking participants that also participated in TIMSS 1995, 1999, 2003, and/or 2007. An up arrow indicates that the percentage of students reaching a benchmark is higher in 2011 than the past cycle, and a down arrow indicates that the percentage is lower in 2011. The patterns in this exhibit generally mirror the trends in average achievement discussed in Chapter 1, and can provide further information about countries' improvement or decline over time.

Three countries—Korea, Slovenia, and Lithuania—improved since 1995 at all four benchmarks. The Russian Federation, Hong Kong, Iran, and the Canadian province of Ontario showed improvements at three benchmarks since 1995, and the United States showed improvement at the two lowest benchmarks. Since 1995, three countries declined at all four benchmarks: Hungary, Sweden, and Norway. Singapore declined since 1995 at the two lowest benchmarks, and Romania declined at the two highest benchmarks.

**Exhibit 2.18: Performance at the International Benchmarks of Science Achievement**



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

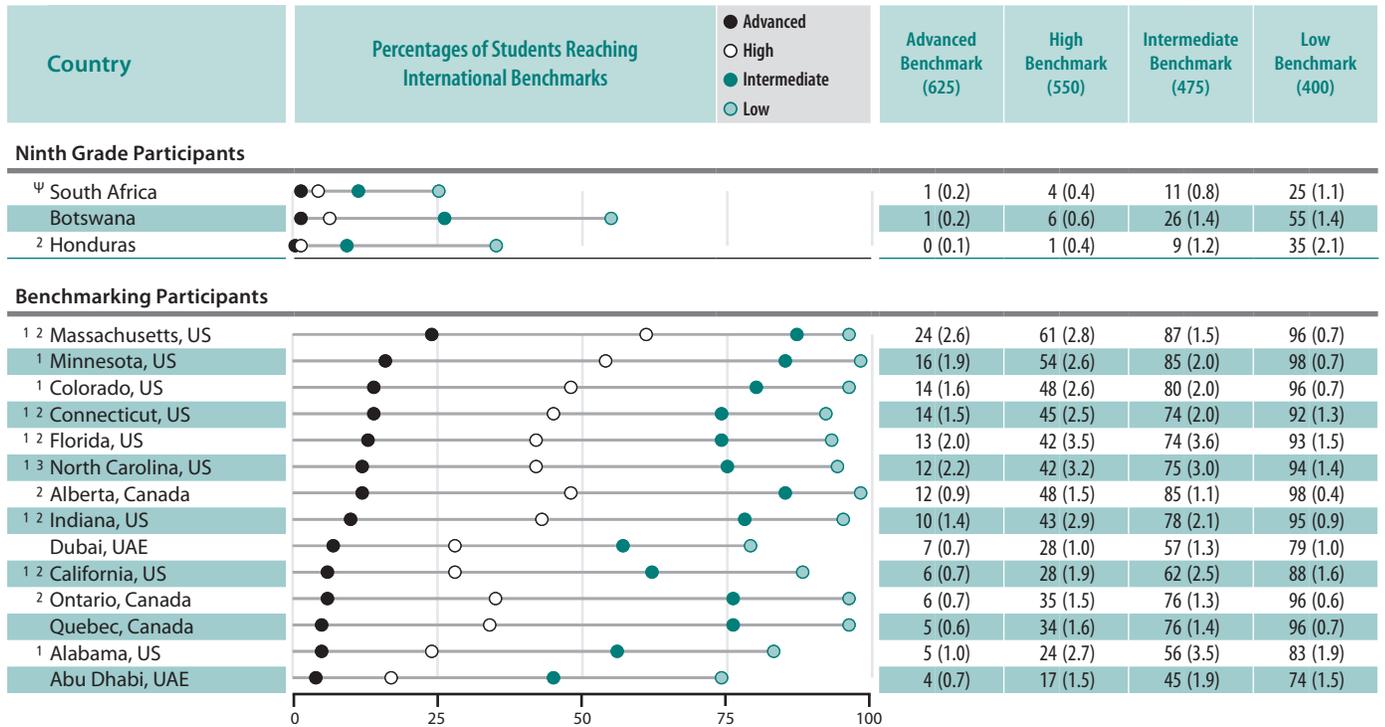
✱ Average achievement not reliably measured because the percentage of students with achievement too low for estimation exceeds 25%.

ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

**Exhibit 2.18: Performance at the International Benchmarks of Science Achievement (Continued)**



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 2.19: Trends in Percentages of Students Reaching the International Benchmarks of Science Achievement**

Country	Advanced International Benchmark (625)					High International Benchmark (550)				
	Percent of Students					Percent of Students				
	2011	2007	2003	1999	1995	2011	2007	2003	1999	1995
Singapore	40	32 ▲	33 ▲	29 ▲	29 ▲	69	61 ▲	66	60 ▲	64
Chinese Taipei	24	25	26	27		60	60	63	61	
Korea, Rep. of	20	17 ▲	17 ▲	19	17 ▲	57	54	57	50 ▲	50 ▲
Japan	18	17	15 ▲	16	18	57	55	53 ▲	52 ▲	54
Russian Federation	14	11 ▲	6 ▲	15	11	48	41 ▲	32 ▲	41 ▲	38 ▲
England	14	17	15	17	15	44	48	48	45	43
Slovenia	13	11 ▲	6 ▲		8 ▲	48	45	33 ▲		32 ▲
Australia	11	8	9		10	35	33	40		36
United States	10	10	11	12	11	40	38	41	37	38
Hong Kong SAR	9	10	13 ▼	7	7	47	45	58 ▼	40 ▲	33 ▲
New Zealand	9		7	10	9	34		35	35	34
Hungary	9	13 ▼	14 ▼	19 ▼	12 ▼	39	46 ▼	46 ▼	53 ▼	44 ▼
Finland (7)	6			12 ▼		41			43	
Sweden	6	6	8		19 ▼	33	32	38 ▼		52 ▼
Lithuania	6	8	6	5	2 ▲	33	36	34	22 ▲	14 ▲
Ukraine	6	3 ▲				29	22 ▲			
Iran, Islamic Rep. of	5	2 ▲	1 ▲	1 ▲	1 ▲	21	14 ▲	9 ▲	11 ▲	11 ▲
Italy	4	4	4	6 ▼		27	24	23 ▲	26	
Bahrain	3	2 ▲	0 ▲			17	17	6 ▲		
Norway	3	2 ▲	2		6 ▼	22	20	21		32 ▼
Romania	3	2	4	5 ▼	5 ▼	16	16	20	21 ▼	22 ▼
Jordan	2	5 ▼	3 ▼	4 ▼		15	26 ▼	21 ▼	17	
Macedonia, Rep. of	2		2	3 ▼		10		13	17 ▼	
Oman	2	1 ▲				11	8 ▲			
Armenia	1		1			12		14		
Malaysia	1	3 ▼	4 ▼	5 ▼		11	18 ▼	28 ▼	24 ▼	
Thailand	1	3 ▼		2		10	17 ▼		18 ▼	
Chile	1		1 ▲	1		12		5 ▲	7 ▲	
Palestinian Nat'l Auth.	1	1	1			10	9	10		
Lebanon	1	1	0			7	8	4 ▲		
Georgia	0	0				6	5			
Syrian Arab Republic	0	1				6	9 ▼			
Tunisia	0	0	0	0		5	4	1 ▲	3	
Indonesia	0	0				3	4 ▼			
Ψ Ghana	0	0	0			1	1	0 ▲		

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Benchmarking Participants**

Massachusetts, US	24	20		15 ▲		61	56		43 ▲	
Minnesota, US	16	11 ▲			17	54	45 ▲			50
Connecticut, US	14			14		45			43	
North Carolina, US	12			9		42			34	
Alberta, Canada	12			17 ▼	17 ▼	48			57	51
Indiana, US	10		8	14		43		40	44	
Dubai, UAE	7	6				28	27			
Ontario, Canada	6	7	7	7	5	35	37	41 ▼	34	26 ▲
Quebec, Canada	5	4	6	10 ▼	7	34	27 ▲	39	43 ▼	30

- ▲ 2011 percent significantly higher
- ▼ 2011 percent significantly lower

Ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%. Such annotations in exhibits with trend data began in 2011, so data from assessments prior to 2011 are not annotated for reservations.

An empty cell indicates a country did not participate in that year's assessment.

Trend Notes: Trend results for Finland are based on 7th grade data from 1999 and 2011, and so Finland's 2011 results differ from Exhibit 2.18.

**Exhibit 2.19: Trends in Percentages of Students Reaching the International Benchmarks of Science Achievement (Continued)**

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Intermediate International Benchmark (475)					Low International Benchmark (400)				
	Percent of Students					Percent of Students				
	2011	2007	2003	1999	1995	2011	2007	2003	1999	1995
Singapore	87	80 ▲	85	84	91 ▼	96	93 ▲	95	95	99 ▼
Chinese Taipei	85	83	88 ▼	86		96	95	98 ▼	96	
Korea, Rep. of	86	85	88	81 ▲	81 ▲	97	97	98	96 ▲	95 ▲
Japan	86	85	86	84	85	97	96	98	97	97
Russian Federation	81	76 ▲	70 ▲	73 ▲	71 ▲	96	95	93 ▲	92 ▲	92 ▲
England	76	79	81	76	75	93	94	96 ▼	94	93
Slovenia	82	81	75 ▲		69 ▲	96	97	96		93 ▲
Australia	70	70	76 ▼		69	92	92	95		89 ▲
United States	73	71	75	67 ▲	68 ▲	93	92	93	87 ▲	87 ▲
Hong Kong SAR	80	77	89 ▼	80	70 ▲	95	92	98 ▼	96	90 ▲
New Zealand	67		73	66	67	90		94 ▼	88	89
Hungary	75	80 ▼	82 ▼	83 ▼	80 ▼	92	96 ▼	97 ▼	96 ▼	95 ▼
Finland (7)	80			79		96			96	
Sweden	68	69	75 ▼		83 ▼	91	91	95 ▼		97 ▼
Lithuania	71	72	74	57 ▲	45 ▲	92	93	95 ▼	86 ▲	79 ▲
Ukraine	64	58 ▲				88	85			
Iran, Islamic Rep. of	50	41 ▲	38 ▲	38 ▲	43 ▲	79	76	77	72 ▲	81
Italy	65	62	59 ▲	59 ▲		90	88	87 ▲	86 ▲	
Bahrain	44	49 ▼	33 ▲			70	78 ▼	70		
Norway	62	58 ▲	63		72 ▼	90	87	91		94 ▼
Romania	47	46	49	50	51	78	77	78	78	77
Jordan	45	56 ▼	53 ▼	42		72	79 ▼	80 ▼	69	
Macedonia, Rep. of	30		42 ▼	46 ▼		53		72 ▼	73 ▼	
Oman	34	32				59	61			
Armenia	37		45 ▼			66		77 ▼		
Malaysia	34	50 ▼	71 ▼	59 ▼		62	80 ▼	95 ▼	87 ▼	
Thailand	39	48 ▼		54 ▼		74	80 ▼		87 ▼	
Chile	43		24 ▲	27 ▲		79		56 ▲	60 ▲	
Palestinian Nat'l Auth.	33	28 ▲	36			59	54 ▲	66 ▼		
Lebanon	25	28	20 ▲			54	55	48		
Georgia	28	27				62	61			
Syrian Arab Republic	29	39 ▼				63	76 ▼			
Tunisia	30	31	12 ▲	25 ▲		72	77 ▼	52 ▲	68	
Indonesia	19	27 ▼				54	65 ▼			
ψ Ghana	6	6	3 ▲			22	19	13 ▲		

**Benchmarking Participants**

Massachusetts, US	87	84		75 ▲		96	96		93 ▲	
Minnesota, US	85	82			79	98	96			94 ▲
Connecticut, US	74			74		92			92	
North Carolina, US	75			65 ▲		94			87 ▲	
Alberta, Canada	85			87	83	98			98	97
Indiana, US	78		79	76		95		96	93	
Dubai, UAE	57	58				79	82			
Ontario, Canada	76	77	81 ▼	72	61 ▲	96	96	97 ▼	95	88 ▲
Quebec, Canada	76	68 ▲	82 ▼	83 ▼	69	96	94	98 ▼	98 ▼	92

- ▲ 2011 percent significantly higher
- ▼ 2011 percent significantly lower

### *Eighth Grade TIMSS 2011 Low International Benchmark*

Exhibit 2.20 presents the detailed description of student achievement at the Low International Benchmark. At this benchmark, students recognized some basic facts from the life and physical sciences, and interpreted simple pictorial diagrams, completed simple tables, and applied their basic knowledge to practical situations.

In biology at the eighth grade, the TIMSS 2011 Science Framework expects that students should be able to compare biological processes at the cellular level, including ideas about heredity. Exhibit 2.21 presents Example Item 1, which required students to recognize the basic biological fact that genetic material is inherited from both parents. On average across countries, this item was relatively easy and was answered correctly by 83 percent of the eighth grade students. In all countries and benchmarking jurisdictions, more than 60 percent of students answered the item correctly.

In chemistry at this benchmark level, students had some basic knowledge of chemical formulas. Exhibit 2.22 presents Example 2, in which students must recognize the chemical formula for carbon dioxide. On average across countries, this item also was relatively easy, with 85 percent of eighth grade students answering it correctly.

● **Low International Benchmark**

**400**

**Summary**

Students can recognize some basic facts from the life and physical sciences. They have some knowledge of biology, and demonstrate some familiarity with physical phenomena. Students interpret simple pictorial diagrams, complete simple tables, and apply basic knowledge to practical situations.

Students demonstrate some basic knowledge of biology. For example, they recognize that influenza is caused by a virus and that genetic material is inherited from both parents.

In chemistry and physics, students have some basic knowledge of chemical formulas and properties of substances as they change states. They recognize some aspects of conductivity and energy. For example, they recognize which material is a conductor of electricity and the type of energy in a compressed spring.

Students interpret simple pictorial diagrams, complete simple tables, and apply basic knowledge to practical situations.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent Correct
Japan	95 (0.9) ▲
Finland	94 (1.0) ▲
Korea, Rep. of	93 (0.9) ▲
<sup>2</sup> Singapore	92 (1.0) ▲
Slovenia	91 (1.4) ▲
Jordan	91 (1.1) ▲
<sup>2</sup> United States	90 (0.8) ▲
<sup>3</sup> Israel	90 (1.4) ▲
Chinese Taipei	89 (1.2) ▲
† England	88 (1.7) ▲
Hong Kong SAR	88 (1.5) ▲
<sup>2</sup> Russian Federation	88 (1.5) ▲
Italy	88 (1.6) ▲
Hungary	87 (1.4) ▲
Armenia	87 (1.4) ▲
Tunisia	87 (1.2) ▲
Ukraine	86 (2.2)
United Arab Emirates	86 (1.0) ▲
Australia	86 (1.5)
Bahrain	85 (1.4)
Saudi Arabia	85 (1.4)
New Zealand	85 (1.6)
<sup>1</sup> Lithuania	84 (1.7)
Turkey	84 (1.3)
Palestinian Nat'l Auth.	84 (1.3)
International Avg.	83 (0.2)
Sweden	83 (1.5)
Romania	83 (1.5)
Norway	82 (1.6)
Qatar	82 (1.8)
Syrian Arab Republic	81 (1.7)
Oman	81 (1.2) ▼
Morocco	80 (1.6) ▼
Chile	80 (1.5) ▼
Kazakhstan	79 (1.7) ▼
Thailand	77 (1.8) ▼
<sup>1</sup> Georgia	76 (2.8) ▼
Lebanon	76 (2.2) ▼
Iran, Islamic Rep. of	75 (1.8) ▼
Indonesia	70 (2.3) ▼
Ghana	69 (1.5) ▼
Malaysia	69 (1.7) ▼
Macedonia, Rep. of	63 (2.4) ▼

**Content Domain: Biology**  
**Cognitive Domain: Applying**  
**Description: Recognizes that genetic material is inherited from both parents**

Twins are born. One is a boy and one is a girl.  
 Which statement is correct about their genetic makeup?

(A) The boy and girl inherit genetic material from the father only.  
 (B) The boy and girl inherit genetic material from the mother only.  
 (C) The boy and girl inherit genetic material from both parents.  
 (D) The boy inherits genetic material from the father only and the girl inherits it from the mother only.

Country	Percent Correct
<b>Ninth Grade Participants</b>	
South Africa	73 (1.2) ▼
<sup>2</sup> Honduras	66 (2.0) ▼
Botswana	63 (1.6) ▼

Country	Percent Correct
<b>Benchmarking Participants</b>	
<sup>1 2</sup> Massachusetts, US	95 (1.3) ▲
<sup>1</sup> Minnesota, US	94 (1.1) ▲
<sup>1 2</sup> Indiana, US	92 (1.3) ▲
<sup>1 3</sup> North Carolina, US	91 (1.7) ▲
<sup>1 2</sup> Connecticut, US	89 (1.8) ▲
<sup>2</sup> Alberta, Canada	89 (1.3) ▲
<sup>1</sup> Colorado, US	89 (2.0) ▲
<sup>1</sup> Alabama, US	88 (2.2) ▲
<sup>1 2</sup> Florida, US	87 (2.8)
Quebec, Canada	87 (1.5) ▲
<sup>2</sup> Ontario, Canada	87 (1.5) ▲
<sup>1 2</sup> California, US	86 (1.8)
Abu Dhabi, UAE	86 (1.4)
Dubai, UAE	86 (1.8)

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.  
 ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent Correct
Japan	99 (0.3) ▲
Chinese Taipei	98 (0.5) ▲
Lebanon	97 (0.9) ▲
Slovenia	96 (0.7) ▲
Romania	94 (1.3) ▲
Hungary	93 (1.0) ▲
‡ England	92 (1.3) ▲
<sup>2</sup> Russian Federation	92 (1.1) ▲
Armenia	91 (1.1) ▲
<sup>2</sup> Singapore	91 (1.1) ▲
Korea, Rep. of	90 (1.4) ▲
Italy	90 (1.2) ▲
Hong Kong SAR	89 (1.6) ▲
Indonesia	89 (1.5) ▲
Ukraine	88 (1.5) ▲
Kazakhstan	88 (1.6) ▲
Macedonia, Rep. of	88 (1.4) ▲
Qatar	87 (1.5)
Syrian Arab Republic	87 (1.5)
<sup>3</sup> Israel	86 (1.5)
Oman	86 (1.6)
Jordan	86 (1.4)
<sup>2</sup> United States	86 (1.1)
<sup>1</sup> Lithuania	85 (1.6)
<b>International Avg.</b>	<b>85 (0.2)</b>
Palestinian Nat'l Auth.	85 (1.2)
Australia	84 (2.0)
Norway	84 (1.8)
New Zealand	84 (1.6)
Turkey	83 (1.6)
United Arab Emirates	83 (1.1)
Morocco	82 (1.3) ▼
Sweden	81 (1.4) ▼
Finland	81 (1.9) ▼
Chile	80 (1.8) ▼
Ghana	79 (1.6) ▼
Bahrain	79 (1.5) ▼
Saudi Arabia	75 (1.8) ▼
Tunisia	73 (2.1) ▼
Thailand	73 (1.7) ▼
<sup>1</sup> Georgia	68 (1.9) ▼
Malaysia	67 (1.9) ▼
Iran, Islamic Rep. of	59 (2.3) ▼

Content Domain: Chemistry  
Cognitive Domain: Knowing  
Description: Recognizes the chemical formula of carbon dioxide

What is the chemical formula for carbon dioxide?

(A) CO  
 (B) CO<sub>2</sub>  
 (C) C  
 (D) O<sub>2</sub>

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Country	Percent Correct
<b>Ninth Grade Participants</b>	
Botswana	73 (2.1) ▼
South Africa	72 (1.6) ▼
<sup>2</sup> Honduras	62 (3.0) ▼

Country	Percent Correct
<b>Benchmarking Participants</b>	
<sup>2</sup> Alberta, Canada	93 (1.1) ▲
<sup>1</sup> Minnesota, US	93 (1.7) ▲
<sup>1</sup> Colorado, US	90 (2.1) ▲
Dubai, UAE	90 (1.1) ▲
<sup>1 2</sup> Florida, US	89 (2.2) ▲
<sup>1 2</sup> Massachusetts, US	89 (2.4)
<sup>1 3</sup> North Carolina, US	88 (1.7)
<sup>1 2</sup> Connecticut, US	87 (2.2)
<sup>2</sup> Ontario, Canada	85 (1.6)
Abu Dhabi, UAE	84 (1.6)
<sup>1 2</sup> Indiana, US	84 (2.3)
Quebec, Canada	84 (1.6)
<sup>1</sup> Alabama, US	81 (1.9)
<sup>1 2</sup> California, US	79 (3.0)

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.  
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

### *Eighth Grade TIMSS 2011 Intermediate International Benchmark*

Exhibit 2.23 provides the detailed description of student achievement at the Intermediate International Benchmark. Students at this level recognized and applied their understanding of basic scientific knowledge in various contexts. They also interpreted information from tables, graphs, and pictorial diagrams, and drew conclusions, as well as communicated their understanding through brief descriptive responses.

Exhibit 2.24 presents Example Item 3, which illustrates a competence typical of the eighth grade Intermediate International Benchmark: interpret a graph and recognize what can be concluded from the data presented in the graph. The international average percent correct for this item was 57 percent, although in some of the highest-performing countries (Japan, Korea, and Finland) 80 percent or more of the students answered the item correctly.

In earth science at this benchmark level, students demonstrated an elementary understanding of Earth's processes. Exhibit 2.25 presents Example Item 4, an item in the earth science domain which requires students to apply their understanding of the processes of the water cycle. On average across countries, 63 percent of the eighth grade students correctly numbered each process in the order in which it takes place. However, the percentage of students answering correctly varied greatly across countries (14–92%), indicating that this particular earth science topic may be more widely taught in some countries than others.

● Intermediate International Benchmark

475

Summary

*Students recognize and apply their understanding of basic scientific knowledge in various contexts. Students apply knowledge and communicate an understanding of human health, life cycles, adaptation, and heredity, and analyze information about ecosystems. They have some knowledge of chemistry in everyday life and elementary knowledge of properties of solutions and the concept of concentration. They are acquainted with some aspects of force, motion, and energy. They demonstrate an understanding of Earth's processes and physical features, including the water cycle and atmosphere. Students interpret information from tables, graphs, and pictorial diagrams and draw conclusions. They apply knowledge to practical situations and communicate their understanding through brief descriptive responses.*

In biology, students demonstrate some understanding of human health. For example, students understand how vaccination helps prevent illness and which cells destroy bacteria. They also state why exercise is important for good health. Students apply their knowledge of life cycles, adaptation, and heredity. They recognize that a tree has growth rings. They also explain that an animal's coloration protects it from predators and that an acquired characteristic cannot be passed on to the next generation. Students interpret and explain information about ecosystems and the effect of population changes. They recognize an organism that is a producer. They analyze information about a lake ecosystem and explain how an introduced population can affect an existing population.

Students have some knowledge of chemistry in everyday life. For example, they recognize that a fire can be stopped by cutting off the supply of oxygen, they recognize, from a description of indicator color changes, that neutralization has occurred, and, in the context of an investigation, they recognize the condition under which nails would rust. Students also have elementary knowledge of properties of solutions and the concept of concentration. They identify which of two solutions is more dilute and justify their selection.

In physics, students are acquainted with some aspects of force, motion, and energy. For example, they recognize the position of a fulcrum that requires the least amount of force to move a heavy object. Given a diagram showing a ball being thrown upward, they state the force that causes the ball to fall. In addition, students draw conclusions from a line graph showing the results of an investigation comparing two heat sources.

In earth science, students demonstrate an elementary understanding of Earth's processes and physical features. They describe a cause of earthquakes, recognize where active volcanoes are found and which soil change is due to a natural cause rather than human activity. Students demonstrate an understanding of the water cycle and knowledge of atmospheric conditions. They order the processes involved in the water cycle and match each process with its description. They recognize that air temperature at high altitudes is very low and that carbon dioxide is increasing over time in Earth's atmosphere.

Students interpret information from tables, graphs, and pictorial diagrams and draw conclusions. They apply knowledge to practical situations and communicate their understanding through brief descriptive responses.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

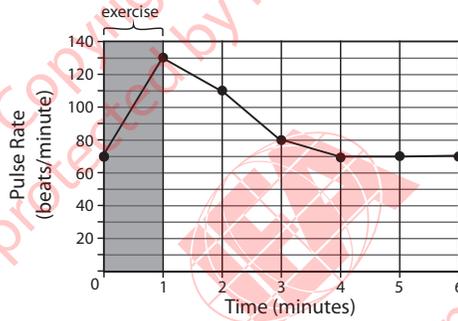
Country	Percent Correct
Japan	82 (1.7) ▲
Korea, Rep. of	80 (1.6) ▲
Finland	80 (1.9) ▲
Italy	79 (1.9) ▲
<sup>2</sup> Russian Federation	75 (1.9) ▲
<sup>2</sup> Singapore	75 (1.6) ▲
Sweden	75 (1.7) ▲
<sup>3</sup> Israel	74 (1.7) ▲
<sup>1</sup> Lithuania	74 (2.0) ▲
Norway	73 (2.5) ▲
<sup>2</sup> United States	73 (1.2) ▲
Slovenia	71 (1.9) ▲
‡ England	69 (2.6) ▲
Australia	66 (2.3) ▲
Chinese Taipei	64 (2.0) ▲
New Zealand	62 (1.9) ▲
Chile	62 (2.0) ▲
Romania	61 (1.9)
Hong Kong SAR	60 (2.3)
Malaysia	60 (1.8)
Turkey	60 (1.9)
<b>International Avg.</b>	<b>57 (0.3)</b>
Ukraine	56 (3.0)
United Arab Emirates	54 (1.5) ▼
Iran, Islamic Rep. of	51 (1.9) ▼
<sup>1</sup> Georgia	49 (2.6) ▼
Tunisia	49 (2.1) ▼
Hungary	48 (2.1) ▼
Saudi Arabia	46 (2.3) ▼
Bahrain	46 (2.1) ▼
Lebanon	46 (2.5) ▼
Indonesia	46 (2.2) ▼
Thailand	45 (2.1) ▼
Macedonia, Rep. of	45 (2.3) ▼
Kazakhstan	44 (2.3) ▼
Qatar	43 (2.2) ▼
Jordan	43 (2.3) ▼
Armenia	42 (2.2) ▼
Morocco	42 (1.4) ▼
Oman	42 (1.5) ▼
Palestinian Nat'l Auth.	38 (1.9) ▼
Syrian Arab Republic	32 (2.6) ▼
Ghana	30 (1.5) ▼

**Content Domain: Biology**

**Cognitive Domain: Reasoning**

**Description: Interprets a graph showing changes in pulse rates before, during, and after exercise and recognizes what can be concluded from the graph**

John measures his pulse rate before he exercises. It is 70 beats per minute. He exercises for one minute and measures his pulse rate again. He then measures it every minute for several minutes. He draws a graph to show his results.



What can be concluded from his results?

- (A) His pulse rate increased by 50 beats per minute.
- (B) His pulse rate took less time to slow down than to increase.
- (C) His pulse rate after 4 minutes was 80 beats per minute.
- His pulse rate returned to normal in less than 6 minutes.

Country	Percent Correct
<b>Ninth Grade Participants</b>	
Botswana	48 (1.7) ▼
<sup>2</sup> Honduras	37 (2.1) ▼
South Africa	31 (1.3) ▼

Country	Percent Correct
<b>Benchmarking Participants</b>	
<sup>1</sup> Minnesota, US	79 (2.5) ▲
<sup>1 2</sup> Massachusetts, US	77 (2.8) ▲
<sup>1 3</sup> North Carolina, US	76 (3.2) ▲
<sup>1 2</sup> Indiana, US	76 (2.3) ▲
Quebec, Canada	76 (2.0) ▲
<sup>1 2</sup> Connecticut, US	75 (2.7) ▲
<sup>2</sup> Alberta, Canada	73 (2.1) ▲
<sup>2</sup> Ontario, Canada	71 (2.2) ▲
<sup>1</sup> Colorado, US	70 (3.0) ▲
<sup>1 2</sup> Florida, US	67 (3.9) ▲
<sup>1 2</sup> California, US	64 (2.5) ▲
<sup>1</sup> Alabama, US	60 (3.0)
Dubai, UAE	57 (2.0)
Abu Dhabi, UAE	55 (2.2)

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §. ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Country	Percent Full Credit
Finland	92 (1.2) ▲
Hong Kong SAR	85 (1.6) ▲
<sup>2</sup> Singapore	83 (1.5) ▲
Chinese Taipei	82 (1.6) ▲
Korea, Rep. of	81 (1.6) ▲
<sup>2</sup> Russian Federation	79 (1.7) ▲
‡ England	79 (2.5) ▲
<sup>3</sup> Israel	79 (2.1) ▲
Sweden	78 (1.9) ▲
<sup>1</sup> Lithuania	76 (1.6) ▲
Slovenia	76 (2.2) ▲
Hungary	74 (2.1) ▲
New Zealand	72 (2.3) ▲
Australia	71 (2.0) ▲
Italy	71 (2.1) ▲
<sup>2</sup> United States	71 (1.4) ▲
Japan	71 (2.2) ▲
Ukraine	69 (2.7) ▲
Norway	67 (2.2)
Chile	66 (1.9)
International Avg.	63 (0.3)
Tunisia	62 (2.1)
United Arab Emirates	62 (1.3)
Thailand	61 (2.3)
Oman	60 (1.7)
Bahrain	59 (2.0) ▼
Iran, Islamic Rep. of	58 (2.2) ▼
Jordan	57 (2.1) ▼
Romania	56 (2.2) ▼
Saudi Arabia	56 (2.5) ▼
Kazakhstan	55 (2.9) ▼
<sup>1</sup> Georgia	54 (2.8) ▼
Turkey	54 (2.1) ▼
Lebanon	50 (2.8) ▼
Malaysia	49 (2.2) ▼
Armenia	47 (2.7) ▼
Syrian Arab Republic	46 (2.7) ▼
Palestinian Nat'l Auth.	45 (1.9) ▼
Indonesia	45 (2.5) ▼
Qatar	45 (2.3) ▼
Morocco	44 (1.6) ▼
Macedonia, Rep. of	37 (2.7) ▼
Ghana	14 (1.5) ▼

**Content Domain: Earth Science**  
**Cognitive Domain: Applying**  
**Description: Given a starting point, orders the processes involved in the water cycle**

The following five statements describe processes involved in the water cycle. Water evaporation from the sea is identified as a first step in the water cycle. Number the other statements 2 through 5 in the order in which these processes take place.

2 Water vapor rises in warm air.  
5 Water travels along a river to the sea.  
1 Water evaporates from the sea.  
3 Water vapor is cooled and forms clouds.  
4 Clouds move and water falls on land as rain.

The answer shown illustrates the type of student response that was given 1 of 1 points.

Country	Percent Full Credit
<b>Ninth Grade Participants</b>	
Botswana	41 (1.8) ▼
<sup>2</sup> Honduras	27 (2.0) ▼
South Africa	18 (1.4) ▼

Country	Percent Full Credit
<b>Benchmarking Participants</b>	
Quebec, Canada	80 (1.6) ▲
<sup>1</sup> Minnesota, US	79 (2.5) ▲
<sup>2</sup> Alberta, Canada	77 (2.1) ▲
<sup>2</sup> Ontario, Canada	76 (1.9) ▲
<sup>1 2</sup> Massachusetts, US	76 (2.5) ▲
<sup>1 3</sup> North Carolina, US	76 (2.3) ▲
<sup>1</sup> Colorado, US	75 (2.5) ▲
<sup>1 2</sup> Indiana, US	74 (2.4) ▲
<sup>1 2</sup> Florida, US	73 (3.4) ▲
Dubai, UAE	68 (2.0) ▲
<sup>1 2</sup> Connecticut, US	67 (3.3)
<sup>1 2</sup> California, US	62 (3.6)
Abu Dhabi, UAE	60 (2.3)
<sup>1</sup> Alabama, US	58 (3.0)

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.  
 ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

### *Eighth Grade TIMSS 2011 High International Benchmark*

Exhibit 2.26 presents the detailed description of achievement at the High International Benchmark. Eighth grade students at this level demonstrated understanding of concepts related to science cycles, systems, and principles. They also demonstrated some scientific inquiry skills, and combined and interpreted information from various types of diagrams, contour maps, graphs, and tables; selected relevant information, analyzed, and drew conclusions; and provided short explanations conveying scientific knowledge.

Example Item 5, shown in Exhibit 2.27, illustrates an item in the chemistry domain that requires reasoning. Students were asked to identify a property of metals and describe how this property could be used to determine whether an unknown substance is a metal or nonmetal. This item demonstrates the increasing sophistication in knowledge and skill demonstrated by students at the High International Benchmark, which is reflected in an international average percent correct of 35 percent.

Exhibit 2.28 presents Example Item 6, an item from the physics domain that requires students to recognize that molecules of a liquid slow down as the liquid cools. This multiple choice item was relatively less difficult than Example Item 5, with 58 percent of eighth grade students, on average, answering the item correctly.

Example Item 7, shown in Exhibit 2.29, illustrates a competence typical of students reaching the eighth grade High International Benchmark—interpreting information appearing in various types of diagrams (in this case, a contour map). This item was moderately difficult; on average across countries, 38 percent of students answered it correctly. As with Example Item 4, there was particularly wide variation across countries in the percentage of students answering this item correctly (4–84%), indicating that this topic also may be more widely taught in some countries than others.

○ High International Benchmark

550 Summary

*Students demonstrate understanding of concepts related to science cycles, systems, and principles. They demonstrate understanding of aspects of human biology, and of the characteristics, classification, and life processes of organisms. Students communicate understanding of processes and relationships in ecosystems. They show an understanding of the classification and compositions of matter and chemical and physical properties and changes. They apply knowledge to situations related to light and sound and demonstrate basic knowledge of heat and temperature, forces and motion, and electrical circuits and magnets. Students demonstrate an understanding of the solar system and of Earth's processes, physical features, and resources. They demonstrate some scientific inquiry skills. They also combine and interpret information from various types of diagrams, contour maps, graphs, and tables; select relevant information, analyze, and draw conclusions; and provide short explanations conveying scientific knowledge.*

In biology, students demonstrate an understanding of aspects of human biology. For example, they recognize the food that is a good source of carbohydrates, recognize what happens to biceps and triceps when an elbow bends, and state one function of the uterus. They also demonstrate an understanding of characteristics, classification, and life processes of organisms. Students classify animals based on physical and behavioral characteristics. They indicate which gas is released into the air and which gas is removed during photosynthesis and animal respiration. Students communicate understanding of processes and relationships in ecosystems. They interpret food chains and recognize competition and predation relationships. They recognize factors that are likely to lead to a change in population size and can predict how populations change over time. They justify whether or not planting trees to decrease the amount of carbon dioxide in a city is a good decision.

In chemistry, students show an understanding of the classification and composition of matter. For example, students recognize elements and compounds from a list of symbols and formulas and recognize a diagrammatic representation of the structure of a water molecule. Given the chemical formula for an acid, they identify the number of atoms of each element in the molecule and the state of each of three substances at a given temperature from a table of melting and boiling points. Students show an understanding of chemical and physical properties and changes. They identify a property of metals and use it to determine whether an unknown substance is a metal or nonmetal, and they recognize chemical processes in everyday activities that involve energy absorption and release. Students use information presented in several tables to work through a multi-step investigation about the mass and density of gold jewelry.

In physics, students apply their knowledge of forces and motion to everyday and abstract situations. For example, they can identify the forces acting on students sitting on a wall. In addition, they recognize an object likely to be used as a lever. Students apply knowledge about the relationship between depth and pressure in water. Given a diagram showing densities of objects and liquids and the objects floating or sinking in the liquids, they identify each liquid. Students apply knowledge to situations related to light and sound. They recognize the pathway of light for an object to be seen, apply their knowledge of light rays reflecting to identify the orientation of a hidden mirror, and explain why lightning is seen before thunder is heard. Students demonstrate basic knowledge of heat and temperature. They recognize what happens to gas and liquid molecules when temperature changes. In the context of an investigation, students explain the effect of temperature on diffusion. Students show an understanding of electrical circuits and properties of magnets and electromagnets. They explain which light bulbs in parallel and series arrangements are affected when one of them breaks. They also recognize how to increase the strength of an electromagnet.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

○ High International Benchmark

550

In earth science, students demonstrate an understanding of Earth's processes, physical features, and resources. For example, they interpret a contour map to recognize a topographical representation of a mountain top, recognize a non-renewable energy source, and state a way that a volcanic eruption impacts the environment. Also, based on a graph of average monthly temperature, they recognize which city is most likely to be located at the equator. Students demonstrate an understanding of the solar system. They recognize the gravitational pull of the moon on Earth as the major cause of tides. They also recognize the main difference between planets and moons, and apply knowledge about rotation and day length to recognize which planet has the shortest day length.

Students demonstrate some scientific inquiry skills. They select and justify an appropriate experimental method. They combine and interpret information from various types of diagrams, contour maps, graphs, and tables; select relevant information, analyze and draw conclusions; and provide short explanations conveying scientific knowledge.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent Full Credit
Japan	72 (2.4) ▲
Slovenia	69 (2.2) ▲
<sup>2</sup> Singapore	64 (2.0) ▲
<sup>‡</sup> England	61 (2.9) ▲
<sup>3</sup> Israel	58 (2.1) ▲
Chinese Taipei	56 (2.5) ▲
Hong Kong SAR	52 (2.5) ▲
Kazakhstan	49 (2.8) ▲
<sup>2</sup> United States	48 (1.4) ▲
<sup>2</sup> Russian Federation	48 (2.1) ▲
Hungary	46 (2.0) ▲
Sweden	45 (2.4) ▲
Jordan	45 (2.2) ▲
Finland	44 (2.6) ▲
<sup>1</sup> Lithuania	42 (1.9) ▲
New Zealand	41 (2.7) ▲
Ukraine	41 (2.6) ▲
Iran, Islamic Rep. of	40 (2.0) ▲
Australia	38 (2.0)
<b>International Avg.</b>	<b>35 (0.3)</b>
Norway	34 (2.3)
Palestinian Nat'l Auth.	32 (2.1)
Saudi Arabia	31 (2.3)
Armenia	31 (2.1) ▼
Korea, Rep. of	31 (1.6) ▼
Bahrain	29 (1.8) ▼
Turkey	29 (1.6) ▼
Qatar	28 (2.1) ▼
United Arab Emirates	24 (1.3) ▼
Italy	24 (2.2) ▼
Ghana	23 (1.9) ▼
Romania	22 (2.3) ▼
Macedonia, Rep. of	22 (2.4) ▼
Lebanon	21 (2.3) ▼
Thailand	20 (1.9) ▼
Malaysia	18 (2.0) ▼
Syrian Arab Republic	17 (2.0) ▼
<sup>1</sup> Georgia	16 (2.0) ▼
Tunisia	15 (1.4) ▼
Oman	15 (1.1) ▼
Chile	13 (1.4) ▼
Indonesia	10 (1.1) ▼
Morocco	7 (0.8) ▼

**Content Domain: Chemistry**

**Cognitive Domain: Reasoning**

**Description: Identifies a property of metals and describes how this property can be used to determine whether an unknown substance is a metal or nonmetal**

David is given a sample of an unknown solid substance. He wants to know if the substance is a metal. Write down one property he can observe or measure and describe how this property could be used to help identify whether the substance is a metal.

Metals conduct electricity.  
He could make a simple electrical circuit with the sample, a battery, and a light bulb. If the bulb lights when everything is connected correctly, the sample is probably a metal.

The answer shown illustrates the type of student response that was given 1 of 1 points.

Country	Percent Full Credit
<b>Ninth Grade Participants</b>	
Botswana	22 (1.5) ▼
South Africa	7 (0.7) ▼
<sup>2</sup> Honduras	4 (0.9) ▼

Country	Percent Full Credit
<b>Benchmarking Participants</b>	
<sup>1 2</sup> Massachusetts, US	65 (2.7) ▲
<sup>1 3</sup> North Carolina, US	56 (3.1) ▲
<sup>1</sup> Minnesota, US	50 (3.4) ▲
<sup>1 2</sup> Indiana, US	49 (2.8) ▲
<sup>1 2</sup> Connecticut, US	47 (3.6) ▲
<sup>1</sup> Colorado, US	47 (2.8) ▲
<sup>1 2</sup> California, US	45 (3.4) ▲
<sup>2</sup> Alberta, Canada	42 (2.1) ▲
Dubai, UAE	41 (2.4) ▲
<sup>1 2</sup> Florida, US	41 (3.4) ▲
Quebec, Canada	39 (2.1) ▲
<sup>2</sup> Ontario, Canada	35 (2.6)
<sup>1</sup> Alabama, US	35 (2.9)
Abu Dhabi, UAE	19 (2.0) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.  
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent Correct
Korea, Rep. of	82 (1.4) ▲
Slovenia	80 (2.0) ▲
<sup>2</sup> Russian Federation	77 (2.0) ▲
<sup>3</sup> Israel	75 (2.0) ▲
<sup>2</sup> Singapore	73 (1.8) ▲
Finland	73 (2.0) ▲
<sup>2</sup> United States	73 (1.5) ▲
Sweden	72 (1.9) ▲
Kazakhstan	71 (2.4) ▲
New Zealand	70 (2.3) ▲
Hungary	70 (2.1) ▲
Norway	68 (2.8) ▲
Bahrain	67 (2.1) ▲
Ukraine	67 (2.6) ▲
‡ England	65 (2.3) ▲
Turkey	63 (1.7) ▲
Saudi Arabia	63 (2.0) ▲
Australia	62 (2.1) ▲
United Arab Emirates	60 (1.3)
Iran, Islamic Rep. of	60 (2.2)
Armenia	59 (2.8)
Romania	59 (1.9)
<sup>1</sup> Lithuania	59 (2.5)
<b>International Avg.</b>	<b>58 (0.3)</b>
<sup>1</sup> Georgia	56 (2.2)
Italy	56 (2.5)
Chinese Taipei	56 (1.9)
Malaysia	53 (2.2) ▼
Hong Kong SAR	52 (2.2) ▼
Chile	51 (2.2) ▼
Oman	50 (1.8) ▼
Japan	50 (2.3) ▼
Macedonia, Rep. of	49 (2.4) ▼
Qatar	47 (2.1) ▼
Jordan	46 (1.9) ▼
Thailand	41 (1.9) ▼
Palestinian Nat'l Auth.	40 (1.8) ▼
Syrian Arab Republic	37 (2.1) ▼
Lebanon	37 (2.5) ▼
Indonesia	35 (2.3) ▼
Morocco	33 (1.6) ▼
Tunisia	32 (2.1) ▼
Ghana	31 (1.8) ▼

**Content Domain: Physics**  
**Cognitive Domain: Knowing**  
**Description: Recognizes what happens to molecules of a liquid as the liquid cools**

What happens to the molecules of a liquid when the liquid cools?

They slow down.  
 They speed up.  
 They decrease in number.  
 They decrease in size.

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Country	Percent Correct
<b>Ninth Grade Participants</b>	
South Africa	47 (1.8) ▼
<sup>2</sup> Honduras	37 (2.3) ▼
Botswana	36 (1.9) ▼

Country	Percent Correct
<b>Benchmarking Participants</b>	
<sup>2</sup> Alberta, Canada	86 (1.6) ▲
<sup>1 2</sup> Massachusetts, US	86 (2.2) ▲
<sup>2</sup> Ontario, Canada	83 (1.6) ▲
<sup>1 2</sup> Florida, US	81 (3.6) ▲
<sup>1 2</sup> Indiana, US	79 (2.7) ▲
<sup>1</sup> Minnesota, US	79 (2.7) ▲
<sup>1</sup> Colorado, US	76 (2.4) ▲
<sup>1 2</sup> Connecticut, US	75 (2.4) ▲
<sup>1 3</sup> North Carolina, US	71 (4.0) ▲
<sup>1 2</sup> California, US	71 (2.3) ▲
<sup>1</sup> Alabama, US	65 (3.4) ▲
Quebec, Canada	65 (2.2) ▲
Abu Dhabi, UAE	61 (2.1)
Dubai, UAE	59 (2.2)

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.  
 ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent Full Credit
Finland	84 (1.4) ▲
Chinese Taipei	81 (1.7) ▲
Slovenia	70 (1.8) ▲
<sup>2</sup> Singapore	68 (2.2) ▲
<sup>2</sup> Russian Federation	67 (2.1) ▲
Hungary	66 (2.3) ▲
Hong Kong SAR	64 (2.5) ▲
Norway	61 (2.2) ▲
Australia	61 (2.4) ▲
<sup>1</sup> Lithuania	60 (2.5) ▲
Korea, Rep. of	60 (2.1) ▲
<sup>2</sup> United States	59 (2.0) ▲
Ukraine	57 (2.5) ▲
‡ England	56 (2.8) ▲
Italy	54 (2.2) ▲
Japan	52 (2.2) ▲
<sup>3</sup> Israel	47 (2.7) ▲
New Zealand	45 (2.7) ▲
Sweden	43 (2.1) ▲
<b>International Avg.</b>	<b>38 (0.3)</b>
Kazakhstan	35 (3.2) ▼
Iran, Islamic Rep. of	31 (2.5) ▼
Turkey	31 (1.8) ▼
Romania	30 (2.2) ▼
Macedonia, Rep. of	28 (2.9) ▼
Malaysia	27 (1.8) ▼
<sup>1</sup> Georgia	25 (2.4) ▼
United Arab Emirates	23 (1.1) ▼
Thailand	22 (1.7) ▼
Chile	22 (1.5) ▼
Saudi Arabia	22 (2.2) ▼
Jordan	21 (1.7) ▼
Bahrain	21 (1.7) ▼
Armenia	20 (2.1) ▼
Qatar	18 (1.6) ▼
Syrian Arab Republic	17 (2.3) ▼
Palestinian Nat'l Auth.	15 (1.8) ▼
Lebanon	11 (1.7) ▼
Morocco	10 (0.8) ▼
Tunisia	10 (1.5) ▼
Indonesia	9 (1.2) ▼
Oman	9 (1.2) ▼
Ghana	4 (1.0) ▼

**Content Domain: Earth Science**  
**Cognitive Domain: Applying**  
**Description: Interprets a contour map to recognize a topographical representation of a mountain top**

The diagram above shows a topographic map of Tiger Island. The lines on the map are contour lines that connect points at the same elevation. The elevations shown are in meters.

A. What geographical feature is found at point X? mountain top

The answer shown illustrates the type of student response that was given 1 of 1 points.

Country	Percent Full Credit
<b>Ninth Grade Participants</b>	
Botswana	22 (1.8) ▼
South Africa	8 (0.9) ▼
<sup>2</sup> Honduras	7 (1.4) ▼

Country	Percent Full Credit
<b>Benchmarking Participants</b>	
<sup>1 2</sup> Massachusetts, US	82 (2.5) ▲
<sup>1</sup> Minnesota, US	70 (2.9) ▲
<sup>1</sup> Colorado, US	65 (3.0) ▲
<sup>1 3</sup> North Carolina, US	63 (2.5) ▲
<sup>1 2</sup> Indiana, US	61 (3.7) ▲
<sup>1 2</sup> Connecticut, US	60 (2.7) ▲
<sup>2</sup> Alberta, Canada	58 (2.5) ▲
Quebec, Canada	57 (2.2) ▲
<sup>1 2</sup> Florida, US	51 (4.3) ▲
<sup>2</sup> Ontario, Canada	50 (2.5) ▲
<sup>1 2</sup> California, US	45 (2.3) ▲
<sup>1</sup> Alabama, US	38 (4.5) ▼
Dubai, UAE	30 (1.6) ▼
Abu Dhabi, UAE	23 (2.1) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.  
 ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

### *Eighth Grade TIMSS 2011 Advanced International Benchmark*

Exhibit 2.30 presents the detailed description of eighth grade performance at the Advanced International Benchmark. At this benchmark, students communicated an understanding of complex and abstract concepts in biology, chemistry, physics, and earth science. They also combined information from several sources to solve problems and draw conclusions, and could provide written explanations to communicate scientific knowledge.

● Advanced International Benchmark

625 Summary

*Students communicate an understanding of complex and abstract concepts in biology, chemistry, physics, and earth science. Students demonstrate some conceptual knowledge about cells and the characteristics, classification, and life processes of organisms. They communicate an understanding of the complexity of ecosystems and adaptations of organisms, and apply an understanding of life cycles and heredity. Students also communicate an understanding of the structure of matter and physical and chemical properties and changes and apply knowledge of forces, pressure, motion, sound, and light. They reason about electrical circuits and properties of magnets. Students apply knowledge and communicate understanding of the solar system and Earth's processes, structures, and physical features. They understand basic features of scientific investigation. They also combine information from several sources to solve problems and draw conclusions, and they provide written explanations to communicate scientific knowledge.*

In biology, students demonstrate some knowledge of concepts related to cells and their functions and the characteristics, classification, and life processes of organisms. For example, they recognize a function of the cell membrane and state a life function of a single-celled organism other than taking in nutrients. They also recognize an organism in which oxygen and carbon dioxide are exchanged through the skin. Students apply an understanding of life cycles and heredity in practical situations. They describe an investigation to find out how fertilizer affects the growth of plants, apply knowledge about heredity to explain why offspring have traits like their parents, and recognize and describe an example of asexual reproduction. Students demonstrate understanding of the complexity of ecosystems and adaptations of organisms to their environment. They demonstrate some appreciation of the impact of human population growth on the environment and know some animal adaptations needed for survival, including both physical and behavioral characteristics. They also apply knowledge of competition to explain the importance of removing weeds from a field where crops are sown.

In chemistry, students demonstrate an understanding of the structure and the physical and chemical properties of matter. For example, they recognize that protons, neutrons, and electrons make up atoms and that atoms make up molecules; recognize what happens to atoms in an object if the shape of the object changes; and classify examples of matter as elements, compounds, or mixtures. Students apply knowledge of expansion of water during freezing and of density to explain why oil floats on water. In the context of an investigation of an irregularly shaped object, they describe the measurements needed to find the volume of the object. Students communicate understanding of physical and chemical changes. They recognize the graph that most likely shows the effect of temperature on solubility and recognize an everyday process that is an example of a physical change. Students describe what might be observed when a chemical reaction takes place. They identify which everyday liquids can neutralize a base and recognize a property common to both acids and bases. They apply knowledge of conservation of mass during neutralization and other chemical reactions.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

● Advanced International Benchmark

625

In physics, students demonstrate a good understanding of states of matter and phase change. For example, students identify from a list of characteristics or properties those that change or remain the same as a liquid changes into a gas. Using knowledge that only gases fill an available space, they infer the spacing of particles in different samples of matter. Students can reason about electrical circuits and properties of magnets. They recognize how the arrangement of components in an electrical circuit affects the battery life and brightness of a light bulb. Students describe how to use a magnet to determine whether a metal bar is a magnet and recognize the relationship between the strength of a magnet and the number of paper clips it attracts. Students apply knowledge of forces, pressure, and motion. They explain the relationship between the orientation of a rectangular block and the pressure it exerts on the ground. Students apply knowledge of sound and light in everyday situations. They predict the effect of removing air from an enclosed jar on the propagation of sound in the jar, and, on a diagram of a person looking through a periscope, draw the path and direction of a light ray passing through it.

In earth science, students apply knowledge and communicate their understanding of Earth's processes, structures, and physical features. For example, they explain how planting trees and terraced farming affects soil erosion. Given a diagram showing weather conditions at different elevations on a mountain, they identify the most likely location of a jungle. They also show understanding of the conditions under the Earth's surface by explaining why water from an artesian well can be hot, and state what fossil evidence would support the idea that two continents were once joined. Students apply knowledge and communicate understanding of the solar system. They recognize why the moon appears to change shape during the month and how a shadow changes as the sun moves. They also explain why an object's weight is less on the Moon than on Earth.

Students understand basic aspects of scientific investigation. In an experimental situation, they identify which variables to control and can design an investigation. They compare information from several sources, combine information to predict and draw conclusions, and interpret information in diagrams, maps, graphs, and tables to solve problems. They provide written explanations to communicate scientific knowledge.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 2.31 presents Example Item 8, which requires students to communicate their understanding of an important concept in chemistry, in this instance by describing the kinds of changes that take place during a chemical reaction. To receive full credit for this constructed response item, students were required to describe two kinds of changes. On average across countries, only 24 percent of students were able to do so.

Example Item 9 in Exhibit 2.32 asks students to demonstrate their understanding of a complex, abstract concept in physics by recognizing that the force of gravity acts on a person regardless of position and movement. On average internationally, 32 percent of the eighth grade students answered this item correctly, although as with many example items, there was great variation across countries, ranging from 13 to 63 percent correct.

The TIMSS 2011 Science Framework describes scientific inquiry as a cross-cutting theme in the TIMSS science assessment. Eighth grade students are expected to be able to propose explanations of scientific phenomena based on evidence. Example Item 10 displayed in Exhibit 2.33, an item from the earth science domain, asks students to present fossil evidence to support the idea that two continents were once joined. Students found this item challenging. On average across the countries, only 18 percent of students were able to provide a correct answer.

Country	Percent Full Credit
‡ England	59 (2.6) ▲
New Zealand	50 (2.5) ▲
<sup>2</sup> United States	46 (1.5) ▲
Chinese Taipei	44 (2.0) ▲
<sup>2</sup> Russian Federation	44 (2.4) ▲
<sup>2</sup> Singapore	44 (1.9) ▲
Australia	42 (2.3) ▲
United Arab Emirates	37 (1.3) ▲
Finland	36 (2.3) ▲
Hong Kong SAR	35 (1.9) ▲
Norway	32 (2.5) ▲
Japan	30 (2.1) ▲
Saudi Arabia	30 (2.1) ▲
Syrian Arab Republic	30 (2.4) ▲
Slovenia	30 (2.1) ▲
Jordan	28 (2.0) ▲
Ukraine	27 (2.5)
International Avg.	24 (0.3)
Bahrain	23 (1.4)
<sup>3</sup> Israel	23 (2.0)
Korea, Rep. of	23 (1.6)
Lebanon	22 (2.3)
Qatar	22 (2.2)
<sup>1</sup> Lithuania	21 (1.9)
Palestinian Nat'l Auth.	21 (1.8)
Sweden	18 (1.5) ▼
Tunisia	18 (1.6) ▼
Kazakhstan	17 (2.0) ▼
Romania	17 (1.6) ▼
Oman	17 (1.4) ▼
Iran, Islamic Rep. of	17 (1.7) ▼
Hungary	15 (1.4) ▼
Armenia	14 (1.5) ▼
Malaysia	10 (1.2) ▼
Italy	9 (1.3) ▼
Turkey	8 (1.2) ▼
Thailand	8 (1.3) ▼
Chile	7 (0.9) ▼
Indonesia	6 (0.9) ▼
Macedonia, Rep. of	5 (1.1) ▼
Morocco	4 (0.5) ▼
<sup>1</sup> Georgia	3 (1.0) ▼
Ghana	1 (0.4) ▼

**Content Domain: Chemistry**  
**Cognitive Domain: Knowing**  
**Description: Describes two things that might be observed as a chemical reaction takes place**

Ahmet put some powder into a test tube. He then added liquid to the powder and shook the test tube. A chemical reaction took place.

Describe two things he might observe as the chemical reaction took place.

1. A temperature change

2. gas bubbles



The answer shown illustrates the type of student response that was given 2 of 2 points.

Country	Percent Full Credit
<b>Ninth Grade Participants</b>	
Botswana	11 (1.0) ▼
South Africa	8 (0.8) ▼
<sup>2</sup> Honduras	8 (1.3) ▼

Country	Percent Full Credit
<b>Benchmarking Participants</b>	
<sup>1</sup> Minnesota, US	53 (2.6) ▲
<sup>1 2</sup> Massachusetts, US	52 (3.4) ▲
<sup>1 2</sup> Indiana, US	51 (3.2) ▲
<sup>1</sup> Colorado, US	51 (3.7) ▲
<sup>1 3</sup> North Carolina, US	47 (3.8) ▲
Quebec, Canada	44 (2.2) ▲
<sup>1 2</sup> California, US	44 (3.6) ▲
<sup>1 2</sup> Florida, US	42 (3.8) ▲
Dubai, UAE	39 (1.8) ▲
Abu Dhabi, UAE	39 (2.4) ▲
<sup>1</sup> Alabama, US	38 (4.1) ▲
<sup>1 2</sup> Connecticut, US	37 (3.7) ▲
<sup>2</sup> Alberta, Canada	37 (2.3) ▲
<sup>2</sup> Ontario, Canada	32 (2.3) ▲

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.  
 ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Country	Percent Correct
Korea, Rep. of	63 (2.0) ▲
Finland	59 (2.1) ▲
<sup>3</sup> Israel	54 (2.3) ▲
Japan	49 (2.1) ▲
Sweden	49 (2.1) ▲
Slovenia	47 (2.7) ▲
<sup>2</sup> Singapore	45 (1.7) ▲
Hungary	45 (2.3) ▲
† England	43 (2.9) ▲
<sup>1</sup> Lithuania	42 (2.3) ▲
Ukraine	40 (2.3) ▲
<sup>2</sup> Russian Federation	38 (2.6) ▲
<sup>2</sup> United States	37 (1.4) ▲
Hong Kong SAR	36 (2.3) ▲
Chinese Taipei	35 (2.0)
Turkey	34 (1.9)
Palestinian Nat'l Auth.	34 (2.1)
Norway	32 (2.2)
<b>International Avg.</b>	<b>32 (0.3)</b>
Jordan	30 (1.9)
Armenia	30 (2.3)
Australia	30 (2.5)
New Zealand	29 (2.0)
United Arab Emirates	28 (1.2) ▼
Italy	26 (2.2) ▼
Qatar	26 (2.5) ▼
Lebanon	26 (2.1) ▼
Bahrain	25 (1.9) ▼
Syrian Arab Republic	25 (2.0) ▼
Ghana	22 (1.7) ▼
Kazakhstan	22 (2.4) ▼
Oman	22 (1.4) ▼
Thailand	22 (1.6) ▼
Iran, Islamic Rep. of	22 (1.7) ▼
Romania	22 (1.9) ▼
Saudi Arabia	20 (1.6) ▼
Macedonia, Rep. of	20 (2.0) ▼
<sup>1</sup> Georgia	20 (2.4) ▼
Chile	19 (1.4) ▼
Morocco	16 (1.2) ▼
Malaysia	16 (1.4) ▼
Tunisia	16 (2.0) ▼
Indonesia	13 (1.5) ▼

**Content Domain: Physics**  
**Cognitive Domain: Applying**  
**Description: Recognizes that the force of gravity acts on a person regardless of position and movement**

The figure shows a parachute jumper in four positions.

1. In the aircraft before the jump

2. In freefall immediately after jumping before parachute opens

3. Falling to the ground after the parachute opens

4. On the ground just after landing

In which of the positions does the force of gravity act on the jumper?

(A) Position 2 only.  
 (B) Positions 2 and 3 only.  
 (C) Positions 1, 2 and 3 only.  
 Positions 1, 2, 3, and 4.

Country	Percent Correct
<b>Ninth Grade Participants</b>	
Botswana	--
South Africa	27 (1.4) ▼
<sup>2</sup> Honduras	24 (1.6) ▼

Country	Percent Correct
<b>Benchmarking Participants</b>	
<sup>1 2</sup> Connecticut, US	51 (2.9) ▲
<sup>1</sup> Minnesota, US	49 (3.7) ▲
<sup>2</sup> Alberta, Canada	44 (2.4) ▲
<sup>1 2</sup> Massachusetts, US	43 (3.3) ▲
<sup>2</sup> Ontario, Canada	43 (2.3) ▲
<sup>1 2</sup> Florida, US	42 (4.1) ▲
<sup>1 2</sup> Indiana, US	38 (3.5)
<sup>1 3</sup> North Carolina, US	38 (3.3)
<sup>1</sup> Colorado, US	36 (2.9)
Quebec, Canada	33 (2.0)
<sup>1 2</sup> California, US	33 (2.8)
<sup>1</sup> Alabama, US	32 (3.7)
Dubai, UAE	27 (2.0) ▼
Abu Dhabi, UAE	26 (2.0) ▼

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §. ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent. A dash (-) indicates comparable data not available.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent Full Credit
Iran, Islamic Rep. of	48 (2.3) ▲
Japan	43 (2.2) ▲
Italy	38 (2.6) ▲
<sup>2</sup> United States	37 (1.7) ▲
<sup>3</sup> Israel	34 (2.2) ▲
Chinese Taipei	32 (2.1) ▲
<sup>2</sup> Russian Federation	31 (2.1) ▲
Slovenia	29 (2.2) ▲
Korea, Rep. of	28 (1.8) ▲
‡ England	28 (2.8) ▲
New Zealand	27 (2.2) ▲
Australia	27 (2.2) ▲
Sweden	24 (1.5) ▲
<sup>1</sup> Lithuania	23 (1.8) ▲
<sup>2</sup> Singapore	22 (1.6) ▲
Romania	21 (2.2)
Kazakhstan	20 (2.4)
Ukraine	20 (2.2)
Norway	20 (2.0)
Hong Kong SAR	19 (2.2)
International Avg.	18 (0.3)
Finland	18 (1.6)
Jordan	17 (1.7)
Chile	15 (1.4) ▼
United Arab Emirates	15 (1.0) ▼
Syrian Arab Republic	13 (1.8) ▼
Hungary	12 (1.3) ▼
Oman	10 (0.9) ▼
Macedonia, Rep. of	9 (1.4) ▼
Turkey	8 (1.2) ▼
Armenia	8 (1.2) ▼
<sup>1</sup> Georgia	8 (1.4) ▼
Thailand	8 (1.1) ▼
Palestinian Nat'l Auth.	7 (0.9) ▼
Qatar	6 (1.2) ▼
Indonesia	5 (0.8) ▼
Morocco	5 (0.7) ▼
Malaysia	5 (0.7) ▼
Bahrain	5 (0.6) ▼
Lebanon	3 (0.8) ▼
Saudi Arabia	3 (0.8) ▼
Tunisia	2 (0.6) ▼
Ghana	--

**Content Domain: Earth Science**  
**Cognitive Domain: Reasoning**  
**Description: States what fossil evidence would support the idea that two continents were once joined**

Two continents are separated by water.  
 Geologists are looking for evidence that the two continents were once joined.  
 What fossil evidence would support this idea?

*The same species of extinct animals are found on the two continents*

The answer shown illustrates the type of student response that was given 1 of 1 points.

Country	Percent Full Credit
<b>Ninth Grade Participants</b>	
South Africa	10 (0.8) ▼
<sup>2</sup> Honduras	3 (0.9) ▼
Botswana	2 (0.6) ▼

Country	Percent Full Credit
<b>Benchmarking Participants</b>	
<sup>1 2</sup> Massachusetts, US	58 (3.7) ▲
<sup>1</sup> Minnesota, US	53 (3.4) ▲
<sup>1 3</sup> North Carolina, US	46 (4.0) ▲
<sup>2</sup> Alberta, Canada	46 (1.8) ▲
<sup>1</sup> Colorado, US	44 (3.1) ▲
<sup>1 2</sup> Indiana, US	41 (3.9) ▲
<sup>1 2</sup> Connecticut, US	38 (3.7) ▲
<sup>1 2</sup> Florida, US	35 (4.2) ▲
<sup>1 2</sup> California, US	32 (2.5) ▲
<sup>2</sup> Ontario, Canada	29 (2.2) ▲
Quebec, Canada	21 (1.9)
<sup>1</sup> Alabama, US	19 (3.0)
Dubai, UAE	16 (1.5)
Abu Dhabi, UAE	15 (1.9)

- ▲ Percent significantly higher than international average
- ▼ Percent significantly lower than international average

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.  
 ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.  
 A dash (–) indicates comparable data not available.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011





# Chapter 3

## International Student Achievement in the TIMSS Science Content and Cognitive Domains

Generally, TIMSS 2011 participants with the highest achievement overall also had the highest achievement in the science content domains (e.g., biology and physics). Internationally, more countries demonstrated relative strengths in knowing science than in applying scientific knowledge and reasoning.

As described in the *TIMSS 2011 Assessment Frameworks*, the science assessment is organized around two dimensions: a content dimension specifying the subject matter or content domains to be assessed in science, and a cognitive dimension specifying the thinking processes that students are likely to use as they engage with the content. Each item in the science assessment is associated with one content domain and one cognitive domain, providing for both content-based and cognitive-oriented perspectives on student achievement in science.

There are three content domains at the fourth grade: life science, physical science, and earth science; and there are four domains at the eighth grade: biology, chemistry, physics, and earth science. The same three cognitive domains—knowing, applying, and reasoning—were used at both the fourth and eighth grades. Knowing covers the student’s knowledge of science facts, procedures, and concepts. Applying focuses on the student’s ability to apply knowledge and conceptual understanding in a science problem situation. Reasoning goes beyond the solution of routine science problems to encompass unfamiliar situations, complex contexts, and multi-step problems.

Chapter 3 presents the TIMSS 2011 results at the fourth and eighth grades for the content and cognitive domains. Previous TIMSS assessments have found that most countries performed relatively better in one or another of the content domains, and similarly, that countries can have relative strengths in one content domain compared to another. In addition to providing TIMSS 2011 average achievement for the content and cognitive domains, the chapter provides changes in achievement in the domains compared to TIMSS 2007, and achievement differences by gender.

### Relative Achievement by Science Content Domains

Exhibit 3.1 presents the average achievement for TIMSS 2011 participants in the fourth grade content domains of life science, physical science, and earth science relative to overall fourth grade science achievement. To provide a way for the TIMSS 2011 participants to examine relative performance in the content domains, IRT scaling was used to place achievement in each of the three domains on the TIMSS fourth grade science scale. The items on which the content domains were based varied in difficulty, as shown in Appendix B.3, which displays the average percent correct across the items in each domain. For example, internationally, the fourth grade students found the life science and physical science items to be somewhat less difficult (48% and 49% correct) than the earth science items (46%), on average. As shown in Appendix B.4, there

was larger variation in the difficulty of the eighth grade content domains, with physics most difficult (38% correct, on average), followed by biology (42%), chemistry (43%), and earth science (45%). However, the scaling process took the differences in difficulty into account, so that average achievement for each of the content domains can be compared relative to overall science achievement at each grade level.

In Exhibit 3.1, the first column presents average overall science achievement, and the next columns show average achievement in the three content domains of life science, physical science, and earth science. TIMSS 2011 participants are presented in order by overall science achievement, first for the fourth grade, followed by the sixth grade and the benchmarking participants. The average scale score for each content domain is shown, together with the difference between achievement in overall science and achievement in the content domain. Up and down arrows are used to indicate whether a country's average content domain score is significantly higher or lower than its overall science average score.

Generally, the TIMSS 2011 participants with the highest achievement overall also had the highest achievement in the content domains. However, many countries performed relatively higher in one or two of the content domains compared to their overall performance; and relatively lower in one or two others. For example, among the top-performing countries, Korea performed relatively better in physical science and earth science than in science overall, and relatively less well in life science; Singapore performed relatively better in life science and physical science, but relatively less well in earth science; and Finland performed equally well in all three domains. Looking across the results in Exhibit 3.1, there is considerable diversity among countries with regard to their relative strengths and weaknesses in the content domains. At the fourth grade, in only four countries and one benchmarking participant was performance in each of the three content areas relatively the same as in science overall (Denmark, Finland, Ireland, Romania, and the Canadian province of Alberta).

Exhibit 3.2 presents average achievement in the eighth grade content domains of biology, chemistry, physics, and earth science. Similar to the fourth grade, there is considerable diversity in countries' strengths and weaknesses in the content domains, even among the high-achieving Asian countries. For example, although the differences were sometimes small, Singapore performed somewhat better in biology and physics than in science overall, and less well

**Exhibit 3.1: Achievement in Science Content Domains**

Country	Overall Science Average Scale Score	Life Science		Physical Science		Earth Science	
		Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score
Korea, Rep. of	587 (2.0)	571 (2.2)	-16 (1.2) ▼	597 (2.6)	10 (1.1) ▲	603 (1.8)	16 (2.0) ▲
<sup>2</sup> Singapore	583 (3.4)	597 (4.3)	14 (2.1) ▲	598 (3.5)	15 (1.7) ▲	541 (3.0)	-42 (1.1) ▼
Finland	570 (2.6)	574 (2.8)	4 (3.4)	568 (2.8)	-2 (2.1)	566 (2.9)	-5 (2.4)
Japan	559 (1.9)	540 (1.9)	-19 (0.9) ▼	589 (1.9)	30 (1.5) ▲	551 (1.8)	-7 (1.2) ▼
Russian Federation	552 (3.5)	556 (3.6)	4 (1.7) ▲	548 (4.0)	-4 (1.5) ▼	552 (4.1)	0 (1.7)
Chinese Taipei	552 (2.2)	538 (2.4)	-14 (1.5) ▼	569 (2.0)	17 (1.2) ▲	553 (2.5)	1 (2.0)
<sup>2</sup> United States	544 (2.1)	547 (2.1)	3 (1.1) ▲	544 (2.0)	0 (1.0)	539 (2.1)	-5 (1.1) ▼
Czech Republic	536 (2.5)	550 (3.0)	13 (2.5) ▲	519 (3.1)	-17 (1.7) ▼	537 (3.4)	1 (1.8)
<sup>2</sup> Hong Kong SAR	535 (3.8)	524 (3.7)	-11 (1.8) ▼	539 (4.4)	4 (2.2)	548 (3.3)	13 (1.4) ▲
Hungary	534 (3.7)	552 (3.5)	17 (1.6) ▲	520 (3.8)	-14 (2.5) ▼	524 (4.4)	-11 (1.6) ▼
Sweden	533 (2.7)	534 (2.7)	0 (2.6)	528 (2.5)	-6 (2.0) ▼	538 (3.2)	5 (2.0) ▲
Slovak Republic	532 (3.8)	534 (3.5)	2 (1.0) ▲	527 (4.0)	-4 (2.0) ▼	535 (3.8)	3 (1.5) ▲
Austria	532 (2.8)	526 (2.6)	-5 (1.3) ▼	535 (2.9)	3 (1.2) ▲	539 (3.6)	7 (1.9) ▲
<sup>†</sup> Netherlands	531 (2.2)	537 (1.8)	6 (1.6) ▲	526 (2.0)	-5 (1.0) ▼	525 (2.7)	-6 (2.8) ▼
England	529 (2.9)	530 (2.8)	1 (1.5)	535 (3.5)	7 (2.2) ▲	522 (3.8)	-7 (2.2) ▼
<sup>2</sup> Denmark	528 (2.8)	530 (2.8)	2 (1.5)	526 (2.5)	-2 (1.3)	527 (3.0)	-1 (1.7)
Germany	528 (2.9)	525 (2.6)	-3 (1.9)	535 (3.1)	7 (1.2) ▲	520 (3.7)	-8 (2.5) ▼
Italy	524 (2.7)	535 (2.7)	11 (1.1) ▲	509 (3.0)	-15 (1.3) ▼	523 (3.6)	-1 (2.5)
Portugal	522 (3.9)	520 (4.2)	-1 (1.3)	517 (4.2)	-5 (1.0) ▼	531 (4.4)	9 (2.1) ▲
Slovenia	520 (2.7)	524 (2.6)	4 (1.5) ▲	524 (3.4)	3 (1.8)	506 (2.7)	-14 (1.5) ▼
<sup>†</sup> Northern Ireland	517 (2.6)	519 (2.9)	2 (1.3)	520 (3.2)	3 (2.5)	507 (2.7)	-9 (1.6) ▼
Ireland	516 (3.4)	513 (3.6)	-3 (1.8)	517 (3.1)	1 (2.7)	520 (3.8)	4 (2.3)
<sup>2</sup> Croatia	516 (2.1)	525 (2.0)	9 (1.2) ▲	502 (2.7)	-14 (1.2) ▼	521 (2.7)	5 (1.3) ▲
Australia	516 (2.8)	516 (3.1)	0 (1.5)	514 (3.2)	-2 (1.6)	520 (3.5)	4 (1.5) ▲
<sup>2</sup> Serbia	516 (3.1)	518 (2.9)	3 (2.3)	523 (3.8)	7 (1.5) ▲	497 (3.6)	-18 (1.5) ▼
<sup>1 2</sup> Lithuania	515 (2.4)	520 (2.9)	6 (2.3) ▲	514 (3.1)	-1 (1.5)	501 (3.0)	-14 (1.7) ▼
Belgium (Flemish)	509 (2.0)	510 (2.4)	2 (1.3)	507 (2.1)	-1 (1.1)	505 (2.8)	-4 (1.6) ▼
Romania	505 (5.9)	504 (6.1)	-1 (1.3)	508 (5.7)	3 (1.6)	502 (6.0)	-3 (1.9)
Spain	505 (3.0)	513 (2.8)	8 (1.7) ▲	497 (2.7)	-8 (1.7) ▼	499 (3.8)	-6 (1.3) ▼
Poland	505 (2.6)	514 (2.5)	9 (1.2) ▲	495 (3.3)	-10 (2.4) ▼	496 (3.3)	-9 (1.4) ▼
New Zealand	497 (2.3)	497 (2.5)	1 (1.2)	493 (2.7)	-3 (1.3) ▼	499 (3.2)	2 (2.2)
<sup>2</sup> Kazakhstan	495 (5.1)	500 (5.1)	5 (2.1) ▲	486 (5.2)	-9 (1.9) ▼	491 (5.8)	-4 (3.3)
<sup>‡</sup> Norway	494 (2.3)	496 (3.0)	2 (2.8)	482 (3.4)	-12 (2.2) ▼	506 (3.0)	12 (1.7) ▲
Chile	480 (2.4)	490 (2.2)	9 (1.5) ▲	471 (2.5)	-9 (1.4) ▼	475 (2.7)	-5 (2.2) ▼
Thailand	472 (5.6)	480 (6.1)	8 (2.5) ▲	462 (5.9)	-9 (1.6) ▼	460 (5.9)	-12 (1.7) ▼
Turkey	463 (4.5)	460 (4.5)	-2 (1.3)	466 (4.7)	4 (1.0) ▲	456 (5.1)	-7 (1.3) ▼
<sup>1</sup> Georgia	455 (3.8)	461 (3.6)	6 (1.4) ▲	440 (4.2)	-15 (2.0) ▼	458 (4.3)	3 (2.3)
Iran, Islamic Rep. of	453 (3.7)	449 (4.1)	-4 (1.5) ▼	453 (4.0)	0 (1.9)	457 (3.5)	4 (2.2)
Bahrain	449 (3.5)	444 (4.1)	-6 (2.2) ▼	453 (4.6)	3 (2.9)	445 (3.7)	-4 (2.0) ▼
Malta	446 (1.9)	439 (2.4)	-7 (1.1) ▼	453 (2.5)	7 (1.9) ▲	447 (2.2)	1 (1.9)
<sup>2</sup> Azerbaijan	438 (5.6)	440 (5.2)	2 (2.3)	436 (5.9)	-2 (2.3)	408 (7.2)	-30 (3.5) ▼
Saudi Arabia	429 (5.4)	415 (6.4)	-14 (2.3) ▼	439 (6.0)	10 (2.4) ▲	432 (6.3)	3 (3.0)
United Arab Emirates	428 (2.5)	420 (2.7)	-8 (1.5) ▼	429 (2.7)	1 (1.1)	435 (2.4)	7 (1.1) ▲
Armenia	416 (3.8)	424 (3.9)	8 (2.8) ▲	399 (3.8)	-17 (1.5) ▼	398 (4.1)	-18 (2.6) ▼
<sup>2</sup> Qatar	394 (4.3)	383 (5.0)	-11 (2.8) ▼	397 (5.0)	3 (2.8)	401 (4.8)	7 (1.8) ▲
Oman	377 (4.3)	370 (3.8)	-7 (2.1) ▼	370 (4.8)	-7 (1.9) ▼	371 (4.6)	-6 (3.4)
<sup>1</sup> <sup>ψ</sup> Kuwait	347 (4.7)	323 (5.0)	-25 (3.2) ▼	348 (4.5)	1 (2.8)	352 (4.7)	5 (2.2) ▲
<sup>ψ</sup> Tunisia	346 (5.3)	342 (5.1)	-3 (2.0)	342 (5.6)	-4 (2.3)	319 (6.6)	-27 (4.0) ▼
<sup>‡</sup> Morocco	264 (4.5)	245 (4.5)	-19 (1.8) ▼	256 (5.3)	-7 (3.1) ▼	208 (4.7)	-55 (2.3) ▼
<sup>‡</sup> Yemen	209 (7.3)	172 (6.9)	-37 (2.5) ▼	198 (6.9)	-11 (3.9) ▼	186 (6.3)	-23 (5.8) ▼

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

▲ Subscale score significantly higher than overall science score  
▼ Subscale score significantly lower than overall science score

‡ Average achievement not reliably measured because the percentage of students with achievement too low for estimation exceeds 25%.  
<sup>ψ</sup> Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.  
 See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and ‡.  
 ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

**Exhibit 3.1: Achievement in Science Content Domains (Continued)**

Country	Overall Science Average Scale Score	Life Science		Physical Science		Earth Science		
		Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score	
<b>Sixth Grade Participants</b>								
Honduras	432 (5.8)	441 (5.5)	9 (1.4) ▲	417 (6.4)	-16 (2.4) ▼	429 (5.8)	-3 (1.7)	
Botswana	367 (5.5)	345 (6.3)	-23 (2.4) ▼	380 (5.5)	12 (1.7) ▲	376 (5.7)	9 (2.6) ▲	
Yemen	345 (7.0)	313 (7.7)	-33 (3.2) ▼	367 (6.8)	21 (3.5) ▲	350 (7.4)	5 (3.8)	
<b>Benchmarking Participants</b>								
<sup>1 3</sup> Florida, US	545 (3.7)	549 (4.2)	5 (2.6)	542 (3.9)	-2 (1.3)	537 (4.4)	-8 (3.5) ▼	
<sup>2</sup> Alberta, Canada	541 (2.4)	542 (2.6)	1 (1.4)	542 (3.0)	0 (3.0)	539 (3.2)	-3 (1.8)	
<sup>1 2</sup> North Carolina, US	538 (4.6)	541 (4.6)	3 (1.4)	541 (5.1)	2 (2.7)	529 (6.2)	-10 (3.9) ▼	
Ontario, Canada	528 (3.0)	535 (3.4)	7 (1.4) ▲	528 (3.2)	0 (1.3)	514 (3.9)	-14 (2.2) ▼	
Quebec, Canada	516 (2.7)	524 (2.5)	8 (2.5) ▲	507 (3.1)	-9 (1.2) ▼	516 (3.5)	-1 (2.5)	
Dubai, UAE	461 (2.3)	455 (2.9)	-6 (2.7) ▼	460 (3.2)	-1 (2.4)	469 (3.0)	8 (1.4) ▲	
Abu Dhabi, UAE	411 (4.9)	403 (5.6)	-8 (1.9) ▼	415 (5.2)	4 (2.0)	418 (5.1)	6 (2.2) ▲	

- ▲ Subscale score significantly higher than overall science score
- ▼ Subscale score significantly lower than overall science score

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 3.2: Achievement in Science Content Domains**

Country	Overall Science Average Scale Score	Biology		Chemistry	
		Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score
<sup>2</sup> Singapore	590 (4.3)	594 (4.8)	4 (1.8) ▲	590 (4.7)	0 (1.5)
Chinese Taipei	564 (2.3)	557 (2.5)	-7 (0.8) ▼	585 (3.9)	22 (2.9) ▲
Korea, Rep. of	560 (2.0)	561 (2.4)	1 (1.6)	551 (2.2)	-9 (1.0) ▼
Japan	558 (2.4)	561 (2.3)	3 (0.9) ▲	560 (2.6)	2 (2.0)
Finland	552 (2.5)	548 (2.9)	-4 (1.7) ▼	554 (2.5)	1 (1.1)
Slovenia	543 (2.7)	532 (2.7)	-11 (1.7) ▼	558 (3.2)	15 (2.3) ▲
<sup>2</sup> Russian Federation	542 (3.2)	537 (3.3)	-6 (1.0) ▼	554 (3.5)	11 (1.1) ▲
Hong Kong SAR	535 (3.4)	535 (3.5)	0 (1.1)	526 (3.6)	-9 (1.9) ▼
<sup>‡</sup> England	533 (4.9)	533 (4.9)	0 (1.1)	529 (5.2)	-4 (1.6) ▼
<sup>2</sup> United States	525 (2.6)	530 (2.5)	6 (1.0) ▲	520 (2.6)	-5 (0.8) ▼
Hungary	522 (3.1)	520 (3.0)	-3 (1.0) ▼	534 (3.4)	12 (1.2) ▲
Australia	519 (4.8)	527 (4.7)	8 (1.2) ▲	501 (5.1)	-18 (1.2) ▼
<sup>3</sup> Israel	516 (4.0)	523 (4.1)	7 (1.3) ▲	514 (5.1)	-2 (2.8)
<sup>1</sup> Lithuania	514 (2.6)	517 (2.8)	3 (2.0)	517 (2.3)	3 (2.2)
New Zealand	512 (4.6)	514 (4.7)	2 (1.4)	501 (5.1)	-11 (2.3) ▼
Sweden	509 (2.5)	513 (3.0)	3 (1.5) ▲	502 (2.7)	-7 (1.5) ▼
Italy	501 (2.5)	503 (3.0)	2 (1.8)	491 (3.1)	-10 (2.1) ▼
Ukraine	501 (3.4)	492 (3.1)	-9 (1.7) ▼	512 (3.9)	11 (2.2) ▲
Norway	494 (2.6)	491 (2.5)	-3 (1.2) ▼	488 (2.8)	-6 (1.4) ▼
Kazakhstan	490 (4.3)	483 (4.3)	-6 (1.6) ▼	508 (4.8)	19 (1.8) ▲
Turkey	483 (3.4)	484 (3.7)	1 (1.5)	477 (4.0)	-6 (1.6) ▼
Iran, Islamic Rep. of	474 (4.0)	466 (3.8)	-8 (0.9) ▼	469 (4.4)	-5 (2.4) ▼
Romania	465 (3.5)	458 (3.8)	-6 (1.7) ▼	469 (4.3)	4 (2.4)
United Arab Emirates	465 (2.4)	463 (2.4)	-1 (0.8) ▼	464 (2.2)	-1 (1.1)
Chile	461 (2.5)	462 (2.5)	0 (0.9)	447 (3.0)	-14 (1.4) ▼
Bahrain	452 (2.0)	449 (2.1)	-4 (1.1) ▼	448 (2.7)	-5 (1.4) ▼
Thailand	451 (3.9)	460 (4.3)	9 (1.2) ▲	436 (4.6)	-15 (1.3) ▼
Jordan	449 (4.0)	447 (4.3)	-2 (1.7) ▼	463 (4.4)	14 (1.4) ▲
Tunisia	439 (2.5)	449 (3.0)	11 (1.7) ▲	434 (3.3)	-5 (1.8) ▼
Armenia	437 (3.1)	420 (3.2)	-17 (1.5) ▼	452 (3.9)	15 (2.3) ▲
Saudi Arabia	436 (3.9)	430 (4.5)	-7 (2.5) ▼	428 (4.4)	-9 (2.4) ▼
Malaysia	426 (6.3)	427 (6.2)	0 (1.2)	426 (6.6)	0 (2.1)
Syrian Arab Republic	426 (3.9)	425 (4.3)	-2 (2.0)	424 (3.7)	-2 (2.2)
Palestinian Nat'l Auth.	420 (3.2)	407 (3.9)	-14 (1.9) ▼	432 (4.0)	12 (2.3) ▲
<sup>1</sup> Georgia	420 (3.0)	435 (3.3)	15 (2.0) ▲	395 (3.2)	-25 (2.1) ▼
Oman	420 (3.2)	407 (3.6)	-12 (1.7) ▼	408 (3.5)	-12 (2.5) ▼
Qatar	419 (3.4)	411 (4.2)	-7 (2.2) ▼	416 (4.1)	-3 (2.2)
Macedonia, Rep. of	407 (5.4)	400 (6.0)	-8 (2.6) ▼	416 (5.5)	8 (1.9) ▲
Lebanon	406 (4.9)	395 (5.2)	-11 (1.3) ▼	435 (5.3)	29 (1.8) ▲
Indonesia	406 (4.5)	410 (4.7)	4 (2.3)	378 (4.9)	-27 (2.7) ▼
Morocco	376 (2.2)	378 (3.0)	2 (2.2)	374 (2.2)	-2 (1.3)
<sup>ψ</sup> Ghana	306 (5.2)	290 (6.2)	-16 (2.6) ▼	331 (5.9)	25 (2.3) ▲

▲ Subscale score significantly higher than overall science score

▼ Subscale score significantly lower than overall science score

ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 3.2: Achievement in Science Content Domains (Continued)

Country	Physics		Earth Science	
	Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score
<sup>2</sup> Singapore	602 (4.2)	12 (1.0) ▲	566 (4.5)	-24 (1.8) ▼
Chinese Taipei	552 (3.4)	-11 (2.5) ▼	568 (2.9)	5 (2.0) ▲
Korea, Rep. of	577 (2.8)	16 (2.0) ▲	548 (3.2)	-13 (2.3) ▼
Japan	558 (2.7)	0 (1.7)	548 (2.8)	-9 (1.9) ▼
Finland	540 (2.7)	-12 (1.4) ▼	574 (3.0)	22 (2.0) ▲
Slovenia	532 (2.8)	-11 (1.3) ▼	560 (3.2)	17 (2.7) ▲
<sup>2</sup> Russian Federation	547 (3.5)	4 (1.4) ▲	535 (3.7)	-7 (2.0) ▼
Hong Kong SAR	539 (3.6)	4 (1.7) ▲	539 (3.7)	4 (1.9) ▲
<sup>4</sup> England	533 (4.6)	0 (2.0)	536 (5.3)	3 (2.8)
<sup>2</sup> United States	513 (2.5)	-11 (0.7) ▼	533 (2.8)	9 (0.8) ▲
Hungary	525 (3.7)	3 (1.7)	511 (3.3)	-11 (1.1) ▼
Australia	511 (5.1)	-8 (1.4) ▼	533 (5.4)	14 (2.1) ▲
<sup>3</sup> Israel	514 (4.1)	-2 (1.2)	504 (4.4)	-11 (1.8) ▼
<sup>1</sup> Lithuania	503 (3.3)	-11 (2.0) ▼	517 (3.5)	3 (2.8)
New Zealand	509 (4.6)	-3 (1.8)	523 (4.8)	11 (1.5) ▲
Sweden	498 (3.2)	-12 (1.9) ▼	520 (2.8)	10 (1.4) ▲
Italy	490 (2.8)	-11 (1.7) ▼	513 (3.8)	12 (2.5) ▲
Ukraine	503 (3.8)	2 (1.9)	495 (3.6)	-6 (1.4) ▼
Norway	481 (3.6)	-13 (2.4) ▼	516 (3.5)	21 (2.0) ▲
Kazakhstan	489 (4.2)	-1 (1.8)	472 (4.9)	-18 (1.6) ▼
Turkey	494 (3.7)	11 (1.2) ▲	468 (3.5)	-14 (1.9) ▼
Iran, Islamic Rep. of	483 (4.1)	9 (1.6) ▲	477 (3.9)	3 (1.4) ▲
Romania	456 (3.9)	-8 (1.6) ▼	470 (3.6)	5 (1.2) ▲
United Arab Emirates	461 (2.3)	-3 (0.6) ▼	466 (2.5)	2 (1.0) ▲
Chile	453 (2.6)	-9 (1.7) ▼	476 (2.8)	15 (2.2) ▲
Bahrain	457 (1.8)	4 (1.5) ▲	451 (1.8)	-1 (1.8)
Thailand	430 (4.5)	-21 (1.8) ▼	466 (4.1)	15 (1.6) ▲
Jordan	446 (4.2)	-3 (1.3) ▼	436 (4.2)	-13 (1.8) ▼
Tunisia	436 (2.6)	-3 (1.5)	414 (3.6)	-25 (2.1) ▼
Armenia	441 (3.7)	4 (2.0)	421 (3.3)	-16 (1.3) ▼
Saudi Arabia	437 (4.2)	1 (1.8)	441 (3.5)	5 (2.4) ▲
Malaysia	435 (6.6)	8 (1.6) ▲	401 (6.5)	-25 (1.2) ▼
Syrian Arab Republic	426 (4.4)	-1 (1.9)	414 (4.8)	-12 (1.6) ▼
Palestinian Nat'l Auth.	432 (3.8)	12 (1.3) ▲	406 (3.3)	-14 (1.9) ▼
<sup>1</sup> Georgia	401 (4.2)	-19 (2.6) ▼	417 (3.7)	-2 (2.3)
Oman	427 (3.3)	7 (1.5) ▲	431 (3.0)	11 (1.8) ▲
Qatar	426 (3.8)	8 (2.1) ▲	408 (3.8)	-11 (1.6) ▼
Macedonia, Rep. of	398 (6.0)	-9 (2.5) ▼	403 (6.5)	-5 (2.8)
Lebanon	405 (5.4)	-1 (2.0)	365 (6.4)	-41 (3.0) ▼
Indonesia	397 (5.4)	-9 (2.2) ▼	412 (5.6)	6 (2.0) ▲
Morocco	349 (2.5)	-27 (1.6) ▼	377 (3.3)	1 (2.9)
Ψ Ghana	292 (5.9)	-14 (1.7) ▼	265 (6.5)	-41 (2.8) ▼

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

▲ Subscale score significantly higher than overall science score

▼ Subscale score significantly lower than overall science score

**Exhibit 3.2: Achievement in Science Content Domains (Continued)**

Country	Overall Science Average Scale Score	Biology		Chemistry	
		Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score
<b>Ninth Grade Participants</b>					
Botswana	404 (3.6)	401 (3.9)	-3 (2.5)	403 (3.6)	-1 (2.0)
<sup>2</sup> Honduras	369 (4.0)	364 (3.9)	-5 (2.3) ▼	368 (3.5)	-1 (2.9)
<sup>ψ</sup> South Africa	332 (3.7)	318 (3.5)	-14 (1.8) ▼	336 (3.8)	4 (2.1) ▲
<b>Benchmarking Participants</b>					
<sup>1 2</sup> Massachusetts, US	567 (5.1)	575 (5.2)	8 (1.2) ▲	568 (6.0)	1 (2.3)
<sup>1</sup> Minnesota, US	553 (4.6)	563 (5.5)	10 (1.7) ▲	538 (5.0)	-15 (1.5) ▼
<sup>2</sup> Alberta, Canada	546 (2.4)	554 (2.7)	9 (1.5) ▲	521 (2.6)	-24 (1.8) ▼
<sup>1</sup> Colorado, US	542 (4.4)	551 (4.6)	9 (1.4) ▲	528 (5.1)	-14 (2.2) ▼
<sup>1 2</sup> Indiana, US	533 (4.8)	540 (5.0)	7 (1.4) ▲	526 (5.0)	-7 (1.8) ▼
<sup>1 2</sup> Connecticut, US	532 (4.6)	539 (5.0)	7 (2.2) ▲	520 (5.3)	-11 (1.8) ▼
<sup>1 3</sup> North Carolina, US	532 (6.3)	541 (6.0)	10 (2.3) ▲	531 (7.2)	0 (3.5)
<sup>1 2</sup> Florida, US	530 (7.3)	529 (7.9)	-1 (2.6) ▼	525 (8.2)	-5 (2.7) ▼
<sup>2</sup> Ontario, Canada	521 (2.5)	531 (2.6)	10 (1.5) ▲	495 (2.5)	-26 (0.9) ▼
Quebec, Canada	520 (2.5)	525 (2.9)	5 (1.0) ▲	515 (3.1)	-5 (1.2) ▼
<sup>1 2</sup> California, US	499 (4.6)	500 (4.7)	1 (1.5) ▲	503 (6.0)	5 (2.2) ▲
<sup>1</sup> Alabama, US	485 (6.2)	491 (6.1)	5 (1.6) ▲	480 (6.6)	-6 (3.1)
Dubai, UAE	485 (2.5)	485 (2.7)	0 (1.4)	487 (2.3)	2 (1.7)
Abu Dhabi, UAE	461 (4.0)	459 (4.3)	-2 (2.0)	461 (3.9)	-1 (1.6)

Country	Overall Science Average Scale Score	Physics		Earth Science	
		Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score
<b>Ninth Grade Participants</b>					
Botswana	404 (3.6)	417 (3.6)	13 (2.1) ▲	384 (4.2)	-20 (4.0) ▼
<sup>2</sup> Honduras	369 (4.0)	351 (3.7)	-17 (2.9) ▼	374 (4.9)	6 (2.1) ▲
<sup>ψ</sup> South Africa	332 (3.7)	351 (3.7)	20 (1.5) ▲	294 (3.8)	-38 (2.0) ▼
<b>Benchmarking Participants</b>					
<sup>1 2</sup> Massachusetts, US	567 (5.1)	555 (5.7)	-12 (2.4) ▼	577 (6.0)	11 (3.4) ▲
<sup>1</sup> Minnesota, US	553 (4.6)	541 (5.6)	-12 (3.5) ▼	574 (6.2)	21 (2.6) ▲
<sup>2</sup> Alberta, Canada	546 (2.4)	545 (2.4)	0 (1.1)	559 (2.7)	14 (1.3) ▲
<sup>1</sup> Colorado, US	542 (4.4)	530 (5.3)	-12 (4.4) ▼	555 (4.6)	13 (1.6) ▲
<sup>1 2</sup> Indiana, US	533 (4.8)	522 (5.1)	-11 (1.4) ▼	540 (5.8)	7 (1.8) ▲
<sup>1 2</sup> Connecticut, US	532 (4.6)	520 (5.4)	-11 (2.8) ▼	542 (5.6)	10 (1.9) ▲
<sup>1 3</sup> North Carolina, US	532 (6.3)	510 (6.0)	-21 (1.8) ▼	540 (6.5)	8 (2.3) ▲
<sup>1 2</sup> Florida, US	530 (7.3)	530 (7.2)	0 (2.1)	536 (7.7)	6 (3.3)
<sup>2</sup> Ontario, Canada	521 (2.5)	521 (2.7)	0 (1.4)	528 (3.4)	7 (2.2) ▲
Quebec, Canada	520 (2.5)	502 (3.2)	-18 (1.3) ▼	536 (2.9)	16 (1.2) ▲
<sup>1 2</sup> California, US	499 (4.6)	487 (4.6)	-12 (1.8) ▼	499 (4.8)	1 (1.9)
<sup>1</sup> Alabama, US	485 (6.2)	476 (5.9)	-9 (2.4) ▼	487 (7.9)	2 (2.7)
Dubai, UAE	485 (2.5)	482 (2.1)	-3 (1.2) ▼	487 (3.1)	2 (2.6)
Abu Dhabi, UAE	461 (4.0)	459 (3.9)	-2 (1.8)	461 (4.7)	0 (2.4)

▲ Subscale score significantly higher than overall science score

▼ Subscale score significantly lower than overall science score

in earth science. Chinese Taipei performed better in chemistry and earth science than in science overall and less well in biology and physics, while Korea performed better in physics relative to science overall and less well in chemistry and earth science. Japan performed better in biology relative to overall science and less well in earth science. Looking across all of the countries, only the UAE emirate of Abu Dhabi had performance in each of the four content areas that was no different than in science overall.

## Relative Achievement by Science Cognitive Domains

Exhibits 3.3 and 3.4 present average achievement at the fourth and eighth grades, respectively, in the cognitive domains of knowing, applying, and reasoning relative to overall science achievement for TIMSS 2011 participants. Because these three scales represent quite different skills, it was expected that the assessment items would have different difficulty levels. The average percent correct in the cognitive domains shown in Appendix E were 53 percent for knowing, 46 percent for applying, and 41 percent for reasoning at the fourth grade, and 49 percent, 41 percent, and 33 percent, respectively, at the eighth grade. However, as with the content domains, the IRT scaling adjusts for these difficulty levels and allows achievement in the three cognitive domains to be placed on the overall science scales for the fourth and eighth grades, so that TIMSS 2011 participants can compare performance in each of the three cognitive domains relative to overall science achievement.

The presentation of results for the cognitive domains in Exhibits 3.3 and 3.4 follows the layout of results for the content domains (Exhibits 3.1 and 3.2). Similar to the results for the content domains, in general, the TIMSS 2011 participants with the highest science achievement overall also had highest achievement in the cognitive domains, although most countries showed a relative strength in one cognitive domain or another.

Among the top-performing countries at the fourth grade, there was no consistent pattern of strength or weakness in the cognitive domains; with regard to science overall, some countries performed relatively well in knowing, some performed relatively well in applying, and some performed relatively well in reasoning. In only four countries and three benchmarking participants was performance in each of the three cognitive domains no different from science performance overall: Australia, Belgium (Flemish), New Zealand, and Chile, and the Canadian provinces of Alberta, Ontario, and Québec.

**Exhibit 3.3: Achievement in Science Cognitive Domains**

Country	Overall Science Average Scale Score	Knowing		Applying		Reasoning	
		Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score
Korea, Rep. of	587 (2.0)	570 (2.0)	-17 (1.5) ▼	593 (1.9)	7 (1.3) ▲	605 (3.0)	18 (3.6) ▲
<sup>2</sup> Singapore	583 (3.4)	570 (3.4)	-13 (1.2) ▼	590 (4.0)	6 (1.6) ▲	597 (3.8)	13 (1.8) ▲
Finland	570 (2.6)	579 (2.5)	9 (1.7) ▲	568 (2.3)	-2 (1.9) ▼	560 (3.2)	-10 (2.4) ▼
Japan	559 (1.9)	538 (1.8)	-21 (1.4) ▼	562 (1.6)	4 (1.8) ▲	591 (2.0)	33 (2.2) ▲
Russian Federation	552 (3.5)	553 (3.8)	1 (1.2)	556 (3.6)	4 (1.2) ▲	542 (4.2)	-11 (2.9) ▼
Chinese Taipei	552 (2.2)	542 (2.7)	-10 (1.5) ▼	552 (3.1)	1 (2.1)	568 (3.2)	16 (2.4) ▲
<sup>2</sup> United States	544 (2.1)	546 (1.9)	2 (0.8) ▲	544 (2.1)	0 (0.9)	537 (2.3)	-7 (1.1) ▼
Czech Republic	536 (2.5)	551 (3.3)	14 (1.7) ▲	534 (2.6)	-2 (1.7) ▼	516 (4.0)	-20 (2.4) ▼
<sup>2</sup> Hong Kong SAR	535 (3.8)	537 (3.6)	2 (1.4)	529 (3.5)	-6 (1.3) ▼	541 (4.2)	6 (2.2) ▲
Hungary	534 (3.7)	547 (3.7)	12 (1.8) ▲	530 (3.6)	-5 (1.4) ▼	525 (4.5)	-9 (1.7) ▼
Sweden	533 (2.7)	536 (2.8)	2 (1.2) ▲	531 (3.0)	-3 (1.9) ▼	537 (3.0)	3 (1.4) ▲
Slovak Republic	532 (3.8)	547 (3.8)	15 (0.9) ▲	528 (4.0)	-4 (0.9) ▼	514 (4.2)	-18 (1.4) ▼
Austria	532 (2.8)	532 (3.1)	1 (1.0)	533 (2.9)	2 (1.5)	525 (3.1)	-6 (1.7) ▼
<sup>†</sup> Netherlands	531 (2.2)	528 (2.3)	-3 (1.3) ▼	534 (2.0)	3 (1.4) ▲	532 (2.9)	1 (2.0)
England	529 (2.9)	529 (3.2)	0 (1.9)	532 (3.1)	4 (1.4) ▲	526 (4.4)	-2 (3.6)
<sup>2</sup> Denmark	528 (2.8)	524 (2.6)	-4 (1.0) ▼	532 (2.5)	4 (1.0) ▲	527 (3.1)	-1 (1.6)
Germany	528 (2.9)	524 (4.0)	-4 (2.0)	533 (2.6)	5 (2.2) ▲	526 (3.6)	-2 (1.9)
Italy	524 (2.7)	532 (3.0)	8 (1.3) ▲	523 (2.7)	-1 (1.5)	510 (2.9)	-14 (1.8) ▼
Portugal	522 (3.9)	528 (4.4)	6 (1.3) ▲	515 (4.3)	-7 (1.6) ▼	524 (4.6)	3 (3.3)
Slovenia	520 (2.7)	518 (2.2)	-2 (1.3)	518 (2.8)	-2 (1.8)	525 (3.6)	5 (2.3) ▲
<sup>†</sup> Northern Ireland	517 (2.6)	517 (2.9)	1 (2.1)	521 (2.6)	5 (1.4) ▲	503 (3.1)	-14 (2.2) ▼
Ireland	516 (3.4)	518 (3.9)	2 (1.9)	517 (3.6)	1 (1.4)	509 (3.4)	-7 (2.2) ▼
<sup>2</sup> Croatia	516 (2.1)	526 (1.9)	10 (1.5) ▲	510 (2.3)	-6 (1.6) ▼	512 (3.5)	-4 (3.6)
Australia	516 (2.8)	517 (2.8)	2 (1.2)	513 (3.0)	-2 (1.2)	518 (3.4)	2 (2.5)
<sup>2</sup> Serbia	516 (3.1)	524 (2.9)	8 (1.9) ▲	506 (3.2)	-9 (2.0) ▼	519 (3.0)	4 (1.9) ▲
<sup>1 2</sup> Lithuania	515 (2.4)	508 (2.9)	-7 (2.1) ▼	521 (2.5)	6 (1.6) ▲	515 (2.8)	1 (1.2)
Belgium (Flemish)	509 (2.0)	507 (2.2)	-2 (1.2)	511 (1.8)	3 (1.5)	508 (2.5)	0 (1.3)
Romania	505 (5.9)	511 (6.1)	6 (2.3) ▲	502 (5.9)	-3 (1.4) ▼	497 (6.0)	-8 (1.8) ▼
Spain	505 (3.0)	516 (3.2)	11 (1.4) ▲	499 (3.0)	-7 (1.7) ▼	496 (3.1)	-9 (1.6) ▼
Poland	505 (2.6)	500 (3.2)	-5 (1.6) ▼	514 (2.6)	9 (1.1) ▲	487 (3.2)	-18 (1.9) ▼
New Zealand	497 (2.3)	496 (2.7)	-1 (1.3)	497 (2.6)	1 (1.2)	497 (2.9)	0 (1.6)
<sup>2</sup> Kazakhstan	495 (5.1)	486 (5.6)	-8 (1.5) ▼	499 (5.1)	4 (1.5) ▲	496 (5.7)	1 (3.2)
<sup>‡</sup> Norway	494 (2.3)	502 (2.8)	8 (1.3) ▲	487 (2.8)	-7 (1.7) ▼	493 (3.7)	-1 (2.8)
Chile	480 (2.4)	483 (2.7)	3 (1.5)	479 (2.3)	-1 (1.5)	477 (2.8)	-3 (2.0)
Thailand	472 (5.6)	473 (5.9)	2 (1.9)	471 (5.4)	-1 (1.3)	463 (6.0)	-9 (2.1) ▼
Turkey	463 (4.5)	457 (4.7)	-5 (1.3) ▼	463 (4.8)	0 (1.3)	472 (5.3)	9 (1.7) ▲
<sup>1</sup> Georgia	455 (3.8)	466 (3.9)	11 (1.6) ▲	452 (4.4)	-3 (1.3) ▼	422 (5.0)	-33 (2.8) ▼
Iran, Islamic Rep. of	453 (3.7)	448 (4.3)	-5 (1.9) ▼	452 (3.8)	-1 (1.0)	459 (3.9)	6 (1.5) ▲
Bahrain	449 (3.5)	454 (3.6)	4 (1.7) ▲	443 (3.5)	-6 (1.7) ▼	442 (4.7)	-7 (3.3) ▼
Malta	446 (1.9)	437 (3.0)	-9 (2.1) ▼	449 (1.6)	3 (1.8)	459 (4.2)	13 (3.3) ▲
<sup>2</sup> Azerbaijan	438 (5.6)	445 (6.4)	7 (2.2) ▲	439 (5.2)	1 (2.1)	402 (5.9)	-36 (1.9) ▼
Saudi Arabia	429 (5.4)	432 (6.0)	3 (2.2)	427 (6.1)	-3 (2.3)	416 (5.8)	-14 (2.4) ▼
United Arab Emirates	428 (2.5)	433 (2.7)	5 (1.2) ▲	421 (2.6)	-7 (0.8) ▼	426 (2.6)	-2 (1.0) ▼
Armenia	416 (3.8)	412 (4.3)	-4 (2.1) ▼	418 (3.9)	2 (2.1)	402 (4.9)	-14 (2.9) ▼
<sup>2</sup> Qatar	394 (4.3)	388 (5.1)	-6 (2.2) ▼	389 (5.4)	-5 (2.6)	404 (4.4)	10 (2.8) ▲
Oman	377 (4.3)	376 (4.5)	-1 (1.4)	372 (4.2)	-5 (1.2) ▼	354 (4.4)	-23 (2.3) ▼
<sup>1</sup> Ψ Kuwait	347 (4.7)	342 (5.7)	-5 (2.9) ▼	334 (4.9)	-14 (2.6) ▼	336 (5.0)	-11 (3.0) ▼
Ψ Tunisia	346 (5.3)	336 (5.3)	-9 (2.3) ▼	343 (4.7)	-3 (2.5)	337 (4.9)	-9 (2.7) ▼
* Morocco	264 (4.5)	237 (6.1)	-27 (2.7) ▼	256 (5.1)	-8 (2.5) ▼	240 (5.0)	-24 (3.1) ▼
* Yemen	209 (7.3)	182 (6.7)	-27 (4.9) ▼	183 (6.6)	-26 (3.4) ▼	180 (7.3)	-29 (3.6) ▼

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

- ▲ Subscale score significantly higher than overall science score
- ▼ Subscale score significantly lower than overall science score

\* Average achievement not reliably measured because the percentage of students with achievement too low for estimation exceeds 25%.  
 Ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.  
 ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

**Exhibit 3.3: Achievement in Science Cognitive Domains (Continued)**

Country	Overall Science Average Scale Score	Knowing		Applying		Reasoning		
		Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score	
<b>Sixth Grade Participants</b>								
Honduras	432 (5.8)	445 (6.0)	13 (1.9) ▲	429 (5.0)	-3 (2.0)	392 (7.4)	-40 (3.2) ▼	
Botswana	367 (5.5)	344 (6.2)	-24 (1.6) ▼	379 (5.5)	12 (1.8) ▲	377 (5.9)	10 (2.3) ▲	
Yemen	345 (7.0)	338 (7.4)	-7 (2.0) ▼	338 (6.8)	-7 (1.9) ▼	337 (7.0)	-8 (3.2) ▼	
<b>Benchmarking Participants</b>								
<sup>1 3</sup> Florida, US	545 (3.7)	550 (4.0)	5 (2.0) ▲	543 (3.6)	-2 (2.2)	536 (3.8)	-9 (2.1) ▼	
<sup>2</sup> Alberta, Canada	541 (2.4)	543 (3.1)	2 (1.5)	541 (2.8)	-1 (2.2)	540 (2.9)	-1 (2.0)	
<sup>1 2</sup> North Carolina, US	538 (4.6)	539 (4.6)	1 (1.9)	539 (4.4)	1 (2.1)	533 (5.1)	-6 (2.1) ▼	
Ontario, Canada	528 (3.0)	529 (3.1)	1 (1.4)	526 (3.3)	-2 (1.0)	529 (3.7)	1 (1.4)	
Quebec, Canada	516 (2.7)	519 (2.7)	2 (1.1)	514 (2.5)	-3 (1.7)	520 (3.7)	3 (3.0)	
Dubai, UAE	461 (2.3)	467 (2.5)	6 (2.3) ▲	453 (2.0)	-8 (1.8) ▼	455 (3.7)	-6 (2.3) ▼	
Abu Dhabi, UAE	411 (4.9)	415 (5.7)	3 (2.6)	405 (5.3)	-6 (1.9) ▼	416 (5.1)	5 (3.0)	

▲ Subscale score significantly higher than overall science score

▼ Subscale score significantly lower than overall science score

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011

**Exhibit 3.4: Achievement in Science Cognitive Domains**

Country	Overall Science Average Scale Score	Knowing		Applying		Reasoning	
		Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score
<sup>2</sup> Singapore	590 (4.3)	588 (4.9)	-2 (1.7)	589 (4.4)	-1 (0.9)	592 (4.5)	2 (1.6)
Chinese Taipei	564 (2.3)	569 (2.7)	5 (1.9) ▲	570 (2.7)	6 (1.0) ▲	551 (2.9)	-13 (1.6) ▼
Korea, Rep. of	560 (2.0)	554 (2.9)	-7 (2.2) ▼	561 (2.0)	1 (0.8)	564 (2.2)	3 (1.7) ▲
Japan	558 (2.4)	541 (2.7)	-17 (2.2) ▼	561 (2.4)	3 (1.2) ▲	568 (2.3)	10 (1.0) ▲
Finland	552 (2.5)	564 (3.0)	12 (2.1) ▲	549 (2.5)	-4 (1.1) ▼	547 (3.4)	-5 (2.8)
Slovenia	543 (2.7)	551 (2.7)	8 (1.9) ▲	542 (2.6)	-1 (1.7) ▼	536 (2.7)	-7 (1.9) ▼
<sup>2</sup> Russian Federation	542 (3.2)	557 (3.9)	15 (1.9) ▲	539 (3.5)	-4 (1.3) ▼	533 (3.3)	-10 (1.5) ▼
Hong Kong SAR	535 (3.4)	544 (3.3)	9 (1.6) ▲	529 (3.5)	-6 (1.2) ▼	538 (4.1)	3 (2.0)
<sup>‡</sup> England	533 (4.9)	533 (5.1)	0 (1.6)	531 (4.7)	-2 (1.3)	537 (4.8)	4 (1.5) ▲
<sup>2</sup> United States	525 (2.6)	527 (2.8)	3 (1.3) ▲	522 (2.3)	-2 (0.7) ▼	524 (2.5)	-1 (0.7)
Hungary	522 (3.1)	511 (3.3)	-12 (1.6) ▼	532 (3.5)	10 (1.3) ▲	518 (3.4)	-4 (1.2) ▼
Australia	519 (4.8)	514 (5.4)	-5 (1.4) ▼	517 (4.8)	-2 (0.9) ▼	526 (5.2)	7 (2.0) ▲
<sup>3</sup> Israel	516 (4.0)	518 (4.2)	2 (1.1)	512 (4.1)	-4 (1.2) ▼	519 (4.4)	3 (1.7) ▲
<sup>1</sup> Lithuania	514 (2.6)	516 (2.3)	2 (1.4)	512 (2.3)	-2 (1.3)	513 (2.6)	-1 (1.5)
New Zealand	512 (4.6)	511 (5.0)	-1 (1.7)	509 (4.3)	-3 (1.3) ▼	515 (4.7)	3 (1.6) ▲
Sweden	509 (2.5)	512 (2.4)	2 (1.6)	508 (2.6)	-2 (0.8) ▼	510 (2.9)	0 (1.6)
Italy	501 (2.5)	512 (2.7)	11 (1.7) ▲	500 (2.4)	-1 (0.9)	489 (2.7)	-12 (1.5) ▼
Ukraine	501 (3.4)	505 (3.9)	4 (1.9) ▲	496 (3.8)	-5 (2.4) ▼	500 (3.9)	-1 (2.7)
Norway	494 (2.6)	490 (2.6)	-4 (2.0) ▼	496 (3.0)	1 (1.6)	494 (3.0)	0 (1.3)
Kazakhstan	490 (4.3)	483 (5.0)	-7 (1.5) ▼	491 (4.1)	1 (1.5)	487 (4.2)	-3 (1.8)
Turkey	483 (3.4)	490 (3.8)	7 (0.9) ▲	478 (3.4)	-5 (0.9) ▼	483 (3.4)	0 (1.3)
Iran, Islamic Rep. of	474 (4.0)	479 (4.7)	5 (1.5) ▲	470 (3.9)	-4 (1.3) ▼	475 (3.9)	1 (1.3)
Romania	465 (3.5)	457 (3.9)	-8 (1.2) ▼	468 (3.6)	3 (1.1) ▲	460 (3.9)	-5 (2.0) ▼
United Arab Emirates	465 (2.4)	471 (2.5)	7 (1.2) ▲	464 (2.1)	0 (1.1)	456 (2.6)	-9 (1.0) ▼
Chile	461 (2.5)	476 (3.2)	14 (1.8) ▲	454 (2.3)	-8 (1.2) ▼	459 (2.8)	-2 (1.1) ▼
Bahrain	452 (2.0)	457 (3.6)	5 (3.1)	450 (2.0)	-3 (1.5) ▼	449 (1.9)	-4 (1.9)
Thailand	451 (3.9)	443 (4.7)	-8 (1.6) ▼	451 (4.1)	0 (1.8)	453 (4.2)	2 (1.6)
Jordan	449 (4.0)	453 (4.3)	4 (1.2) ▲	451 (4.0)	2 (0.9) ▲	441 (4.5)	-8 (1.2) ▼
Tunisia	439 (2.5)	424 (2.3)	-14 (1.8) ▼	437 (2.2)	-1 (1.4)	446 (2.7)	8 (1.1) ▲
Armenia	437 (3.1)	464 (3.1)	27 (1.5) ▲	428 (3.4)	-9 (1.8) ▼	419 (3.6)	-18 (2.2) ▼
Saudi Arabia	436 (3.9)	448 (4.4)	11 (1.5) ▲	432 (3.9)	-4 (1.5) ▼	424 (3.5)	-13 (1.7) ▼
Malaysia	426 (6.3)	403 (7.0)	-24 (2.0) ▼	424 (6.2)	-2 (1.1) ▼	439 (5.8)	13 (2.4) ▲
Syrian Arab Republic	426 (3.9)	441 (4.3)	14 (2.1) ▲	426 (4.4)	0 (2.5)	402 (5.1)	-25 (2.7) ▼
Palestinian Nat'l Auth.	420 (3.2)	431 (3.6)	10 (1.6) ▲	422 (3.6)	1 (1.3)	404 (3.6)	-16 (1.4) ▼
<sup>1</sup> Georgia	420 (3.0)	428 (3.9)	8 (3.0) ▲	418 (3.8)	-2 (3.0)	412 (3.6)	-8 (2.8) ▼
Oman	420 (3.2)	416 (3.4)	-3 (2.2)	419 (3.3)	0 (1.5)	417 (3.0)	-3 (1.4) ▼
Qatar	419 (3.4)	418 (4.3)	-1 (2.9)	420 (3.5)	1 (2.2)	409 (4.4)	-9 (2.8) ▼
Macedonia, Rep. of	407 (5.4)	417 (6.0)	9 (1.7) ▲	408 (5.4)	0 (2.4)	391 (6.0)	-17 (2.2) ▼
Lebanon	406 (4.9)	381 (5.8)	-25 (2.1) ▼	408 (5.2)	2 (2.1)	408 (5.6)	2 (1.9)
Indonesia	406 (4.5)	402 (5.4)	-4 (3.3)	398 (4.7)	-8 (2.1) ▼	413 (5.2)	8 (2.6) ▲
Morocco	376 (2.2)	363 (2.7)	-13 (1.6) ▼	381 (1.9)	5 (1.1) ▲	366 (2.3)	-10 (1.4) ▼
□ Ghana	306 (5.2)	292 (6.1)	-14 (2.1) ▼	295 (6.3)	-10 (3.0) ▼	315 (4.9)	9 (1.9) ▲

▲ Subscale score significantly higher than overall science score

▼ Subscale score significantly lower than overall science score

Ψ Reservations about reliability of average achievement in TIMSS 2011, because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 3.4: Achievement in Science Cognitive Domains (Continued)**

Country	Overall Science Average Scale Score	Knowing		Applying		Reasoning		
		Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score	Average Scale Score	Difference from Overall Science Score	
<b>Ninth Grade Participants</b>								
Botswana	404 (3.6)	397 (3.7)	-7 (2.0) ▼	404 (3.3)	-1 (2.0)	404 (3.2)	0 (2.9)	
<sup>2</sup> Honduras	369 (4.0)	373 (4.4)	4 (2.8)	369 (4.0)	0 (3.0)	358 (4.6)	-11 (2.7) ▼	
<sup>ψ</sup> South Africa	332 (3.7)	282 (4.1)	-49 (1.3) ▼	335 (3.5)	4 (1.1) ▲	338 (5.0)	7 (2.9) ▲	
<b>Benchmarking Participants</b>								
<sup>1 2</sup> Massachusetts, US	567 (5.1)	576 (6.5)	9 (2.8) ▲	561 (4.8)	-6 (1.1) ▼	567 (5.9)	0 (1.7)	
<sup>1</sup> Minnesota, US	553 (4.6)	552 (5.2)	-1 (1.8)	553 (4.9)	0 (1.4)	556 (5.0)	2 (1.8)	
<sup>2</sup> Alberta, Canada	546 (2.4)	542 (2.8)	-3 (1.5) ▼	543 (2.5)	-3 (1.4)	552 (2.6)	6 (1.2) ▲	
<sup>1</sup> Colorado, US	542 (4.4)	542 (5.0)	1 (2.6)	538 (4.4)	-4 (2.6)	545 (4.7)	3 (1.6) ▲	
<sup>1 2</sup> Indiana, US	533 (4.8)	537 (5.4)	4 (1.4) ▲	531 (4.5)	-2 (1.3)	530 (5.2)	-2 (1.2) ▼	
<sup>1 2</sup> Connecticut, US	532 (4.6)	537 (5.4)	5 (1.9) ▲	527 (5.0)	-5 (1.8) ▼	530 (5.0)	-1 (1.5)	
<sup>1 3</sup> North Carolina, US	532 (6.3)	536 (6.7)	5 (2.1) ▲	528 (6.1)	-3 (2.5)	530 (6.6)	-1 (2.5)	
<sup>1 2</sup> Florida, US	530 (7.3)	541 (7.6)	11 (2.5) ▲	526 (7.2)	-4 (2.6)	524 (7.5)	-6 (1.5) ▼	
<sup>2</sup> Ontario, Canada	521 (2.5)	513 (2.9)	-8 (1.6) ▼	518 (2.4)	-4 (1.2) ▼	532 (3.1)	11 (1.8) ▲	
Quebec, Canada	520 (2.5)	519 (2.7)	0 (1.5)	518 (2.8)	-2 (1.2)	522 (3.1)	2 (1.8)	
<sup>1 2</sup> California, US	499 (4.6)	495 (5.6)	-4 (2.6)	498 (4.4)	0 (2.0)	499 (4.9)	0 (2.1)	
<sup>1</sup> Alabama, US	485 (6.2)	490 (7.6)	5 (1.9) ▲	484 (6.3)	-1 (2.3)	480 (6.6)	-6 (3.5)	
Dubai, UAE	485 (2.5)	492 (2.8)	7 (2.7) ▲	486 (2.7)	1 (1.4)	479 (2.5)	-6 (1.7) ▼	
Abu Dhabi, UAE	461 (4.0)	466 (4.2)	4 (1.4) ▲	461 (3.9)	-1 (1.9)	455 (4.4)	-7 (1.7) ▼	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

▲ Subscale score significantly higher than overall science score

▼ Subscale score significantly lower than overall science score

Similar to the fourth grade, at the eighth grade there was much variability across countries in relative strengths or weaknesses in the cognitive domains, and only in two countries and three benchmarking participants was performance in each of the three cognitive domains relatively the same as in science overall: the top-performing country of Singapore, Lithuania, the province of Québec, and the states of California and Minnesota. More eighth and ninth grade participants had better performance relative to overall science in the knowing domain (19 countries and 8 benchmarking entities) than in the applying (6 countries and 1 benchmarking entity) and reasoning (10 countries and 4 benchmarking entities) domains.

### Trends in Achievement in Science Content Domains

Exhibits 3.5 and 3.6 show changes from 2007 to 2011 in average achievement in the science content domains for fourth and eighth grade students, respectively. Countries are shown in alphabetical order, followed by the benchmarking participants.

Of the TIMSS 2011 fourth grade participants that also participated in 2007 and have comparable data, some had increases and some had decreases in average science achievement over the period. From Exhibit 1.5 it can be seen that nine countries (Czech Republic, Denmark, Georgia, Iran, Japan, the Netherlands, Norway, Sweden, and Tunisia) had higher average science achievement in 2011 than in 2007, and five countries (Australia, England, Hong Kong SAR, Italy, and New Zealand) had lower achievement. Exhibit 3.5 shows that in three of the countries with an overall increase—Czech Republic, Georgia, and Norway—the increase was due to improved performance in all three science content domains. However, in Denmark, the Netherlands, and Sweden, the increase was due mainly to improvement in physical science, and in Iran and Japan due to increased performance in both physical and earth science. In Tunisia, the increase was due to improvement in life science and earth science. Among the countries with a decrease in overall science achievement, only Hong Kong SAR decreased in all three content domains. Of the others, the decline in Australia and New Zealand was due mainly to a drop in life and earth science performance; in England it was due to lower physical and earth science achievement; and in Italy it was due to a decrease in life and physical science achievement.

Although not showing overall increases in science achievement between 2007 and 2011, Austria and the Slovak Republic both had increased achievement

in physical science. Slovenia also had no overall science achievement difference, but had increased achievement in life science and a decrease in earth science. Singapore and the two Canadian provinces of Alberta and Ontario, also with no overall difference, had a decrease in earth science achievement.

Of the TIMSS 2011 eighth grade participants with comparable data from 2007, some had increased average science achievement over the period and some decreased. From Exhibit 1.6 it can be seen that seven countries (Iran, Korea, Norway, Palestinian Authority, Russian Federation, Singapore, and the Ukraine as well as the province of Québec and the state of Minnesota) had higher average science achievement in 2011 than in 2007, and seven countries had lower achievement (Bahrain, Hungary, Indonesia, Jordan, Malaysia, Syria, and Thailand). Exhibit 3.6 shows that only in Singapore and the province of Quebec was the overall increase due to improved performance in all four science content domains. In Iran, the increase was due to improved achievement in biology, chemistry, and physics; in Korea due to improved biology and chemistry; in Norway due to improved earth science; in the Palestinian Authority due to improved chemistry and physics; in the Russian Federation due to increased achievement in biology, chemistry, and physics; in the Ukraine due to improved biology, chemistry, and earth science; and in the state of Minnesota due to improved chemistry, physics, and earth science. In six of the seven countries with an overall decrease in science achievement, including Bahrain, Indonesia, Jordan, Malaysia, Syria, and Thailand, the decrease was evident in all four content domains. In Hungary, the remaining country, the decline was due to a drop in achievement in biology, physics, and earth science.

Although showing no change in overall in eighth grade science achievement between 2007 and 2011, several countries had improved performance in one or more content domains, including Chinese Taipei (earth science), Ghana (physics), Italy and Slovenia (chemistry, earth science), Japan (biology, earth science), and the United States as well as its state of Massachusetts (chemistry, physics). There were also several participants with lower achievement in one or more content domains in 2011 without having lower overall science achievement, including England, Lebanon, Oman, and Sweden (physics), and the province of Ontario (chemistry). Finally, a number of countries had a mixture of increases and decreases among the science content domains, including Georgia (increase in biology, decrease in chemistry); Lithuania (decrease in biology, increase in chemistry); and Tunisia (decrease in chemistry and earth science, increase in physics).

**Exhibit 3.5: Trends in Achievement for Science Content Domains**

Country	Life Science			Physical Science		
	2011 Average Scale Score	2007 Average Scale Score	Difference	2011 Average Scale Score	2007 Average Scale Score	Difference
Australia	516 (3.1)	529 (3.6)	-14 (4.7) ▼	514 (3.2)	521 (3.8)	-7 (5.0)
Austria	526 (2.6)	528 (2.3)	-2 (3.5)	535 (2.9)	517 (3.1)	18 (4.2) ▲
Chinese Taipei	538 (2.4)	547 (2.8)	-9 (3.7) ▼	569 (2.0)	564 (2.5)	5 (3.3)
Czech Republic	550 (3.0)	522 (3.5)	27 (4.6) ▲	519 (3.1)	509 (3.4)	10 (4.6) ▲
Denmark	530 (2.8)	527 (3.2)	3 (4.3)	526 (2.5)	502 (2.8)	24 (3.7) ▲
England	530 (2.8)	536 (3.1)	-6 (4.2)	535 (3.5)	546 (3.3)	-10 (4.8) ▼
Georgia	461 (3.6)	421 (4.0)	39 (5.4) ▲	440 (4.2)	403 (4.9)	37 (6.4) ▲
Germany	525 (2.6)	531 (2.2)	-6 (3.4)	535 (3.1)	527 (3.2)	8 (4.4)
Hong Kong SAR	524 (3.7)	540 (4.0)	-16 (5.4) ▼	539 (4.4)	562 (4.0)	-23 (5.9) ▼
Hungary	552 (3.5)	553 (3.3)	-1 (4.8)	520 (3.8)	529 (3.7)	-8 (5.3)
Iran, Islamic Rep. of	449 (4.1)	437 (5.2)	11 (6.6)	453 (4.0)	440 (4.9)	13 (6.3) ▲
Italy	535 (2.7)	555 (3.6)	-20 (4.5) ▼	509 (3.0)	520 (3.7)	-11 (4.8) ▼
Japan	540 (1.9)	536 (2.3)	4 (2.9)	589 (1.9)	571 (2.9)	18 (3.4) ▲
Lithuania	520 (2.9)	518 (2.2)	2 (3.7)	514 (3.1)	511 (2.0)	3 (3.7)
Netherlands	537 (1.8)	539 (2.7)	-3 (3.3)	526 (2.0)	503 (3.1)	22 (3.7) ▲
New Zealand	497 (2.5)	506 (2.8)	-8 (3.7) ▼	493 (2.7)	494 (3.4)	-1 (4.3)
Norway	496 (3.0)	482 (3.0)	13 (4.3) ▲	482 (3.4)	461 (3.5)	21 (4.9) ▲
Russian Federation	556 (3.6)	545 (4.7)	12 (5.9)	548 (4.0)	552 (5.4)	-4 (6.7)
Singapore	597 (4.3)	595 (4.7)	3 (6.4)	598 (3.5)	597 (4.3)	2 (5.6)
Slovak Republic	534 (3.5)	535 (4.6)	-1 (5.8)	527 (4.0)	512 (5.2)	15 (6.6) ▲
Slovenia	524 (2.6)	511 (2.0)	13 (3.3) ▲	524 (3.4)	528 (2.3)	-5 (4.1)
Sweden	534 (2.7)	532 (2.8)	2 (3.9)	528 (2.5)	509 (3.2)	19 (4.0) ▲
Ψ Tunisia	342 (5.1)	307 (6.5)	36 (8.3) ▲	342 (5.6)	325 (7.0)	16 (9.0)
United States	547 (2.1)	544 (2.9)	3 (3.5)	544 (2.0)	535 (3.1)	9 (3.7) ▲
<b>Benchmarking Participants</b>						
Alberta, Canada	542 (2.6)	545 (4.2)	-3 (5.0)	542 (3.0)	536 (4.2)	6 (5.1)
Ontario, Canada	535 (3.4)	539 (4.0)	-4 (5.2)	528 (3.2)	535 (3.3)	-7 (4.6)
Quebec, Canada	524 (2.5)	524 (3.0)	0 (3.8)	507 (3.1)	509 (3.1)	-2 (4.4)
Dubai, UAE	455 (2.9)	456 (2.8)	-1 (4.0)	460 (3.2)	456 (3.5)	4 (4.8)

▲ 2011 average significantly higher  
▼ 2011 average significantly lower

Ψ Reservations about reliability of average achievement in TIMSS 2011, because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.  
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 3.5: Trends in Achievement for Science Content Domains (Continued)**

Country	Earth Science		
	2011 Average Scale Score	2007 Average Scale Score	Difference
Australia	520 (3.5)	536 (4.5)	-17 (5.7) ▼
Austria	539 (3.6)	535 (2.5)	4 (4.4)
Chinese Taipei	553 (2.5)	563 (2.9)	-10 (3.9) ▼
Czech Republic	537 (3.4)	514 (3.5)	24 (4.9) ▲
Denmark	527 (3.0)	519 (3.3)	8 (4.5)
England	522 (3.8)	542 (3.4)	-19 (5.1) ▼
Georgia	458 (4.3)	416 (5.4)	42 (6.9) ▲
Germany	520 (3.7)	524 (2.8)	-4 (4.6)
Hong Kong SAR	548 (3.3)	568 (4.2)	-20 (5.4) ▼
Hungary	524 (4.4)	517 (4.3)	7 (6.1)
Iran, Islamic Rep. of	457 (3.5)	416 (5.0)	40 (6.1) ▲
Italy	523 (3.6)	527 (4.1)	-3 (5.5)
Japan	551 (1.8)	532 (3.5)	20 (4.0) ▲
Lithuania	501 (3.0)	508 (2.9)	-8 (4.1)
Netherlands	525 (2.7)	524 (3.3)	1 (4.2)
New Zealand	499 (3.2)	513 (3.4)	-14 (4.7) ▼
Norway	506 (3.0)	490 (3.8)	17 (4.9) ▲
Russian Federation	552 (4.1)	541 (5.5)	11 (6.8)
Singapore	541 (3.0)	565 (4.0)	-24 (5.0) ▼
Slovak Republic	535 (3.8)	532 (6.5)	3 (7.5)
Slovenia	506 (2.7)	516 (3.2)	-10 (4.2) ▼
Sweden	538 (3.2)	539 (3.7)	-1 (4.9)
Ψ Tunisia	319 (6.6)	297 (6.1)	22 (9.0) ▲
United States	539 (2.1)	537 (3.2)	2 (3.9)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Benchmarking Participants**

Alberta, Canada	539 (3.2)	551 (4.2)	-13 (5.3) ▼
Ontario, Canada	514 (3.9)	533 (4.2)	-19 (5.8) ▼
Quebec, Canada	516 (3.5)	522 (3.0)	-6 (4.7)
Dubai, UAE	469 (3.0)	461 (3.8)	8 (4.8)

- ▲ 2011 average significantly higher
- ▼ 2011 average significantly lower

**Exhibit 3.6: Trends in Achievement for Science Content Domains**

Country	Biology			Chemistry		
	2011 Average Scale Score	2007 Average Scale Score	Difference	2011 Average Scale Score	2007 Average Scale Score	Difference
Australia	527 (4.7)	519 (3.7)	8 (6.0)	501 (5.1)	504 (4.0)	-3 (6.5)
Bahrain	449 (2.1)	470 (2.1)	-22 (3.0) ▼	448 (2.7)	467 (2.9)	-19 (3.9) ▼
Chinese Taipei	557 (2.5)	554 (3.8)	3 (4.5)	585 (3.9)	585 (4.8)	1 (6.2)
England	533 (4.9)	544 (4.8)	-11 (6.9)	529 (5.2)	539 (4.6)	-11 (6.9)
Georgia	435 (3.3)	419 (4.1)	16 (5.2) ▲	395 (3.2)	408 (5.3)	-13 (6.2) ▼
Ψ Ghana	290 (6.2)	296 (5.5)	-6 (8.3)	331 (5.9)	324 (5.6)	7 (8.1)
Hong Kong SAR	535 (3.5)	529 (5.1)	6 (6.2)	526 (3.6)	521 (5.3)	5 (6.4)
Hungary	520 (3.0)	535 (3.0)	-15 (4.3) ▼	534 (3.4)	540 (4.1)	-6 (5.3)
Indonesia	410 (4.7)	424 (3.3)	-14 (5.8) ▼	378 (4.9)	408 (3.7)	-30 (6.2) ▼
Iran, Islamic Rep. of	466 (3.8)	445 (3.8)	21 (5.3) ▲	469 (4.4)	457 (4.0)	12 (5.9) ▲
Italy	503 (3.0)	502 (3.2)	1 (4.3)	491 (3.1)	478 (3.3)	13 (4.5) ▲
Japan	561 (2.3)	554 (1.9)	6 (3.0) ▲	560 (2.6)	559 (2.4)	1 (3.5)
Jordan	447 (4.3)	476 (4.2)	-29 (6.1) ▼	463 (4.4)	493 (4.7)	-30 (6.5) ▼
Korea, Rep. of	561 (2.4)	552 (2.0)	9 (3.1) ▲	551 (2.2)	539 (3.1)	12 (3.8) ▲
Lebanon	395 (5.2)	399 (6.5)	-4 (8.3)	435 (5.3)	440 (6.2)	-5 (8.2)
Lithuania	517 (2.8)	530 (2.6)	-13 (3.8) ▼	517 (2.3)	506 (2.5)	11 (3.4) ▲
Malaysia	427 (6.2)	466 (6.4)	-39 (8.9) ▼	426 (6.6)	475 (5.9)	-49 (8.9) ▼
Norway	491 (2.5)	485 (2.8)	6 (3.7)	488 (2.8)	480 (2.9)	8 (4.1)
Oman	407 (3.6)	408 (3.2)	0 (4.8)	408 (3.5)	408 (4.4)	0 (5.6)
Palestinian Nat'l Auth.	407 (3.9)	396 (4.2)	11 (5.7)	432 (4.0)	405 (4.8)	28 (6.2) ▲
Romania	458 (3.8)	457 (3.6)	2 (5.2)	469 (4.3)	458 (5.0)	11 (6.6)
Russian Federation	537 (3.3)	527 (3.9)	10 (5.1) ▲	554 (3.5)	540 (4.1)	13 (5.4) ▲
Singapore	594 (4.8)	567 (4.5)	27 (6.6) ▲	590 (4.7)	566 (4.8)	24 (6.7) ▲
Slovenia	532 (2.7)	532 (2.5)	0 (3.7)	558 (3.2)	546 (3.0)	11 (4.4) ▲
Sweden	513 (3.0)	515 (2.6)	-3 (3.9)	502 (2.7)	499 (2.6)	3 (3.8)
Syrian Arab Republic	425 (4.3)	457 (3.0)	-33 (5.2) ▼	424 (3.7)	445 (3.4)	-21 (5.0) ▼
Thailand	460 (4.3)	476 (4.8)	-16 (6.4) ▼	436 (4.6)	455 (4.7)	-19 (6.6) ▼
Tunisia	449 (3.0)	447 (2.5)	2 (3.9)	434 (3.3)	452 (2.6)	-19 (4.2) ▼
Ukraine	492 (3.1)	475 (3.6)	18 (4.8) ▲	512 (3.9)	490 (3.9)	22 (5.5) ▲
United States	530 (2.5)	531 (3.1)	0 (4.0)	520 (2.6)	510 (3.1)	10 (4.1) ▲

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Benchmarking Participants**

Ontario, Canada	531 (2.6)	537 (4.0)	-6 (4.7)	495 (2.5)	504 (4.0)	-9 (4.7) ▼
Quebec, Canada	525 (2.9)	512 (3.1)	12 (4.2) ▲	515 (3.1)	495 (3.5)	20 (4.6) ▲
Dubai, UAE	485 (2.7)	483 (3.6)	2 (4.5)	487 (2.3)	492 (4.0)	-5 (4.6)
Massachusetts, US	575 (5.2)	565 (4.8)	10 (7.1)	568 (6.0)	546 (5.2)	22 (7.9) ▲
Minnesota, US	563 (5.5)	556 (5.8)	7 (8.0)	538 (5.0)	518 (5.6)	20 (7.5) ▲

▲ 2011 average significantly higher

▼ 2011 average significantly lower

Ψ Reservations about reliability of average achievement in TIMSS 2011, because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.

() Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

**Exhibit 3.6: Trends in Achievement for Science Content Domains (Continued)**

Country	Physics			Earth Science		
	2011 Average Scale Score	2007 Average Scale Score	Difference	2011 Average Scale Score	2007 Average Scale Score	Difference
Australia	511 (5.1)	509 (4.4)	2 (6.7)	533 (5.4)	521 (4.5)	13 (7.1)
Bahrain	457 (1.8)	463 (1.6)	-7 (2.4) ▼	451 (1.8)	460 (2.8)	-9 (3.3) ▼
Chinese Taipei	552 (3.4)	559 (4.0)	-6 (5.2)	568 (2.9)	552 (3.4)	16 (4.5) ▲
England	533 (4.6)	549 (4.4)	-15 (6.4) ▼	536 (5.3)	531 (5.0)	5 (7.3)
Georgia	401 (4.2)	411 (6.4)	-9 (7.7)	417 (3.7)	416 (4.6)	2 (5.9)
Ψ Ghana	292 (5.9)	259 (6.9)	33 (9.1) ▲	265 (6.5)	279 (6.8)	-14 (9.4)
Hong Kong SAR	539 (3.6)	530 (5.3)	9 (6.4)	539 (3.7)	535 (5.2)	4 (6.4)
Hungary	525 (3.7)	544 (3.6)	-19 (5.2) ▼	511 (3.3)	535 (3.3)	-24 (4.7) ▼
Indonesia	397 (5.4)	426 (3.2)	-29 (6.3) ▼	412 (5.6)	434 (3.7)	-23 (6.7) ▼
Iran, Islamic Rep. of	483 (4.1)	467 (4.1)	16 (5.9) ▲	477 (3.9)	472 (4.3)	5 (5.8)
Italy	490 (2.8)	489 (3.6)	2 (4.6)	513 (3.8)	502 (3.6)	11 (5.3) ▲
Japan	558 (2.7)	563 (2.1)	-5 (3.5)	548 (2.8)	536 (3.3)	12 (4.4) ▲
Jordan	446 (4.2)	478 (4.5)	-31 (6.2) ▼	436 (4.2)	481 (4.1)	-46 (5.9) ▼
Korea, Rep. of	577 (2.8)	576 (2.7)	0 (3.9)	548 (3.2)	543 (2.4)	5 (4.0)
Lebanon	405 (5.4)	424 (5.6)	-19 (7.8) ▼	365 (6.4)	378 (7.0)	-14 (9.4)
Lithuania	503 (3.3)	507 (3.2)	-4 (4.6)	517 (3.5)	517 (3.0)	0 (4.6)
Malaysia	435 (6.6)	482 (6.5)	-47 (9.3) ▼	401 (6.5)	457 (6.1)	-56 (8.9) ▼
Norway	481 (3.6)	474 (3.4)	8 (5.0)	516 (3.5)	502 (2.7)	14 (4.5) ▲
Oman	427 (3.3)	439 (3.0)	-12 (4.5) ▼	431 (3.0)	432 (2.8)	-1 (4.2)
Palestinian Nat'l Auth.	432 (3.8)	407 (4.1)	26 (5.6) ▲	406 (3.3)	399 (3.9)	7 (5.1)
Romania	456 (3.9)	454 (3.8)	2 (5.4)	470 (3.6)	466 (3.9)	4 (5.3)
Russian Federation	547 (3.5)	521 (4.4)	26 (5.6) ▲	535 (3.7)	528 (4.1)	7 (5.5)
Singapore	602 (4.2)	582 (4.2)	19 (5.9) ▲	566 (4.5)	547 (4.8)	19 (6.6) ▲
Slovenia	532 (2.8)	528 (2.2)	4 (3.6)	560 (3.2)	548 (2.6)	13 (4.1) ▲
Sweden	498 (3.2)	507 (3.0)	-9 (4.4) ▼	520 (2.8)	511 (3.3)	8 (4.3)
Syrian Arab Republic	426 (4.4)	442 (3.1)	-16 (5.4) ▼	414 (4.8)	440 (3.4)	-26 (5.9) ▼
Thailand	430 (4.5)	454 (4.7)	-25 (6.5) ▼	466 (4.1)	485 (4.4)	-20 (6.0) ▼
Tunisia	436 (2.6)	427 (2.7)	9 (3.8) ▲	414 (3.6)	440 (1.9)	-26 (4.1) ▼
Ukraine	503 (3.8)	493 (3.8)	10 (5.4)	495 (3.6)	480 (4.3)	15 (5.6) ▲
United States	513 (2.5)	503 (3.0)	10 (3.9) ▲	533 (2.8)	526 (3.8)	7 (4.7)

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011

**Benchmarking Participants**

Ontario, Canada	521 (2.7)	523 (4.4)	-1 (5.2)	528 (3.4)	533 (4.8)	-5 (5.9)
Quebec, Canada	502 (3.2)	492 (3.6)	10 (4.8) ▲	536 (2.9)	514 (4.3)	21 (5.2) ▲
Dubai, UAE	482 (2.1)	489 (3.6)	-7 (4.2)	487 (3.1)	488 (3.7)	-1 (4.9)
Massachusetts, US	555 (5.7)	539 (5.4)	16 (7.9) ▲	577 (6.0)	567 (4.8)	10 (7.7)
Minnesota, US	541 (5.6)	516 (5.2)	25 (7.7) ▲	574 (6.2)	549 (6.4)	24 (8.9) ▲

- ▲ 2011 average significantly higher
- ▼ 2011 average significantly lower

## Trends in Achievement in Science Cognitive Domains

Exhibits 3.7 and 3.8 show changes from 2007 to 2011 in average achievement in the science cognitive domains for fourth and eighth grade students, respectively. As with the content domains, overall increases or decreases in science achievement since 2007 were reflected in increases or decreases in the cognitive domains. As shown in Exhibit 3.7, the overall increase in science achievement was the result of increases in all three cognitive domains in just two countries: Georgia and Norway. In the Czech Republic, the Netherlands, and Tunisia, the overall increase was due to increases in the knowing and applying domains, whereas in Denmark and Sweden it was the result of improvement in the applying domain. In Iran, the overall science increase was due to improved performance in knowing and reasoning, and in Japan due to improvements in applying and reasoning. Among countries with an overall decrease in science achievement, only in Hong Kong SAR was this decrease the result of lower achievement in all three cognitive domains. In Australia and England, the overall decrease was due to a decrease in knowing and reasoning, in Italy due to a decrease in applying and reasoning, and in New Zealand due to a decrease in knowing.

A number of countries had improved performance in one or more cognitive domains at the fourth grade without having an overall difference in science achievement between 2007 and 2011, including Austria (reasoning), the Slovak Republic and Slovenia (knowing), and the United States (applying). Singapore performed less well in knowing but better in reasoning. The Canadian provinces of Alberta and Ontario, while not having lower overall science achievement, performed less well in knowing, and Ontario also performed less well in reasoning.

Exhibit 3.8 shows that for three of the seven countries with higher average science achievement in 2011 than in 2007 (the Palestinian Authority, the Russian Federation, and Singapore), the increase was due to improved performance in all three science cognitive domains; whereas for Iran, it was due to improved performance in applying and reasoning, for Korea and Norway, in applying, and for the Ukraine in knowing and reasoning. The overall increases in the provinces of Québec and state of Minnesota were due to improved performance in knowing and applying. In all seven of the countries where overall science achievement decreased since 2007, this decrease was the result of lower achievement in all three cognitive domains.

Countries without an overall increase in eighth grade science achievement between 2007 and 2011, but with improved performance in one or more cognitive domains included Georgia (reasoning), Italy, the United States and the state of Massachusetts (knowing), and Slovenia (knowing and applying). Countries with a decrease in one or more cognitive domains but without an overall decrease in science achievement included Lebanon and Tunisia (knowing), and Lithuania (reasoning). Ghana, with no change in overall science achievement between 2007 and 2011, had a decrease in the knowing domain and an increase in reasoning.

**Exhibit 3.7: Trends in Achievement for Science Cognitive Domains**

Country	Knowing			Applying		
	2011 Average Scale Score	2007 Average Scale Score	Difference	2011 Average Scale Score	2007 Average Scale Score	Difference
Australia	517 (2.8)	532 (3.6)	-14 (4.5) ▼	513 (3.0)	522 (3.8)	-9 (4.8)
Austria	532 (3.1)	531 (2.5)	1 (3.9)	533 (2.9)	527 (2.7)	7 (3.9)
Chinese Taipei	542 (2.7)	544 (2.8)	-1 (3.9)	552 (3.1)	560 (2.2)	-7 (3.8)
Czech Republic	551 (3.3)	521 (2.9)	30 (4.4) ▲	534 (2.6)	515 (3.4)	19 (4.3) ▲
Denmark	524 (2.6)	517 (3.3)	7 (4.2)	532 (2.5)	513 (3.2)	19 (4.1) ▲
England	529 (3.2)	547 (3.4)	-19 (4.7) ▼	532 (3.1)	537 (3.2)	-4 (4.5)
Georgia	466 (3.9)	429 (4.3)	37 (5.8) ▲	452 (4.4)	415 (4.5)	38 (6.3) ▲
Germany	524 (4.0)	529 (2.4)	-4 (4.6)	533 (2.6)	526 (2.5)	7 (3.6)
Hong Kong SAR	537 (3.6)	553 (3.9)	-16 (5.3) ▼	529 (3.5)	552 (3.4)	-24 (4.8) ▼
Hungary	547 (3.7)	544 (3.5)	2 (5.0)	530 (3.6)	532 (3.8)	-2 (5.2)
Iran, Islamic Rep. of	448 (4.3)	431 (5.0)	17 (6.6) ▲	452 (3.8)	443 (4.9)	9 (6.2)
Italy	532 (3.0)	535 (4.2)	-3 (5.1)	523 (2.7)	541 (3.4)	-18 (4.4) ▼
Japan	538 (1.8)	534 (2.7)	3 (3.3)	562 (1.6)	546 (3.2)	16 (3.6) ▲
Lithuania	508 (2.9)	511 (2.3)	-4 (3.7)	521 (2.5)	513 (3.3)	7 (4.2)
Netherlands	528 (2.3)	521 (2.6)	7 (3.4) ▲	534 (2.0)	525 (2.4)	10 (3.1) ▲
New Zealand	496 (2.7)	511 (3.4)	-15 (4.3) ▼	497 (2.6)	496 (2.7)	1 (3.7)
Norway	502 (2.8)	480 (3.2)	21 (4.3) ▲	487 (2.8)	472 (3.5)	15 (4.5) ▲
Russian Federation	553 (3.8)	546 (5.6)	7 (6.8)	556 (3.6)	550 (5.3)	6 (6.4)
Singapore	570 (3.4)	599 (4.4)	-29 (5.6) ▼	590 (4.0)	587 (4.2)	2 (5.8)
Slovak Republic	547 (3.8)	531 (4.8)	15 (6.1) ▲	528 (4.0)	527 (4.9)	1 (6.3)
Slovenia	518 (2.2)	510 (2.0)	9 (2.9) ▲	518 (2.8)	525 (2.5)	-7 (3.8)
Sweden	536 (2.8)	528 (3.0)	8 (4.1)	531 (3.0)	520 (3.0)	11 (4.2) ▲
Ψ Tunisia	336 (5.3)	301 (6.0)	36 (8.0) ▲	343 (4.7)	315 (7.4)	27 (8.7) ▲
United States	546 (1.9)	546 (2.7)	1 (3.3)	544 (2.1)	534 (3.1)	10 (3.7) ▲
<b>Benchmarking Participants</b>						
Alberta, Canada	543 (3.1)	555 (4.0)	-11 (5.0) ▼	541 (2.8)	536 (4.4)	5 (5.3)
Ontario, Canada	529 (3.1)	542 (3.7)	-14 (4.8) ▼	526 (3.3)	529 (3.9)	-3 (5.1)
Quebec, Canada	519 (2.7)	517 (3.0)	2 (4.0)	514 (2.5)	515 (3.0)	-1 (3.9)
Dubai, UAE	467 (2.5)	461 (2.6)	7 (3.6)	453 (2.0)	458 (3.7)	-5 (4.2)

- ▲ 2011 average significantly higher
- ▼ 2011 average significantly lower

Ψ Reservations about reliability of average achievement in TIMSS 2011, because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.  
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 3.7: Trends in Achievement for Science Cognitive Domains (Continued)**

Country	Reasoning		
	2011 Average Scale Score	2007 Average Scale Score	Difference
Australia	518 (3.4)	528 (4.1)	-11 (5.3) ▼
Austria	525 (3.1)	514 (2.9)	11 (4.2) ▲
Chinese Taipei	568 (3.2)	574 (3.2)	-6 (4.5)
Czech Republic	516 (4.0)	507 (3.6)	9 (5.4)
Denmark	527 (3.1)	524 (4.5)	3 (5.4)
England	526 (4.4)	540 (2.8)	-14 (5.2) ▼
Georgia	422 (5.0)	379 (6.0)	43 (7.8) ▲
Germany	526 (3.6)	525 (2.6)	1 (4.5)
Hong Kong SAR	541 (4.2)	563 (4.9)	-21 (6.5) ▼
Hungary	525 (4.5)	528 (4.2)	-3 (6.2)
Iran, Islamic Rep. of	459 (3.9)	427 (4.6)	32 (6.0) ▲
Italy	510 (2.9)	523 (3.6)	-14 (4.6) ▼
Japan	591 (2.0)	573 (2.3)	18 (3.0) ▲
Lithuania	515 (2.8)	521 (2.9)	-5 (4.0)
Netherlands	532 (2.9)	526 (2.7)	6 (4.0)
New Zealand	497 (2.9)	503 (4.0)	-6 (5.0)
Norway	493 (3.7)	475 (3.2)	17 (4.9) ▲
Russian Federation	542 (4.2)	542 (5.2)	0 (6.7)
Singapore	597 (3.8)	576 (4.0)	20 (5.5) ▲
Slovak Republic	514 (4.2)	512 (5.3)	2 (6.7)
Slovenia	525 (3.6)	525 (2.0)	0 (4.1)
Sweden	537 (3.0)	528 (4.3)	9 (5.2)
Ψ Tunisia	337 (4.9)	330 (6.2)	7 (7.9)
United States	537 (2.3)	535 (3.0)	2 (3.8)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Benchmarking Participants**

Alberta, Canada	540 (2.9)	536 (4.9)	5 (5.7)
Ontario, Canada	529 (3.7)	540 (3.4)	-11 (5.1) ▼
Quebec, Canada	520 (3.7)	526 (3.7)	-6 (5.2)
Dubai, UAE	455 (3.7)	456 (3.0)	-1 (4.7)

- ▲ 2011 average significantly higher
- ▼ 2011 average significantly lower

**Exhibit 3.8: Trends in Achievement for Science Cognitive Domains**

Country	Knowing			Applying		
	2011 Average Scale Score	2007 Average Scale Score	Difference	2011 Average Scale Score	2007 Average Scale Score	Difference
Australia	514 (5.4)	505 (3.4)	9 (6.4)	517 (4.8)	511 (3.5)	6 (6.0)
Bahrain	457 (3.6)	468 (2.3)	-10 (4.3) ▼	450 (2.0)	465 (2.2)	-16 (3.0) ▼
Chinese Taipei	569 (2.7)	574 (3.9)	-5 (4.8)	570 (2.7)	564 (3.6)	6 (4.5)
England	533 (5.1)	536 (5.4)	-3 (7.4)	531 (4.7)	540 (4.3)	-8 (6.4)
Georgia	428 (3.9)	438 (5.3)	-10 (6.5)	418 (3.8)	418 (4.8)	0 (6.1)
Ψ Ghana	292 (6.1)	311 (5.8)	-19 (8.4) ▼	295 (6.3)	286 (5.9)	9 (8.6)
Hong Kong SAR	544 (3.3)	537 (4.9)	7 (5.9)	529 (3.5)	522 (5.3)	6 (6.3)
Hungary	511 (3.3)	530 (3.2)	-19 (4.6) ▼	532 (3.5)	551 (3.3)	-19 (4.8) ▼
Indonesia	402 (5.4)	424 (4.0)	-23 (6.7) ▼	398 (4.7)	421 (3.5)	-24 (5.9) ▼
Iran, Islamic Rep. of	479 (4.7)	468 (4.1)	11 (6.2)	470 (3.9)	452 (4.0)	18 (5.6) ▲
Italy	512 (2.7)	496 (3.6)	16 (4.5) ▲	500 (2.4)	497 (3.0)	3 (3.8)
Japan	541 (2.7)	542 (2.5)	-1 (3.7)	561 (2.4)	556 (2.1)	4 (3.2)
Jordan	453 (4.3)	492 (4.9)	-39 (6.5) ▼	451 (4.0)	484 (4.3)	-33 (5.9) ▼
Korea, Rep. of	554 (2.9)	550 (2.3)	4 (3.7)	561 (2.0)	550 (2.3)	11 (3.1) ▲
Lebanon	381 (5.8)	401 (6.3)	-20 (8.5) ▼	408 (5.2)	418 (6.1)	-10 (8.0)
Lithuania	516 (2.3)	517 (2.6)	-1 (3.5)	512 (2.3)	513 (2.4)	-1 (3.3)
Malaysia	403 (7.0)	458 (6.9)	-55 (9.8) ▼	424 (6.2)	470 (6.4)	-46 (8.9) ▼
Norway	490 (2.6)	487 (2.6)	3 (3.7)	496 (3.0)	485 (2.5)	11 (3.9) ▲
Oman	416 (3.4)	425 (3.6)	-8 (5.0)	419 (3.3)	419 (3.6)	0 (4.9)
Palestinian Nat'l Auth.	431 (3.6)	404 (3.8)	27 (5.2) ▲	422 (3.6)	408 (4.4)	13 (5.7) ▲
Romania	457 (3.9)	451 (4.5)	6 (6.0)	468 (3.6)	468 (3.7)	0 (5.2)
Russian Federation	557 (3.9)	541 (4.7)	16 (6.1) ▲	539 (3.5)	527 (4.1)	12 (5.3) ▲
Singapore	588 (4.9)	561 (4.9)	26 (6.9) ▲	589 (4.4)	570 (4.5)	19 (6.3) ▲
Slovenia	551 (2.7)	538 (2.3)	12 (3.5) ▲	542 (2.6)	535 (2.5)	7 (3.6) ▲
Sweden	512 (2.4)	508 (2.6)	4 (3.6)	508 (2.6)	509 (2.8)	-1 (3.9)
Syrian Arab Republic	441 (4.3)	472 (3.1)	-31 (5.3) ▼	426 (4.4)	442 (3.1)	-16 (5.4) ▼
Thailand	443 (4.7)	473 (4.7)	-30 (6.6) ▼	451 (4.1)	471 (4.5)	-19 (6.1) ▼
Tunisia	424 (2.3)	438 (2.2)	-13 (3.2) ▼	437 (2.2)	441 (2.7)	-4 (3.5)
Ukraine	505 (3.9)	478 (4.2)	28 (5.7) ▲	496 (3.8)	486 (4.0)	10 (5.5)
United States	527 (2.8)	516 (3.2)	11 (4.2) ▲	522 (2.3)	517 (2.9)	5 (3.7)
<b>Benchmarking Participants</b>						
Ontario, Canada	513 (2.9)	515 (3.6)	-2 (4.6)	518 (2.4)	524 (3.9)	-6 (4.6)
Quebec, Canada	519 (2.7)	499 (3.3)	20 (4.3) ▲	518 (2.8)	500 (3.4)	17 (4.4) ▲
Dubai, UAE	492 (2.8)	496 (3.3)	-4 (4.4)	486 (2.7)	488 (3.3)	-2 (4.3)
Massachusetts, US	576 (6.5)	551 (4.6)	25 (8.0) ▲	561 (4.8)	553 (4.5)	8 (6.5)
Minnesota, US	552 (5.2)	532 (5.2)	20 (7.4) ▲	553 (4.9)	536 (5.1)	17 (7.0) ▲

▲ 2011 average significantly higher  
▼ 2011 average significantly lower

Ψ Reservations about reliability of average achievement in TIMSS 2011, because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.  
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 3.8: Trends in Achievement for Science Cognitive Domains (Continued)**

Country	Reasoning		
	2011 Average Scale Score	2007 Average Scale Score	Difference
Australia	526 (5.2)	530 (4.0)	-4 (6.6)
Bahrain	449 (1.9)	464 (2.5)	-15 (3.1) ▼
Chinese Taipei	551 (2.9)	544 (3.9)	7 (4.9)
England	537 (4.8)	548 (4.5)	-12 (6.5)
Georgia	412 (3.6)	385 (5.3)	27 (6.4) ▲
Ψ Ghana	315 (4.9)	292 (5.1)	22 (7.1) ▲
Hong Kong SAR	538 (4.1)	535 (5.7)	3 (7.0)
Hungary	518 (3.4)	530 (3.3)	-12 (4.7) ▼
Indonesia	413 (5.2)	430 (3.3)	-17 (6.2) ▼
Iran, Islamic Rep. of	475 (3.9)	456 (4.1)	19 (5.7) ▲
Italy	489 (2.7)	489 (3.0)	-1 (4.0)
Japan	568 (2.3)	564 (2.2)	4 (3.2)
Jordan	441 (4.5)	466 (4.4)	-25 (6.3) ▼
Korea, Rep. of	564 (2.2)	561 (2.4)	2 (3.2)
Lebanon	408 (5.6)	410 (6.4)	-2 (8.5)
Lithuania	513 (2.6)	527 (2.7)	-14 (3.8) ▼
Malaysia	439 (5.8)	483 (5.6)	-44 (8.1) ▼
Norway	494 (3.0)	488 (2.9)	6 (4.2)
Oman	417 (3.0)	419 (3.9)	-2 (4.9)
Palestinian Nat'l Auth.	404 (3.6)	385 (4.4)	20 (5.6) ▲
Romania	460 (3.9)	453 (4.0)	7 (5.5)
Russian Federation	533 (3.3)	519 (4.1)	13 (5.3) ▲
Singapore	592 (4.5)	568 (4.5)	24 (6.4) ▲
Slovenia	536 (2.7)	540 (2.5)	-4 (3.6)
Sweden	510 (2.9)	516 (2.8)	-6 (4.0)
Syrian Arab Republic	402 (5.1)	433 (3.0)	-32 (5.9) ▼
Thailand	453 (4.2)	467 (4.4)	-14 (6.1) ▼
Tunisia	446 (2.7)	452 (3.1)	-6 (4.1)
Ukraine	500 (3.9)	485 (4.1)	14 (5.7) ▲
United States	524 (2.5)	529 (3.1)	-5 (3.9)

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011

**Benchmarking Participants**

Ontario, Canada	532 (3.1)	542 (4.4)	-10 (5.4)
Quebec, Canada	522 (3.1)	523 (3.4)	-1 (4.6)
Dubai, UAE	479 (2.5)	478 (3.3)	1 (4.2)
Massachusetts, US	567 (5.9)	567 (4.3)	0 (7.3)
Minnesota, US	556 (5.0)	546 (5.8)	10 (7.6)

▲ 2011 average significantly higher

▼ 2011 average significantly lower

## Achievement in the Science Content and Cognitive Domains by Gender

Exhibits 3.9 and 3.10 present the TIMSS 2011 gender differences in average achievement for the content domains at the fourth and eighth grades. At the fourth grade, girls had higher achievement in life science than boys in 18 countries and one benchmarking entity, compared with four countries and no benchmarking participants where boys outperformed girls. Conversely, boys had higher achievement in physical science than girls in 25 countries and five benchmarking participants, compared with seven countries and one benchmarking participant where girls outperformed boys. Also, boys had higher achievement in earth science than girls in 20 countries and five benchmarking entities, compared with eight countries and one benchmarking participant where girls outperformed boys. On average across countries, girls had an 8-point advantage in life science, and boys had a 1-point advantage in physical science and a 4-point advantage in earth science. At the sixth grade, girls in Botswana and Yemen performed better than boys in life science, and boys in Honduras performed better than girls in earth science.

As shown in Exhibit 3.10, on average across the eighth grade countries, girls had a 12-point advantage in biology and a 10-point advantage in chemistry, while boys had a 2-point advantage in earth science. There was no significant difference between the achievement of girls and boys in physics. Girls outperformed boys in biology in 24 countries and two benchmarking entities, and in chemistry in 20 countries and one benchmarking participant. Boys outperformed girls in biology in seven countries and in chemistry in seven countries and four benchmarking entities. Boys outperformed girls in physics in 16 countries and eleven benchmarking participants, and in earth science in 16 countries and twelve benchmarking participants. Girls outperformed boys in physics in nine countries and one benchmarking entity, and in earth science in six countries and one benchmarking entity.

Exhibits 3.11 and 3.12 present gender differences in the cognitive domains for the fourth and eighth grades. On average across the fourth grade countries, girls had higher achievement than boys in the reasoning domain. In eight countries and one benchmarking participant, girls outperformed boys in all three cognitive domains (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, Tunisia, the United Arab Emirates, Yemen, and the emirate of Abu Dhabi), while in six countries and one benchmarking participant, boys outperformed girls in all three domains (Austria, Belgium-Flemish, Chile, the Czech Republic, Germany, Italy, and the province of Alberta).

At the eighth grade, on average across countries, girls outperformed boys in all three of the cognitive domains. Specifically, girls outperformed boys in all three domains in twelve countries and one benchmarking participant (Armenia, Bahrain, Georgia, Jordan, Macedonia, Malaysia, Oman, the Palestinian National Authority, Qatar, Thailand, Turkey, the United Arab Emirates, and the emirate of Dubai). Conversely, boys outperformed girls in all three domains in seven countries and one benchmarking participant (Chile, Ghana, Hungary, Italy, New Zealand, Tunisia, Honduras, and the state of Indiana).

**Exhibit 3.9: Achievement in Science Content Domains by Gender**

Country	Life Science		Physical Science		Earth Science	
	Girls	Boys	Girls	Boys	Girls	Boys
Armenia	428 (5.0)	421 (3.8)	401 (4.5)	396 (5.2)	401 (5.7)	395 (4.8)
Australia	518 (3.5)	513 (3.8)	512 (3.3)	516 (4.3)	516 (4.8)	523 (3.8)
Austria	525 (2.8)	527 (3.7)	526 (3.2)	544 (4.0) ▲	526 (4.6)	550 (4.6) ▲
<sup>2</sup> Azerbaijan	444 (6.5)	437 (5.0)	437 (7.2)	435 (5.9)	415 (8.6) ▲	401 (6.8)
Bahrain	459 (6.2) ▲	428 (5.5)	459 (6.5)	447 (5.7)	455 (6.0) ▲	435 (4.9)
Belgium (Flemish)	507 (3.0)	513 (2.7) ▲	503 (2.6)	511 (2.5) ▲	493 (3.5)	516 (3.0) ▲
Chile	486 (2.7)	493 (2.8) ▲	465 (3.6)	477 (3.3) ▲	465 (3.3)	485 (3.2) ▲
Chinese Taipei	535 (3.1)	541 (2.7)	564 (2.6)	572 (2.3) ▲	546 (3.5)	559 (2.6) ▲
<sup>2</sup> Croatia	527 (2.5)	523 (2.4)	495 (3.6)	509 (3.0) ▲	517 (3.2)	525 (3.5)
Czech Republic	547 (3.7)	552 (3.5)	506 (3.6)	531 (3.7) ▲	530 (3.9)	544 (4.3) ▲
<sup>2</sup> Denmark	533 (3.4)	527 (3.4)	523 (3.5)	528 (3.1)	522 (4.1)	531 (5.1)
England	534 (3.6)	527 (4.1)	532 (3.5)	538 (4.9)	520 (4.5)	524 (3.9)
Finland	580 (2.8) ▲	569 (3.6)	564 (3.6)	572 (3.2) ▲	562 (3.2)	569 (3.7)
<sup>1</sup> Georgia	467 (3.5) ▲	455 (4.6)	442 (3.9)	438 (5.2)	463 (4.2)	453 (5.8)
Germany	525 (2.8)	525 (3.1)	526 (4.0)	543 (3.2) ▲	507 (4.2)	533 (4.6) ▲
<sup>2</sup> Hong Kong SAR	525 (3.2)	524 (4.5)	533 (3.5)	545 (5.7) ▲	538 (3.2)	557 (4.1) ▲
Hungary	554 (4.0)	549 (3.8)	514 (4.3)	527 (4.2) ▲	519 (5.1)	529 (4.7) ▲
Iran, Islamic Rep. of	451 (6.0)	447 (6.5)	446 (5.8)	459 (6.6)	455 (5.2)	458 (5.9)
Ireland	514 (4.6)	511 (4.1)	516 (4.5)	518 (3.6)	518 (4.2)	522 (4.7)
Italy	534 (2.9)	537 (3.2)	504 (3.3)	514 (4.2) ▲	518 (4.2)	529 (5.2)
Japan	538 (1.9)	542 (2.6)	588 (2.7)	590 (2.2)	544 (2.6)	559 (2.5) ▲
<sup>2</sup> Kazakhstan	500 (5.4)	500 (5.3)	479 (5.8)	493 (5.6) ▲	484 (6.5)	497 (5.7) ▲
Korea, Rep. of	570 (2.2)	572 (2.9)	591 (4.1)	602 (2.5) ▲	596 (2.8)	610 (2.6) ▲
<sup>1</sup> <sup>ψ</sup> Kuwait	346 (6.1) ▲	295 (8.1)	379 (5.9) ▲	312 (6.7)	371 (5.2) ▲	330 (7.3)
<sup>1</sup> <sup>2</sup> Lithuania	524 (3.4) ▲	517 (3.1)	510 (3.7)	518 (3.3) ▲	498 (3.8)	503 (3.7)
Malta	437 (3.0)	440 (3.0)	448 (3.4)	458 (3.2) ▲	442 (2.5)	452 (4.3)
* Morocco	253 (4.6) ▲	237 (5.5)	257 (5.6)	256 (6.6)	208 (5.6)	208 (5.8)
† Netherlands	536 (2.1)	538 (2.8)	518 (2.4)	535 (3.0) ▲	517 (4.4)	534 (2.9) ▲
New Zealand	499 (3.2)	496 (3.1)	493 (3.1)	494 (3.2)	494 (4.3)	504 (3.2) ▲
† Northern Ireland	523 (3.5) ▲	514 (3.4)	519 (3.5)	522 (3.8)	503 (3.8)	512 (4.8)
‡ Norway	498 (3.5)	493 (3.6)	476 (4.2)	489 (3.8) ▲	502 (3.8)	511 (4.1)
Oman	388 (4.3) ▲	352 (4.1)	386 (5.3) ▲	354 (5.0)	386 (5.2) ▲	356 (5.4)
Poland	514 (2.8)	513 (3.0)	489 (4.5)	500 (3.6) ▲	491 (3.4)	500 (4.3) ▲
Portugal	520 (5.2)	521 (4.0)	511 (4.7)	523 (4.2) ▲	526 (5.7)	536 (5.0)
<sup>2</sup> Qatar	396 (6.7) ▲	371 (6.0)	410 (6.5) ▲	385 (5.8)	411 (5.9) ▲	391 (6.6)
Romania	507 (6.8)	501 (6.4)	504 (6.3)	512 (5.7) ▲	499 (7.0)	504 (6.1)
Russian Federation	561 (3.8) ▲	552 (4.0)	546 (4.1)	551 (4.7)	551 (4.9)	554 (4.6)
Saudi Arabia	440 (5.9) ▲	388 (11.1)	462 (5.3) ▲	415 (11.4)	452 (7.0) ▲	410 (10.5)
<sup>2</sup> Serbia	518 (3.8)	518 (3.2)	519 (4.8)	526 (4.0)	495 (4.6)	500 (4.7)
<sup>2</sup> Singapore	598 (4.5)	597 (4.7)	596 (3.6)	601 (4.0)	536 (3.9)	546 (3.8) ▲
Slovak Republic	533 (4.3)	535 (4.2)	519 (4.5)	535 (4.1) ▲	530 (4.4)	540 (3.6) ▲
Slovenia	525 (3.4)	523 (3.3)	515 (3.7)	531 (4.2) ▲	503 (3.4)	509 (3.4)
Spain	510 (2.9)	516 (3.4) ▲	490 (3.0)	503 (3.3) ▲	493 (4.7)	505 (3.9) ▲
Sweden	538 (2.8) ▲	530 (3.5)	521 (3.0)	534 (2.9) ▲	533 (4.0)	543 (3.7) ▲
Thailand	486 (6.7) ▲	474 (6.9)	467 (6.3)	458 (6.7)	464 (6.2)	456 (7.2)
<sup>ψ</sup> Tunisia	355 (5.8) ▲	330 (5.3)	354 (6.7) ▲	331 (5.7)	333 (7.7) ▲	306 (7.5)
Turkey	463 (5.2)	457 (4.5)	469 (5.1)	464 (5.0)	456 (5.7)	455 (5.9)
United Arab Emirates	433 (3.6) ▲	407 (4.0)	435 (3.6) ▲	422 (4.0)	442 (3.3) ▲	428 (3.7)
<sup>2</sup> United States	544 (2.4)	550 (2.1) ▲	538 (2.4)	550 (2.4) ▲	531 (2.6)	547 (2.1) ▲
* Yemen	192 (7.1) ▲	158 (8.3)	216 (7.7) ▲	186 (8.0)	185 (6.4)	187 (8.1)
International Avg.	489 (0.6) ▲	481 (0.6)	484 (0.6)	485 (0.7) ▲	479 (0.7)	483 (0.7) ▲

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

▲ Average significantly higher than other gender

\* Average achievement not reliably measured because the percentage of students with achievement too low for estimation exceeds 25%.

<sup>ψ</sup> Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

**Exhibit 3.9: Achievement in Science Content Domains by Gender (Continued)**

Country	Life Science		Physical Science		Earth Science	
	Girls	Boys	Girls	Boys	Girls	Boys
<b>Sixth Grade Participants</b>						
Botswana	354 (6.2) ▲	334 (8.2)	384 (6.1)	375 (6.5)	382 (6.9)	369 (6.5)
Honduras	439 (6.1)	444 (6.1)	415 (7.3)	419 (7.2)	419 (6.5)	440 (6.3) ▲
Yemen	325 (9.8) ●	304 (9.0)	374 (8.9)	361 (7.8)	357 (8.8)	345 (9.4)
<b>Benchmarking Participants</b>						
<sup>2</sup> Alberta, Canada	542 (3.2)	543 (3.2)	537 (3.2)	546 (3.9) ▲	527 (3.6)	549 (3.7) ▲
Ontario, Canada	536 (3.9)	534 (3.6)	522 (4.1)	533 (3.6) ▲	506 (4.9)	521 (4.3) ▲
Quebec, Canada	527 (2.9)	522 (2.8)	498 (3.3)	516 (3.4) ▲	507 (3.7)	525 (4.2) ▲
Abu Dhabi, UAE	422 (6.1) ▲	384 (7.3)	427 (5.8) ▲	403 (7.2)	431 (5.8) ▲	405 (7.1)
Dubai, UAE	460 (4.6)	451 (5.3)	457 (4.5)	462 (5.7)	467 (4.6)	471 (4.8)
<sup>1 3</sup> Florida, US	548 (4.6)	551 (4.6)	537 (4.6)	548 (4.1) ▲	529 (4.8)	545 (6.0) ▲
<sup>1 2</sup> North Carolina, US	540 (5.5)	542 (5.9)	535 (5.2)	547 (5.6) ▲	517 (8.1)	540 (6.6) ▲

▲ Average significantly higher than other gender

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 3.10: Achievement in Science Content Domains by Gender**

Country	Biology		Chemistry		Physics		Earth Science	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
Armenia	433 (3.9) ▲	407 (3.9)	462 (4.1) ▲	443 (4.8)	443 (3.9)	438 (4.2)	432 (3.6) ▲	412 (3.8)
Australia	525 (4.6)	529 (6.6)	496 (4.7)	506 (7.0)	500 (4.9)	522 (6.9) ▲	520 (5.5)	546 (7.2) ▲
Bahrain	484 (2.4) ▲	414 (3.7)	481 (3.3) ▲	415 (4.0)	483 (3.0) ▲	430 (3.5)	475 (2.3) ▲	427 (3.3)
Chile	456 (3.3)	468 (3.4) ▲	444 (4.0)	451 (3.0)	444 (3.6)	463 (3.8) ▲	463 (3.4)	490 (3.3) ▲
Chinese Taipei	560 (2.7)	554 (3.1)	591 (5.0) ▲	580 (4.5)	548 (3.9)	556 (3.9) ▲	563 (3.0)	573 (4.0) ▲
‡ England	538 (5.4)	529 (6.2)	530 (5.9)	527 (6.2)	531 (5.5)	535 (5.6)	531 (5.6)	541 (6.7)
Finland	556 (3.5) ▲	541 (3.3)	555 (3.1)	552 (3.8)	537 (3.2)	543 (3.2)	575 (5.6)	573 (3.8)
<sup>1</sup> Georgia	448 (3.3) ▲	423 (3.9)	397 (4.0)	393 (5.3)	402 (5.2)	400 (4.5)	419 (3.6)	416 (4.2)
<sup>ψ</sup> Ghana	273 (6.9)	305 (6.3) ▲	318 (6.2)	342 (6.7) ▲	278 (6.2)	305 (6.8) ▲	243 (6.2)	286 (7.5) ▲
Hong Kong SAR	539 (4.7)	531 (4.0)	529 (5.1)	523 (3.9)	534 (4.8)	543 (3.8)	537 (5.6)	541 (4.7)
Hungary	516 (3.1)	523 (3.6) ▲	527 (4.4)	541 (4.3) ▲	508 (4.2)	541 (4.3) ▲	498 (3.8)	524 (4.1) ▲
Indonesia	416 (5.7) ▲	404 (5.0)	382 (5.0) ▲	374 (5.7)	399 (5.5)	395 (6.4)	412 (7.0)	412 (5.2)
Iran, Islamic Rep. of	471 (5.0)	462 (5.4)	478 (6.0) ▲	461 (5.9)	482 (5.3)	484 (5.8)	475 (5.6)	478 (5.3)
<sup>3</sup> Israel	529 (3.8) ▲	517 (5.5)	521 (4.9) ▲	506 (6.5)	514 (3.8)	514 (5.3)	503 (4.4)	506 (5.6)
Italy	500 (3.7)	507 (3.2) ▲	483 (3.3)	499 (4.2) ▲	476 (4.4)	504 (3.4) ▲	503 (5.0)	522 (3.9) ▲
Japan	560 (2.7)	562 (3.3)	557 (3.1)	563 (4.0)	553 (3.5)	563 (3.3) ▲	539 (3.0)	557 (3.5) ▲
Jordan	472 (4.6) ▲	424 (6.6)	487 (4.7) ▲	439 (6.7)	463 (5.1) ▲	430 (6.4)	455 (5.0) ▲	418 (6.5)
Kazakhstan	488 (4.8) ▲	479 (4.7)	511 (5.2)	506 (5.4)	486 (4.4)	492 (4.8)	473 (5.0)	471 (5.9)
Korea, Rep. of	559 (2.8)	563 (2.8)	552 (2.8)	550 (2.8)	574 (3.7)	580 (3.1)	541 (4.4)	555 (2.8) ▲
Lebanon	396 (5.7)	394 (6.7)	440 (5.5)	429 (7.1)	399 (6.1)	412 (6.8)	357 (6.7)	374 (8.3) ▲
<sup>1</sup> Lithuania	523 (3.2) ▲	510 (3.3)	522 (2.7) ▲	513 (3.2)	502 (3.9)	503 (3.7)	518 (4.9)	515 (3.4)
Macedonia, Rep. of	412 (6.3) ▲	388 (7.3)	426 (5.4) ▲	406 (6.7)	407 (6.8) ▲	390 (6.7)	407 (7.0)	398 (7.2)
Malaysia	437 (6.3) ▲	417 (7.2)	436 (6.8) ▲	416 (7.6)	441 (6.4) ▲	428 (7.9)	402 (6.5)	400 (7.4)
Morocco	382 (3.0) ▲	374 (3.8)	380 (3.4) ▲	369 (3.0)	346 (3.4)	351 (3.3)	375 (4.5)	378 (3.6)
New Zealand	509 (5.2)	519 (5.1) ▲	488 (5.9)	513 (5.2) ▲	494 (4.8)	522 (5.1) ▲	507 (5.2)	536 (5.2) ▲
Norway	497 (3.5) ▲	486 (3.5)	487 (3.7)	489 (3.4)	476 (4.1)	487 (4.3) ▲	514 (4.2)	517 (4.4)
Oman	448 (3.4) ▲	365 (4.8)	450 (3.7) ▲	364 (4.5)	464 (3.0) ▲	388 (4.8)	466 (3.2) ▲	396 (4.2)
Palestinian Nat'l Auth.	422 (4.4) ▲	391 (6.6)	449 (4.6) ▲	415 (6.2)	445 (4.2) ▲	420 (6.3)	415 (4.3) ▲	396 (4.8)
Qatar	424 (7.8) ▲	399 (6.8)	434 (7.1) ▲	398 (7.2)	435 (7.5)	418 (5.8)	418 (7.9)	398 (6.3)
Romania	461 (3.8)	456 (4.7)	475 (5.0) ▲	464 (4.9)	454 (4.4)	459 (4.3)	468 (4.1)	472 (4.2)
<sup>2</sup> Russian Federation	541 (3.8) ▲	533 (3.5)	549 (4.1)	558 (3.8) ▲	539 (3.8)	555 (4.2) ▲	527 (4.4)	543 (4.1) ▲
Saudi Arabia	445 (4.7) ▲	415 (6.5)	447 (3.7) ▲	410 (8.0)	449 (4.5) ▲	426 (7.1)	447 (3.9)	435 (5.8)
<sup>2</sup> Singapore	596 (4.5)	593 (5.9)	592 (4.7)	589 (5.9)	599 (3.9)	604 (5.3)	562 (4.3)	570 (5.6)
Slovenia	534 (3.1)	530 (3.7)	554 (4.6)	561 (3.4)	526 (3.1)	538 (4.0) ▲	554 (3.6)	566 (4.6) ▲
Sweden	519 (3.0) ▲	506 (3.7)	503 (3.4)	501 (3.1)	495 (3.2)	501 (4.1)	517 (3.4)	522 (3.6)
Syrian Arab Republic	424 (4.9)	425 (5.6)	423 (5.0)	425 (4.6)	420 (4.8)	432 (5.6) ▲	408 (5.4)	420 (6.2)
Thailand	470 (4.0) ▲	448 (5.5)	448 (4.5) ▲	422 (6.3)	434 (4.6)	424 (5.9)	469 (4.0)	462 (5.7)
Tunisia	442 (3.5)	457 (3.5) ▲	429 (3.7)	439 (3.8) ▲	426 (2.9)	447 (3.0) ▲	402 (4.2)	426 (3.8) ▲
Turkey	494 (3.4) ▲	474 (4.6)	489 (3.5) ▲	465 (5.3)	502 (3.4) ▲	486 (4.7)	468 (3.0)	469 (4.6)
Ukraine	495 (3.5)	490 (4.2)	510 (4.5)	514 (4.6)	496 (4.7)	509 (4.6) ▲	487 (4.2)	502 (5.4) ▲
United Arab Emirates	480 (2.8) ▲	447 (3.3)	477 (3.1) ▲	450 (3.3)	471 (2.9) ▲	452 (3.5)	475 (3.0) ▲	458 (3.6)
<sup>2</sup> United States	528 (3.0)	533 (2.7)	515 (2.9)	525 (3.1) ▲	504 (2.8)	523 (2.7) ▲	525 (3.4)	542 (3.1) ▲
International Avg.	481 (0.7) ▲	469 (0.8)	482 (0.7) ▲	472 (0.8)	473 (0.7)	474 (0.8)	473 (0.7)	475 (0.8) ▲

▲ Average significantly higher than other gender

<sup>ψ</sup> Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.

(.) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 3.10: Achievement in Science Content Domains by Gender (Continued)**

Country	Biology		Chemistry		Physics		Earth Science	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
<b>Ninth Grade Participants</b>								
Botswana	409 (4.6) ⬆	393 (4.7)	413 (3.8) ⬆	392 (4.4)	416 (3.8)	418 (4.2)	388 (4.5)	381 (4.9)
<sup>2</sup> Honduras	356 (4.9)	373 (4.7) ⬆	364 (3.8)	373 (5.1)	339 (4.0)	366 (5.1) ⬆	358 (5.5)	394 (6.1) ⬆
<sup>ψ</sup> South Africa	324 (4.6) ⬆	312 (4.3)	341 (3.8)	331 (5.7)	351 (3.9)	351 (4.6)	294 (4.4)	294 (5.0)
<b>Benchmarking Participants</b>								
<sup>2</sup> Alberta, Canada	557 (3.3)	552 (2.5)	516 (3.3)	527 (3.8) ⬆	540 (2.9)	551 (2.8) ⬆	552 (3.9)	567 (2.6) ⬆
<sup>2</sup> Ontario, Canada	534 (2.9)	529 (3.3)	492 (3.5)	497 (3.4)	519 (3.5)	524 (3.8)	525 (3.4)	532 (4.0) ⬆
Quebec, Canada	528 (3.2)	522 (3.4)	514 (3.9)	517 (3.5)	496 (4.0)	507 (3.4) ⬆	529 (3.4)	542 (4.7) ⬆
Abu Dhabi, UAE	467 (4.4) ⬆	452 (6.3)	465 (4.6)	457 (6.0)	459 (3.9)	459 (6.1)	461 (4.8)	461 (6.6)
Dubai, UAE	504 (4.2) ⬆	468 (5.8)	502 (4.6) ⬆	474 (6.1)	492 (4.4) ⬆	472 (5.8)	498 (4.8) ⬆	477 (6.3)
<sup>1</sup> Alabama, US	492 (6.3)	489 (7.2)	476 (7.4)	483 (8.4)	468 (5.8)	484 (7.1) ⬆	479 (7.9)	496 (9.6) ⬆
<sup>1 2</sup> California, US	496 (5.7)	503 (5.5)	500 (7.2)	507 (6.3)	478 (5.0)	495 (4.9) ⬆	488 (5.9)	510 (6.3) ⬆
<sup>1</sup> Colorado, US	550 (4.9)	552 (5.5)	524 (6.0)	533 (5.9)	521 (4.9)	540 (6.6) ⬆	545 (5.1)	566 (5.8) ⬆
<sup>1 2</sup> Connecticut, US	544 (5.3)	534 (6.3)	523 (5.5)	517 (6.7)	510 (6.4)	530 (6.2) ⬆	535 (5.8)	548 (6.8) ⬆
<sup>1 2</sup> Florida, US	525 (9.0)	532 (8.1)	518 (9.7)	530 (8.3)	517 (9.0)	543 (7.7) ⬆	526 (8.6)	546 (8.5) ⬆
<sup>1 2</sup> Indiana, US	536 (5.1)	545 (6.1)	521 (5.2)	531 (5.8) ⬆	511 (4.9)	534 (6.3) ⬆	530 (6.4)	552 (6.6) ⬆
<sup>1 2</sup> Massachusetts, US	576 (6.1)	574 (5.2)	565 (6.0)	571 (6.7)	546 (6.5)	563 (6.1) ⬆	570 (6.7)	585 (7.1) ⬆
<sup>1</sup> Minnesota, US	561 (5.3)	565 (6.6)	532 (4.9)	545 (6.4) ⬆	532 (5.6)	552 (6.7) ⬆	563 (6.6)	585 (7.2) ⬆
<sup>1 3</sup> North Carolina, US	539 (6.2)	543 (6.9)	525 (7.0)	538 (8.1) ⬆	499 (5.6)	522 (7.2) ⬆	531 (6.2)	549 (7.9) ⬆

⬆ Average significantly higher than other gender

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 3.11: Achievement in Science Cognitive Domains by Gender**

Country	Knowing		Applying		Reasoning	
	Girls	Boys	Girls	Boys	Girls	Boys
Armenia	416 (4.8)	409 (4.7)	419 (4.3)	417 (4.6)	409 (5.5) ▲	396 (5.6)
Australia	515 (3.1)	520 (3.8)	513 (3.6)	513 (3.8)	520 (3.8)	515 (4.1)
Austria	526 (3.4)	538 (3.8) ▲	527 (2.9)	539 (3.7) ▲	518 (3.8)	533 (3.8) ▲
<sup>2</sup> Azerbaijan	449 (6.9)	441 (6.8)	444 (5.9)	436 (5.3)	405 (7.3)	399 (7.0)
Bahrain	466 (5.8) ▲	441 (4.7)	454 (5.1) ▲	433 (4.9)	450 (6.0) ▲	435 (5.8)
Belgium (Flemish)	499 (2.6)	515 (2.7) ▲	506 (2.1)	517 (2.3) ▲	505 (3.1)	512 (2.5) ▲
Chile	475 (3.0)	491 (3.3) ▲	474 (2.9)	485 (3.4) ▲	473 (3.9)	482 (2.7) ▲
Chinese Taipei	536 (3.6)	547 (2.9) ▲	548 (3.1)	556 (3.9) ▲	570 (3.9)	566 (3.2)
<sup>2</sup> Croatia	522 (2.5)	529 (2.4) ▲	508 (2.4)	512 (2.8)	513 (4.0)	512 (3.7)
Czech Republic	541 (3.8)	560 (3.5) ▲	528 (2.8)	540 (3.6) ▲	509 (4.4)	523 (4.9) ▲
<sup>2</sup> Denmark	523 (2.9)	526 (2.9)	530 (3.9)	533 (3.0)	532 (4.3)	523 (3.6)
England	527 (3.9)	530 (4.0)	533 (3.7)	532 (3.9)	533 (6.3)	521 (4.4)
Finland	580 (2.8)	579 (3.3)	569 (2.8)	568 (2.7)	559 (4.8)	561 (3.8)
<sup>1</sup> Georgia	471 (3.9) ▲	460 (5.3)	455 (3.9)	450 (5.9)	430 (5.4) ▲	415 (6.2)
Germany	517 (4.3)	531 (4.5) ▲	527 (2.8)	539 (3.2) ▲	521 (4.2)	531 (3.8) ▲
<sup>2</sup> Hong Kong SAR	530 (3.8)	542 (4.2) ▲	525 (3.5)	532 (4.0) ▲	542 (5.0)	541 (4.8)
Hungary	544 (4.6)	549 (3.8)	527 (3.8)	533 (4.2)	525 (5.6)	525 (4.3)
Iran, Islamic Rep. of	445 (6.6)	451 (6.4)	450 (6.0)	453 (6.1)	458 (6.1)	460 (6.1)
Ireland	516 (4.9)	520 (4.6)	516 (4.1)	518 (4.4)	513 (4.8)	505 (3.7)
Italy	528 (3.1)	536 (3.8) ▲	519 (3.2)	527 (3.2) ▲	506 (3.3)	513 (3.4) ▲
Japan	531 (2.6)	544 (2.1) ▲	560 (1.6)	565 (2.7)	593 (2.0)	589 (2.6)
<sup>2</sup> Kazakhstan	482 (5.8)	490 (5.8) ▲	495 (5.3)	502 (5.3) ▲	491 (6.2)	500 (6.3)
Korea, Rep. of	563 (2.4)	576 (2.6) ▲	590 (2.7)	597 (3.0)	604 (3.1)	606 (4.2)
<sup>1</sup> <sup>ψ</sup> Kuwait	367 (6.6) ▲	312 (8.5)	359 (5.7) ▲	304 (7.7)	360 (6.5) ▲	308 (7.2)
<sup>1</sup> <sup>2</sup> Lithuania	507 (3.1)	509 (3.6)	519 (3.0)	522 (3.5)	518 (3.3)	513 (3.4)
Malta	433 (2.7)	440 (4.7)	443 (2.0)	454 (2.5) ▲	459 (5.7)	459 (4.7)
✱ Morocco	243 (7.4) ▲	231 (5.9)	261 (5.2) ▲	251 (5.7)	239 (5.9)	241 (6.1)
† Netherlands	522 (3.3)	535 (2.4) ▲	530 (2.1)	539 (2.7) ▲	530 (3.3)	534 (4.3)
New Zealand	494 (3.1)	498 (3.3)	497 (3.3)	498 (2.8)	501 (3.8)	492 (3.8)
† Northern Ireland	518 (3.6)	517 (3.3)	520 (3.3)	523 (3.0)	505 (3.6)	500 (5.5)
‡ Norway	499 (2.9)	505 (3.9)	484 (2.8)	490 (3.4) ▲	497 (4.9)	488 (3.9)
Oman	393 (5.1) ▲	359 (4.8)	387 (4.9) ▲	357 (4.3)	372 (4.9) ▲	336 (4.8)
Poland	497 (3.7)	503 (3.3)	510 (3.1)	517 (3.3) ▲	488 (3.1)	486 (4.2)
Portugal	525 (5.6)	530 (4.5)	510 (5.3)	520 (4.2) ▲	524 (7.4)	525 (4.4)
<sup>2</sup> Qatar	401 (6.9) ▲	376 (6.6)	403 (6.9) ▲	377 (6.3)	418 (5.6) ▲	392 (5.1)
Romania	510 (7.0)	512 (6.0)	502 (7.1)	503 (5.6)	499 (7.4)	495 (6.1)
Russian Federation	554 (4.1)	552 (4.0)	554 (3.4)	558 (4.3)	547 (4.8) ▲	537 (4.0)
Saudi Arabia	457 (5.0) ▲	406 (11.3)	450 (5.9) ▲	402 (10.9)	436 (4.7) ▲	394 (11.0)
<sup>2</sup> Serbia	523 (3.5)	525 (3.9)	503 (3.8)	509 (4.1)	519 (4.1)	520 (4.1)
<sup>2</sup> Singapore	565 (3.8)	574 (3.8) ▲	586 (4.6)	592 (4.2)	601 (4.8) ▲	592 (3.6)
Slovak Republic	540 (4.4)	553 (3.7) ▲	524 (4.5)	532 (4.0) ▲	512 (4.7)	516 (4.2)
Slovenia	516 (2.7)	521 (2.8)	514 (2.9)	522 (3.7) ▲	523 (3.9)	528 (4.2)
Spain	509 (3.0)	523 (4.0) ▲	494 (3.4)	503 (4.0) ▲	494 (3.9)	498 (3.3)
Sweden	533 (3.4)	538 (3.0)	530 (3.2)	531 (3.5)	535 (3.4)	538 (4.2)
Thailand	476 (6.5)	470 (6.9)	474 (6.0)	468 (6.0)	472 (7.1) ▲	455 (6.9)
<sup>ψ</sup> Tunisia	350 (6.3) ▲	324 (5.8)	353 (5.4) ▲	333 (5.2)	353 (6.5) ▲	322 (5.1)
Turkey	459 (5.3)	455 (4.7)	464 (5.4)	462 (5.2)	476 (6.9)	468 (5.0)
United Arab Emirates	444 (3.6) ▲	422 (4.1)	429 (3.5) ▲	413 (3.7)	438 (3.7) ▲	413 (3.7)
<sup>2</sup> United States	541 (2.4)	551 (2.0) ▲	537 (2.4)	552 (2.2) ▲	537 (2.8)	537 (2.9)
✱ Yemen	200 (7.4) ▲	170 (7.8)	200 (6.7) ▲	171 (7.9)	195 (9.8) ▲	170 (7.7)
International Avg.	486 (0.6)	485 (0.7)	485 (0.6)	484 (0.6)	485 (0.7) ▲	478 (0.7)

▲ Average significantly higher than other gender

✱ Average achievement not reliably measured because the percentage of students with achievement too low for estimation exceeds 25%.

<sup>ψ</sup> Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.

See Appendix C.2 for target population coverage notes 1, 2, and 3. See Appendix C.8 for sampling guidelines and sampling participation notes †, ‡, and §.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

**Exhibit 3.11: Achievement in Science Cognitive Domains by Gender (Continued)**

Country	Knowing		Applying		Reasoning	
	Girls	Boys	Girls	Boys	Girls	Boys
<b>Sixth Grade Participants</b>						
Botswana	353 (6.6) ▲	333 (7.2)	382 (5.6)	376 (6.4)	387 (5.6) ▲	367 (7.5)
Honduras	440 (6.9)	450 (6.5)	423 (5.7)	436 (5.6) ▲	389 (7.9)	396 (8.0)
Yemen	349 (9.2)	331 (9.0)	344 (8.9)	334 (7.8)	351 (9.4) ▲	327 (8.1)
<b>Benchmarking Participants</b>						
<sup>2</sup> Alberta, Canada	537 (3.5)	549 (3.4) ▲	536 (3.5)	545 (3.5) ▲	536 (3.4)	544 (3.6) ▲
Ontario, Canada	525 (3.8)	532 (3.3) ▲	522 (3.7)	529 (3.7) ▲	530 (3.9)	528 (4.7)
Quebec, Canada	514 (3.5)	523 (2.8) ▲	508 (3.1)	519 (2.7) ▲	519 (3.9)	520 (5.0)
Abu Dhabi, UAE	433 (6.4) ▲	396 (7.7)	419 (6.3) ▲	391 (7.1)	434 (6.0) ▲	398 (6.9)
Dubai, UAE	468 (4.6)	467 (5.1)	452 (4.2)	454 (4.7)	460 (5.4)	451 (5.2)
<sup>1 3</sup> Florida, US	543 (4.3)	557 (4.4) ▲	539 (3.3)	547 (5.1)	535 (5.2)	536 (4.4)
<sup>1 2</sup> North Carolina, US	534 (5.0)	545 (5.5) ▲	535 (4.9)	543 (4.6)	526 (5.5)	539 (5.5) ▲

▲ Average significantly higher than other gender

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 3.12: Achievement in Science Cognitive Domains by Gender**

Country	Knowing		Applying		Reasoning	
	Girls	Boys	Girls	Boys	Girls	Boys
Armenia	474 (3.8) ▲	454 (3.7)	437 (4.2) ▲	421 (4.2)	427 (4.4) ▲	412 (3.6)
Australia	503 (4.7)	525 (7.6) ▲	509 (4.4)	525 (7.0) ▲	521 (4.5)	531 (7.5)
Bahrain	486 (3.9) ▲	429 (4.4)	476 (2.3) ▲	423 (3.1)	483 (3.2) ▲	415 (3.6)
Chile	467 (4.3)	486 (3.6) ▲	446 (2.8)	462 (2.9) ▲	453 (3.2)	466 (3.8) ▲
Chinese Taipei	565 (2.9)	573 (3.4) ▲	571 (2.9)	569 (3.4)	553 (3.6)	549 (3.5)
‡ England	532 (5.3)	535 (6.4)	531 (4.8)	532 (5.9)	540 (5.2)	534 (5.9)
Finland	565 (3.2)	564 (3.7)	553 (2.5) ▲	545 (3.2)	552 (3.5) ▲	543 (4.0)
<sup>1</sup> Georgia	433 (4.9) ▲	422 (4.1)	424 (4.7) ▲	412 (4.4)	420 (4.5) ▲	406 (4.6)
<sup>ψ</sup> Ghana	272 (7.1)	309 (6.3) ▲	282 (6.3)	308 (7.4) ▲	300 (5.3)	328 (5.2) ▲
Hong Kong SAR	541 (4.4)	548 (3.9)	529 (4.7)	529 (4.0)	544 (5.2) ▲	532 (4.3)
Hungary	500 (3.6)	520 (3.9) ▲	522 (3.9)	542 (4.0) ▲	511 (4.1)	524 (4.1) ▲
Indonesia	406 (6.7)	398 (5.5)	401 (5.2)	394 (4.9)	415 (5.7)	412 (5.4)
Iran, Islamic Rep. of	484 (6.0)	475 (5.9)	469 (5.2)	470 (5.4)	480 (5.3)	471 (5.3)
<sup>3</sup> Israel	521 (4.4)	514 (6.0)	515 (3.9)	508 (5.3)	522 (4.4)	516 (5.9)
Italy	504 (3.4)	520 (2.6) ▲	493 (3.3)	507 (2.4) ▲	480 (3.6)	497 (2.6) ▲
Japan	534 (3.2)	548 (3.1) ▲	557 (3.2)	565 (2.8) ▲	567 (3.2)	569 (3.1)
Jordan	478 (4.9) ▲	429 (6.5)	470 (4.2) ▲	433 (6.3)	465 (4.9) ▲	419 (7.1)
Kazakhstan	481 (5.3)	484 (5.3)	494 (4.5)	488 (5.1)	489 (4.7)	486 (4.7)
Korea, Rep. of	547 (3.2)	561 (3.6) ▲	559 (2.9)	563 (2.4)	564 (3.1)	564 (2.2)
Lebanon	383 (6.2)	379 (8.1)	404 (5.5)	413 (6.6)	409 (6.0)	407 (7.2)
<sup>1</sup> Lithuania	519 (3.0)	512 (3.1)	517 (3.1) ▲	508 (2.8)	517 (4.4)	509 (3.0)
Macedonia, Rep. of	425 (6.6) ▲	408 (6.7)	417 (5.8) ▲	399 (6.1)	402 (6.2) ▲	380 (6.8)
Malaysia	410 (7.1) ▲	395 (8.1)	434 (6.2) ▲	415 (7.1)	445 (6.0) ▲	433 (6.7)
Morocco	363 (2.8)	362 (3.7)	380 (1.9)	381 (2.7)	370 (2.8) ▲	363 (2.9)
New Zealand	498 (5.5)	524 (5.4) ▲	498 (4.5)	519 (4.8) ▲	507 (5.1)	522 (5.1) ▲
Norway	491 (4.8)	489 (3.1)	496 (3.9)	496 (3.3)	495 (4.1)	494 (3.4)
Oman	456 (3.4) ▲	376 (4.4)	458 (3.0) ▲	379 (4.5)	456 (3.4) ▲	377 (4.2)
Palestinian Nat'l Auth.	442 (4.3) ▲	419 (5.9)	434 (4.2) ▲	409 (5.9)	421 (4.5) ▲	387 (5.8)
Qatar	429 (7.5) ▲	407 (5.8)	431 (6.2) ▲	409 (5.4)	421 (8.0) ▲	397 (6.7)
Romania	457 (4.1)	457 (4.7)	467 (4.3)	469 (4.1)	464 (4.3)	456 (4.5)
<sup>2</sup> Russian Federation	553 (4.7)	561 (4.6)	535 (4.0)	542 (3.7) ▲	531 (3.7)	534 (3.7)
Saudi Arabia	457 (3.8) ▲	439 (7.6)	446 (4.0) ▲	419 (6.6)	439 (4.5) ▲	409 (6.7)
<sup>2</sup> Singapore	584 (4.7)	591 (6.1)	588 (4.4)	590 (5.4)	596 (4.2)	589 (5.5)
Slovenia	546 (2.7)	555 (3.6) ▲	540 (2.9)	545 (3.4)	535 (3.0)	536 (3.7)
Sweden	509 (3.0)	514 (3.0)	510 (2.9)	506 (3.2)	514 (3.1) ▲	506 (3.4)
Syrian Arab Republic	436 (4.5)	446 (5.2) ▲	424 (4.9)	428 (5.9)	396 (5.5)	407 (6.0) ▲
Thailand	448 (4.6) ▲	436 (6.6)	459 (3.9) ▲	442 (5.4)	462 (4.3) ▲	442 (5.2)
Tunisia	417 (2.8)	433 (2.5) ▲	428 (2.7)	447 (3.0) ▲	439 (3.1)	455 (3.5) ▲
Turkey	499 (3.6) ▲	481 (4.6)	484 (3.3) ▲	472 (4.2)	492 (3.2) ▲	475 (4.1)
Ukraine	505 (4.2)	506 (4.8)	493 (4.4)	499 (4.5)	498 (4.4)	501 (4.9)
United Arab Emirates	485 (3.1) ▲	458 (3.4)	477 (2.9) ▲	452 (3.1)	470 (3.0) ▲	442 (3.8)
<sup>2</sup> United States	518 (3.0)	537 (3.6) ▲	517 (2.7)	528 (2.5) ▲	521 (3.0)	526 (2.8)
International Avg.	479 (0.7) ▲	476 (0.8)	478 (0.6) ▲	473 (0.7)	478 (0.7) ▲	470 (0.8)

▲ Average significantly higher than other gender

<sup>ψ</sup> Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.

See Appendix C.3 for target population coverage notes 1, 2, and 3. See Appendix C.9 for sampling guidelines and sampling participation notes †, ‡, and §.

(.) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

**Exhibit 3.12: Achievement in Science Cognitive Domains by Gender (Continued)**

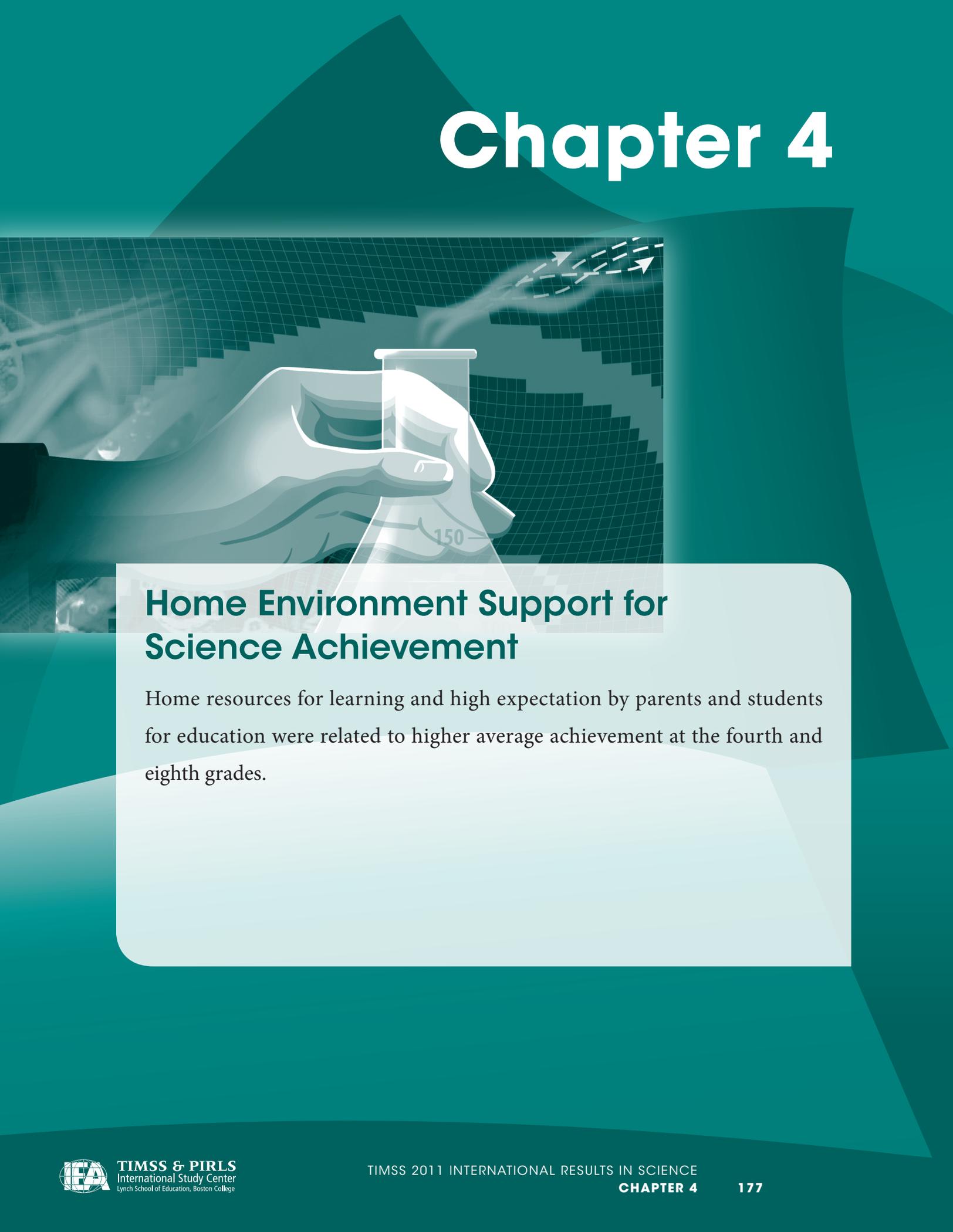
Country	Knowing		Applying		Reasoning	
	Girls	Boys	Girls	Boys	Girls	Boys
<b>Ninth Grade Participants</b>						
Botswana	406 (4.2) ▲	388 (4.3)	406 (3.6)	401 (3.9)	411 (4.1) ▲	397 (4.4)
<sup>2</sup> Honduras	360 (4.7)	390 (5.5) ▲	362 (5.2)	377 (4.4) ▲	347 (5.3)	371 (5.5) ▲
<sup>ψ</sup> South Africa	286 (4.9)	278 (5.2)	338 (4.2)	333 (4.1)	343 (5.5) ▲	333 (5.6)
<b>Benchmarking Participants</b>						
<sup>2</sup> Alberta, Canada	534 (3.3)	551 (2.8) ▲	541 (3.3)	545 (2.5)	552 (3.2)	551 (2.7)
<sup>2</sup> Ontario, Canada	506 (3.2)	520 (4.1) ▲	518 (2.5)	518 (2.9)	535 (3.2) ▲	530 (3.5)
Quebec, Canada	513 (2.9)	527 (3.4) ▲	516 (2.8)	519 (3.9)	524 (3.6)	520 (3.6)
Abu Dhabi, UAE	471 (4.9)	462 (5.9)	465 (4.2)	457 (5.6)	461 (4.7)	450 (6.3)
Dubai, UAE	507 (5.3) ▲	478 (5.9)	500 (4.5) ▲	473 (5.9)	496 (4.9) ▲	464 (6.0)
<sup>1</sup> Alabama, US	479 (8.1)	502 (8.6) ▲	480 (5.9)	489 (7.5)	483 (5.7)	476 (8.7)
<sup>1 2</sup> California, US	485 (7.5)	504 (6.3) ▲	493 (5.2)	503 (4.9)	495 (5.4)	502 (5.5)
<sup>1</sup> Colorado, US	536 (5.1)	549 (5.8) ▲	532 (4.5)	545 (5.2) ▲	541 (6.0)	550 (4.5)
<sup>1 2</sup> Connecticut, US	534 (5.4)	540 (6.6)	526 (4.9)	528 (6.1)	531 (4.9)	530 (6.4)
<sup>1 2</sup> Florida, US	528 (8.8)	553 (7.8) ▲	518 (8.2)	533 (7.4) ▲	522 (8.5)	527 (8.2)
<sup>1 2</sup> Indiana, US	529 (5.6)	546 (6.2) ▲	524 (4.8)	539 (5.2) ▲	526 (5.2)	535 (5.8) ▲
<sup>1 2</sup> Massachusetts, US	570 (7.9)	582 (5.8) ▲	560 (5.7)	563 (4.4)	564 (7.0)	569 (5.6)
<sup>1</sup> Minnesota, US	542 (5.3)	563 (6.4) ▲	547 (4.9)	560 (5.9) ▲	554 (5.2)	557 (5.7)
<sup>1 3</sup> North Carolina, US	527 (6.3)	545 (8.6) ▲	523 (5.5)	534 (7.7) ▲	526 (5.8)	535 (8.6)

▲ Average significantly higher than other gender

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



# Chapter 4



## Home Environment Support for Science Achievement

Home resources for learning and high expectation by parents and students for education were related to higher average achievement at the fourth and eighth grades.

Considerable research supports the fundamental importance of a supportive home environment in shaping children’s achievement in school. Internationally, IEA studies in science through four cycles of TIMSS have found a strong positive relationship between students’ science achievement at the fourth and eighth grades and home environments that foster learning.

This chapter presents the fourth grade TIMSS 2011 science achievement results in relation to parents’ reports about the following: 1) their children’s home resources for learning, 2) their children’s language experiences before starting school, 3) their educational expectations for their children, and 4) their children’s attendance at preprimary education. The parents’ data were collected using the *TIMSS & PIRLS 2011 Learning to Read Survey* in which students’ parents or primary caregivers were asked to provide information about their child’s home environment and early educational experiences, and so are available only for countries that administered both TIMSS and PIRLS to the same fourth grade students. The chapter also presents the eighth grade science achievement in relation to students’ own reports about several aspects of their home environment and their educational expectations.

### *Home Resources for Learning*

The *TIMSS & PIRLS 2011 Learning to Read Survey* asked students’ parents to report on the availability of three key home resources highly related to student achievement in school:

- ◆ Parents’ education;
- ◆ Parents’ occupation; and
- ◆ Number of children’s books in the home.

In addition, students were asked about:

- ◆ Number of books in the home; and
- ◆ Availability of two study supports at home—An Internet connection and their own room.

Research consistently shows a strong positive relationship between achievement and socioeconomic status (SES), or indicators of socioeconomic status such as parents’ or caregivers’ level of education or occupation. TIMSS, PIRLS, and PISA have found strong positive relationships between level

of parents' education and/or occupation and their children's educational attainment. In general, higher levels of education can lead to careers in higher paying professions, higher socioeconomic status, and more home resources. However, the benefits of higher levels of parents' education can extend to having more positive beliefs and higher expectations toward educational achievement transfer to their children. Availability of reading material in the home likewise is strongly related to achievement in mathematics and science as well as in reading. IEA's TIMSS studies have consistently shown that students with a large number of books in the home have higher achievement in mathematics and science.

Exhibit 4.1 presents the results for the TIMSS 2011 Home Resources for Learning scale, which was created based on parents' and students' reports about the five types of home resources described above. Results are shown for countries that administered both TIMSS and PIRLS fourth grade assessments to the same fourth grade students. The second page of the exhibit provides detail about the questions forming the scale and the categorization of responses. Students were scored according to the availability of the five home resources, with **Many Resources** corresponding to more than 100 books in the home, having both their own room and an Internet connection, more than 25 children's books, at least one parent having completed university, and one with a professional occupation, on average. **Few Resources** corresponds, on average, to having 25 or fewer books, neither of the home study supports, 10 or fewer children's books, neither parent having gone beyond upper secondary school, and neither having a business, clerical, or professional occupation.

Countries are ordered by the percentage of students in the **Many Resources** category, with the fourth grade countries on the first page of the exhibit and the sixth grade and benchmarking participants on the second page. Internationally, on average, almost three-quarters of the fourth grade students (74%) were assigned to the **Some Resources** category. Seventeen percent, on average, were in the **Many Resources** category and nine percent internationally were in the **Few Resources** category, with a 131-point difference in their average science achievement (559 vs. 428). Students in the countries participating at the sixth grade had relatively few home resources, comparable to the fourth grade countries with the lowest levels of resources.

## Exhibit 4.1: Home Resources for Learning\*

Reported by Parents, except Number of Books and Study Supports Reported by Students

Students were scored according to their own and their parents' responses concerning the availability of five resources on the *Home Resources for Learning* scale. Students with **Many Resources** had a score of at least 11.9, which is the point on the scale corresponding to students reporting they had more than 100 books in the home and two home study supports, and parents reporting that they had more than 25 children's books in the home, that at least one parent had finished university, and that at least one parent had a professional occupation, on average. Students with **Few Resources** had a score no higher than 7.3, which is the scale point corresponding to students reporting that they had 25 or fewer books in the home and neither of the two home study supports, and parents reporting that they had 10 or fewer children's books in the home, that neither parent had gone beyond upper-secondary education, and that neither parent was a small business owner or had a clerical or professional occupation, on average. All other students were assigned to the **Some Resources** category.

Country	Many Resources		Some Resources		Few Resources		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Norway	42 (1.6)	517 (2.7)	57 (1.6)	480 (2.3)	0 (0.1)	~ ~	11.5 (0.06)
Australia	s 41 (1.5)	565 (3.0)	59 (1.5)	509 (3.5)	1 (0.2)	~ ~	11.5 (0.06)
Sweden	39 (1.6)	570 (3.0)	60 (1.6)	522 (2.6)	1 (0.2)	~ ~	11.4 (0.05)
Finland	33 (1.4)	596 (2.7)	67 (1.4)	560 (2.9)	0 (0.1)	~ ~	11.2 (0.04)
Northern Ireland	s 30 (1.5)	562 (3.4)	68 (1.6)	518 (3.2)	2 (0.4)	~ ~	10.9 (0.07)
Ireland	27 (1.4)	563 (3.8)	71 (1.4)	508 (2.9)	2 (0.3)	~ ~	10.8 (0.06)
Germany	r 24 (1.4)	580 (2.6)	75 (1.4)	525 (2.8)	2 (0.3)	~ ~	10.7 (0.07)
Singapore	24 (0.9)	637 (3.7)	74 (0.9)	573 (3.4)	3 (0.3)	474 (9.5)	10.7 (0.03)
Hungary	21 (1.5)	600 (3.2)	69 (1.4)	535 (2.8)	11 (1.1)	447 (8.3)	10.1 (0.10)
Spain	19 (1.3)	548 (3.6)	77 (1.2)	504 (2.7)	5 (0.5)	452 (7.9)	10.3 (0.06)
Chinese Taipei	18 (1.0)	596 (2.2)	76 (1.0)	546 (2.3)	6 (0.4)	501 (5.5)	10.2 (0.06)
Czech Republic	18 (1.0)	577 (3.7)	81 (1.0)	531 (2.5)	1 (0.2)	~ ~	10.5 (0.04)
Slovenia	17 (0.8)	568 (3.3)	82 (0.9)	514 (2.7)	1 (0.2)	~ ~	10.4 (0.04)
Austria	17 (1.0)	576 (2.5)	82 (0.9)	527 (2.9)	2 (0.3)	~ ~	10.4 (0.06)
Portugal	16 (1.0)	561 (4.0)	75 (1.0)	523 (3.8)	9 (0.7)	482 (7.9)	9.9 (0.06)
Russian Federation	16 (1.0)	592 (3.7)	82 (1.1)	546 (3.6)	2 (0.4)	~ ~	10.4 (0.05)
Malta	16 (0.5)	520 (4.2)	83 (0.6)	444 (2.4)	1 (0.2)	~ ~	10.3 (0.02)
Poland	15 (1.0)	569 (3.8)	79 (1.0)	499 (2.4)	6 (0.6)	441 (6.6)	10.0 (0.06)
Slovak Republic	13 (0.8)	590 (4.1)	81 (1.1)	532 (2.9)	6 (1.0)	458 (14.6)	9.9 (0.06)
Qatar	r 12 (0.9)	478 (12.1)	84 (0.9)	397 (4.1)	4 (0.4)	320 (12.7)	10.2 (0.05)
Hong Kong SAR	12 (1.0)	569 (4.4)	80 (0.9)	540 (2.9)	8 (0.7)	520 (5.6)	9.8 (0.08)
Georgia	12 (1.0)	502 (4.2)	80 (1.2)	457 (3.8)	8 (1.0)	400 (11.3)	9.9 (0.07)
Lithuania	11 (0.9)	566 (4.6)	83 (1.0)	513 (2.1)	6 (0.5)	461 (8.5)	9.8 (0.05)
United Arab Emirates	10 (0.5)	516 (5.1)	84 (0.6)	428 (2.7)	6 (0.4)	369 (5.3)	9.9 (0.03)
Italy	8 (0.7)	570 (4.5)	85 (0.8)	527 (2.7)	7 (0.6)	483 (7.0)	9.7 (0.05)
Croatia	7 (0.6)	560 (4.8)	88 (0.7)	515 (1.9)	5 (0.6)	475 (7.7)	9.7 (0.05)
Romania	7 (0.7)	604 (4.6)	67 (1.8)	524 (4.1)	26 (1.7)	438 (12.1)	8.7 (0.09)
Iran, Islamic Rep. of	4 (0.5)	560 (4.7)	57 (1.7)	476 (3.4)	39 (1.9)	411 (4.1)	8.1 (0.09)
Saudi Arabia	4 (0.6)	492 (11.0)	78 (1.2)	436 (5.2)	18 (1.2)	394 (10.6)	9.0 (0.07)
Oman	3 (0.3)	456 (10.3)	75 (0.8)	391 (4.4)	23 (0.8)	339 (6.1)	8.7 (0.04)
Morocco	s 1 (0.2)	~ ~	46 (2.1)	291 (4.3)	53 (2.1)	260 (8.0)	7.2 (0.10)
Azerbaijan	1 (0.1)	~ ~	77 (1.3)	445 (6.1)	22 (1.3)	427 (7.1)	8.5 (0.04)
International Avg.	17 (0.2)	559 (0.9)	74 (0.2)	495 (0.6)	9 (0.1)	428 (2.0)	

\* Available only for countries that administered both TIMSS and PIRLS to the same fourth grade students because this item was included in the PIRLS Home Questionnaire completed by parents.

Centerpoint of scale set at 10.

() Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

**Exhibit 4.1: Home Resources for Learning\* (Continued)**

Country	Many Resources		Some Resources		Few Resources		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Sixth Grade Participants</b>							
Botswana	1 (0.4)	~ ~	57 (1.8)	416 (7.8)	42 (1.9)	333 (6.9)	7.7 (0.10)
Honduras	0 (0.1)	~ ~	44 (2.5)	474 (7.3)	56 (2.5)	419 (6.2)	7.1 (0.12)
<b>Benchmarking Participants</b>							
Quebec, Canada	29 (1.6)	546 (3.0)	71 (1.6)	508 (2.8)	0 (0.1)	~ ~	11.1 (0.05)
Dubai, UAE	21 (0.5)	542 (3.6)	77 (0.6)	455 (2.5)	3 (0.2)	361 (10.1)	10.6 (0.02)
Abu Dhabi, UAE	8 (1.2)	497 (13.6)	85 (1.3)	413 (4.5)	6 (0.7)	359 (7.1)	9.8 (0.07)

<p><b>Number of books in the home (students):</b></p> <ul style="list-style-type: none"> <li>1) 0-10</li> <li>2) 11-25</li> <li>3) 26-100</li> <li>4) 101-200</li> <li>5) More than 200</li> </ul>	<p><b>Number of children's books in the home (parents):</b></p> <ul style="list-style-type: none"> <li>1) 0-10</li> <li>2) 11-25</li> <li>3) 26-50</li> <li>4) 51-100</li> <li>5) More than 100</li> </ul>
<p><b>Number of home study supports (students):</b></p> <ul style="list-style-type: none"> <li>1) None</li> <li>2) Internet connection or own room</li> <li>3) Both</li> </ul>	<p><b>Highest level of education of either parent (parents):</b></p> <ul style="list-style-type: none"> <li>1) Finished some primary or lower secondary or did not go to school</li> <li>2) Finished lower secondary</li> <li>3) Finished upper secondary</li> <li>4) Finished post-secondary education</li> <li>5) Finished university or higher</li> </ul>
<p><b>Highest level of occupation of either parent (parents):</b></p> <ul style="list-style-type: none"> <li>1) Has never worked outside home for pay, general laborer, or semi-professional (skilled agricultural or fishery worker, craft or trade worker, plant or machine operator)</li> <li>2) Clerical (clerk or service or sales worker)</li> <li>3) Small business owner</li> <li>4) Professional (corporate manager or senior official, professional, or technician or associate professional)</li> </ul>	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Exhibit 4.2 provides supporting detail about the availability of the specific home resources included in the Home Resources for Learning scale for the fourth grade assessment. The exhibit presents data on two resource components (More than 100 Books in Their Home as well as both Own Room and Internet Connection in Home) for all participants in the fourth grade TIMSS assessment, as well as data on an additional three resources for countries that participated in both TIMSS and PIRLS with the same students. On average, across all of the countries participating in TIMSS 2011 at the fourth grade, one-fourth of the students were from homes with more than 100 books in total, and slightly more than half (52%) reported having both their own room and an Internet connection at home. Across the countries participating in both studies at the fourth grade, on average, 30 percent of the students had at least one parent that had earned a university degree and 36 percent had at least one parent in a professional occupation, and the majority of students (58%) had more than 25 children's books at home.

Exhibit 4.3 presents the results for the TIMSS 2011 eighth grade assessment for the Home Educational Resources scale, which was created based on students' reports about three of the five types of home resources that comprised the fourth grade Home Resources for Learning scale—number of books in the home, availability of two home study supports, and parents' education. The second page of the exhibit provides detail about the questions forming the scale and the categorization of responses. Students were scored according to the availability of the three home study supports, with **Many Resources** corresponding to more than 100 books in the home, having both their own room and an Internet connection, and at least one parent having completed university, on average. **Few Resources** corresponds, on average, to having 25 or fewer books, neither home study support, and neither parent having gone beyond upper secondary school.

Countries are ordered by the percentage of students in the **Many Resources** category, with the eighth grade countries on the first page of the exhibit and the ninth grade and benchmarking participants on the second page. Internationally, on average, two-thirds of the eighth grade students (67%) were assigned to the **Some Resources** category. On average, twelve percent were in the **Many Resources** category and 21 percent were in the **Few Resources** category, with a 116-point difference in their average science achievement (540 vs. 424).

Exhibit 4.4 provides supporting detail about the availability of the specific home resources included in the Home Educational Resources scale for the eighth grade assessment. Across the countries participating at the eighth grade, on average, one-fourth of the students had more than 100 books in their home, more than half (53%) reported having both their own room and an Internet connection at home, and about one-third (32%) had at least one parent that had earned a university degree.

**Exhibit 4.2: Components of the Home Resources for Learning Scale\***

Columns 1-2 Reported by Students and Columns 3-5 Reported by Parents

Country	Percent of Students with				
	More than 100 Books in Their Home	Own Room and Internet Connection in Home	At Least One Parent with a University Degree or Higher	At Least One Parent in a Professional Occupation**	More than 25 Children's Books in Their Home
Armenia	29 (0.9)	30 (1.0)			
Australia	41 (1.0)	74 (1.0)	s	s	s
Austria	28 (1.3)	69 (1.0)			
Azerbaijan	8 (0.7)	10 (0.6)			
Bahrain	24 (1.0)	50 (1.5)			
Belgium (Flemish)	26 (1.1)	79 (0.9)			
Chile	15 (0.5)	46 (1.1)			
Chinese Taipei	30 (1.1)	52 (0.9)			
Croatia	16 (0.8)	64 (1.2)			
Czech Republic	34 (1.1)	58 (1.2)			
Denmark	28 (1.2)	90 (0.8)			
England	34 (1.3)	75 (1.4)			
Finland	38 (1.4)	78 (1.0)			
Georgia	35 (1.4)	34 (1.3)			
Germany	35 (1.5)	71 (1.0)	r	r	r
Hong Kong SAR	25 (1.2)	56 (1.3)			
Hungary	33 (1.5)	62 (1.4)			
Iran, Islamic Rep. of	14 (0.8)	23 (1.4)			
Ireland	33 (1.5)	71 (1.0)			
Italy	23 (1.0)	38 (0.8)			
Japan	22 (0.9)	57 (1.1)			
Kazakhstan	17 (1.3)	28 (1.6)			
Korea, Rep. of	65 (1.3)	54 (1.3)			
Kuwait	25 (1.1)	54 (1.5)			
Lithuania	16 (0.8)	48 (1.0)			
Malta	24 (0.7)	67 (0.7)	r	r	
Morocco	r 9 (0.6)	16 (0.9)	r	s	r
Netherlands	26 (1.3)	87 (0.9)			
New Zealand	38 (1.1)	69 (0.8)			
Northern Ireland	31 (1.4)	70 (1.1)	s	s	s
Norway	36 (1.4)	87 (0.8)			
Oman	22 (0.9)	19 (0.7)		r	
Poland	24 (0.9)	52 (1.1)			
Portugal	21 (1.2)	64 (1.3)			
Qatar	27 (0.9)	51 (1.1)	r	r	
Romania	15 (1.0)	42 (1.5)			
Russian Federation	25 (1.0)	40 (1.6)			
Saudi Arabia	20 (1.2)	28 (1.5)			
Serbia	16 (0.8)	57 (1.3)			
Singapore	31 (0.9)	49 (0.7)			
Slovak Republic	26 (1.0)	47 (1.1)			
Slovenia	27 (1.0)	67 (1.2)			
Spain	29 (1.5)	65 (1.1)			
Sweden	39 (1.4)	84 (0.8)	r	r	
Thailand	8 (0.7)	11 (0.7)			
Tunisia	11 (0.7)	20 (1.1)			
Turkey	14 (0.8)	26 (1.1)			
United Arab Emirates	22 (0.6)	42 (0.8)		r	
United States	28 (0.8)	64 (0.6)			
Yemen	9 (0.9)	7 (0.7)			
International Avg.	25 (0.2)	52 (0.2)	30 (0.2)	36 (0.2)	58 (0.2)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

\* Data reported in columns 3-5 were from the PIRLS Home Questionnaire completed by parents, so data are available only for countries that administered both TIMSS and PIRLS to the same fourth grade students.

\*\* Includes corporate manager or senior official, professional, and technician or associate professional.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

**Exhibit 4.2: Components of the Home Resources for Learning Scale\* (Continued)**

Country	Percent of Students with						
	More than 100 Books in Their Home	Own Room and Internet Connection in Home	At Least One Parent with a University Degree or Higher	At Least One Parent in a Professional Occupation**	More than 25 Children's Books in Their Home		
<b>Sixth Grade Participants</b>							
Botswana	10 (0.7)	11 (1.0)	s	10 (1.5)	s	22 (1.7)	14 (0.8)
Honduras	6 (0.6)	17 (1.6)	s	10 (2.3)	s	13 (1.8)	11 (0.9)
Yemen	8 (0.5)	6 (0.6)					
<b>Benchmarking Participants</b>							
Alberta, Canada	40 (1.3)	79 (1.1)					
Ontario, Canada	37 (1.3)	74 (1.2)					
Quebec, Canada	28 (1.2)	82 (1.0)		45 (2.0)		55 (1.5)	78 (1.2)
Abu Dhabi, UAE	22 (1.1)	41 (1.5)		52 (1.7)		47 (1.8)	29 (1.7)
Dubai, UAE	26 (0.6)	49 (0.9)		67 (0.9)	r	63 (0.8)	50 (0.6)
Florida, US	21 (1.1)	66 (1.3)					
North Carolina, US	27 (1.6)	68 (1.7)					

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

### Exhibit 4.3: Home Educational Resources

Reported by Students

Students were scored according to their responses concerning the availability of three home educational resources on the *Home Educational Resources* scale. Students with **Many Resources** had a score of at least 12.5, which is the point on the scale corresponding to students reporting that they had more than 100 books in the home and two home study supports, and that at least one parent had finished university, on average. Students with **Few Resources** had a score no higher than 8.2, which is the scale point corresponding to students reporting that they had 25 or fewer books in the home, neither of the two home study supports, and that neither parent had gone beyond upper-secondary education, on average. All other students were assigned to the **Some Resources** category.

Country	Many Resources		Some Resources		Few Resources		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Korea, Rep. of	32 (1.4)	596 (2.6)	64 (1.3)	546 (1.7)	4 (0.3)	496 (7.0)	11.4 (0.06)
Norway	32 (1.2)	530 (3.0)	67 (1.1)	480 (2.5)	1 (0.2)	~ ~	11.6 (0.04)
Sweden	27 (1.0)	554 (2.8)	71 (1.0)	498 (2.5)	2 (0.2)	~ ~	11.3 (0.04)
United States	23 (0.8)	575 (2.8)	70 (0.8)	516 (2.4)	8 (0.4)	465 (4.7)	10.9 (0.04)
Finland	22 (1.0)	584 (3.0)	76 (1.0)	545 (2.4)	2 (0.2)	~ ~	11.2 (0.04)
Australia	22 (1.4)	577 (7.6)	75 (1.3)	508 (4.0)	4 (0.4)	433 (7.7)	11.2 (0.06)
Hungary	20 (1.0)	574 (3.2)	72 (1.0)	520 (2.4)	8 (0.9)	418 (8.2)	10.8 (0.06)
Armenia	20 (0.9)	469 (5.4)	72 (0.8)	434 (3.1)	8 (0.5)	390 (7.4)	10.8 (0.05)
New Zealand	19 (1.1)	571 (4.9)	76 (1.0)	506 (4.2)	5 (0.5)	429 (6.3)	10.9 (0.06)
Russian Federation	19 (0.9)	579 (3.8)	75 (0.9)	537 (3.1)	6 (0.6)	501 (8.3)	10.8 (0.05)
Georgia	17 (1.0)	471 (3.7)	71 (1.1)	419 (3.0)	12 (1.0)	360 (5.9)	10.5 (0.06)
Japan	17 (1.0)	593 (4.2)	78 (0.9)	553 (2.3)	5 (0.5)	497 (7.5)	10.8 (0.05)
England	17 (1.1)	597 (5.9)	79 (1.1)	526 (4.5)	5 (0.5)	439 (13.5)	10.8 (0.05)
Qatar	17 (0.9)	472 (8.1)	74 (1.1)	419 (3.9)	10 (0.7)	329 (7.6)	10.7 (0.04)
Israel	16 (1.1)	575 (6.3)	82 (1.1)	519 (4.1)	2 (0.3)	~ ~	11.0 (0.05)
Slovenia	16 (0.8)	586 (3.9)	82 (0.8)	538 (2.6)	2 (0.3)	~ ~	10.9 (0.03)
Chinese Taipei	15 (0.6)	621 (3.8)	73 (0.8)	564 (2.1)	12 (0.7)	498 (4.1)	10.4 (0.04)
Italy	13 (0.8)	549 (3.7)	75 (1.0)	501 (2.3)	12 (0.8)	451 (6.4)	10.3 (0.04)
Ukraine	12 (0.9)	551 (5.3)	79 (1.0)	502 (3.1)	9 (0.9)	434 (8.7)	10.4 (0.05)
Singapore	12 (0.6)	654 (4.5)	76 (0.7)	591 (4.0)	12 (0.6)	522 (7.5)	10.3 (0.04)
United Arab Emirates	11 (0.5)	518 (5.1)	76 (0.6)	465 (2.3)	12 (0.5)	416 (3.3)	10.3 (0.03)
Lithuania	11 (0.9)	561 (4.9)	81 (1.0)	515 (2.3)	8 (0.6)	443 (7.3)	10.4 (0.04)
Romania	10 (0.8)	535 (4.8)	71 (1.3)	470 (3.2)	19 (1.2)	412 (5.7)	9.9 (0.06)
Hong Kong SAR	10 (0.8)	578 (8.2)	72 (1.0)	537 (3.2)	19 (0.8)	512 (5.1)	9.9 (0.05)
Bahrain	9 (0.5)	514 (5.8)	78 (0.9)	456 (2.2)	14 (0.7)	405 (5.8)	10.1 (0.03)
Kazakhstan	8 (0.9)	538 (10.1)	77 (1.1)	492 (4.0)	15 (1.2)	455 (7.9)	10.0 (0.07)
Macedonia, Rep. of	7 (0.8)	505 (10.3)	77 (1.0)	416 (4.7)	16 (1.0)	335 (7.9)	9.9 (0.06)
Iran, Islamic Rep. of	7 (0.7)	564 (9.6)	45 (1.6)	494 (3.9)	49 (1.8)	444 (3.5)	8.6 (0.09)
Chile	6 (0.5)	528 (6.3)	72 (1.1)	467 (2.4)	21 (1.2)	424 (3.6)	9.7 (0.05)
Saudi Arabia	6 (0.5)	472 (7.7)	61 (1.4)	445 (3.8)	32 (1.6)	414 (4.9)	9.4 (0.08)
Jordan	6 (0.5)	488 (7.2)	67 (1.0)	461 (3.5)	27 (1.0)	421 (5.1)	9.5 (0.05)
Lebanon	6 (0.5)	472 (10.5)	64 (1.5)	418 (5.4)	30 (1.6)	370 (4.7)	9.4 (0.07)
Oman	5 (0.3)	489 (4.7)	57 (0.9)	440 (3.2)	38 (1.0)	388 (3.8)	9.0 (0.04)
Turkey	5 (0.7)	614 (16.4)	41 (1.4)	508 (4.2)	54 (1.7)	454 (3.3)	8.4 (0.09)
Palestinian Nat'l Auth.	4 (0.4)	474 (8.5)	63 (1.1)	433 (3.4)	33 (1.2)	391 (4.7)	9.2 (0.05)
Malaysia	4 (0.4)	526 (9.9)	61 (1.3)	444 (5.8)	35 (1.5)	386 (6.9)	9.1 (0.07)
Tunisia	3 (0.4)	494 (8.6)	58 (1.3)	446 (2.9)	38 (1.4)	423 (2.3)	9.0 (0.07)
Syrian Arab Republic	3 (0.3)	448 (9.3)	52 (1.4)	433 (4.6)	45 (1.5)	419 (3.9)	8.7 (0.07)
Thailand	3 (0.5)	536 (14.2)	45 (1.3)	467 (4.8)	52 (1.5)	434 (3.8)	8.5 (0.06)
Morocco	3 (0.2)	448 (8.4)	38 (1.0)	391 (2.6)	59 (1.1)	366 (2.6)	8.0 (0.05)
Ghana	1 (0.2)	~ ~	37 (1.7)	318 (7.1)	62 (1.8)	301 (5.1)	7.9 (0.08)
Indonesia	1 (0.1)	~ ~	46 (1.9)	414 (5.3)	54 (2.0)	400 (4.6)	8.4 (0.06)
International Avg.	12 (0.1)	540 (1.1)	67 (0.2)	480 (0.6)	21 (0.2)	424 (1.0)	

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

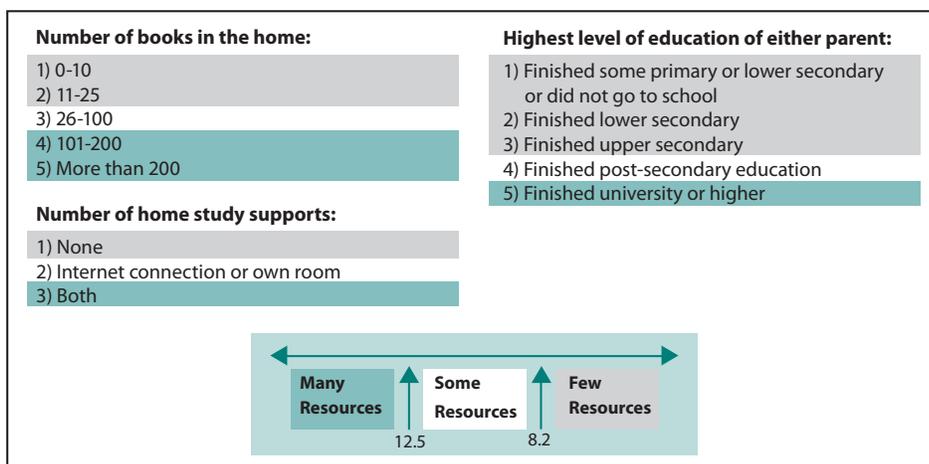
An "r" indicates data are available for at least 70% but less than 85% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 4.3: Home Educational Resources (Continued)**

Country	Many Resources		Some Resources		Few Resources		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Ninth Grade Participants</b>							
Honduras	3 (0.4)	419 (13.5)	43 (1.4)	384 (5.3)	53 (1.6)	354 (3.6)	8.5 (0.07)
South Africa	3 (0.2)	504 (9.9)	55 (0.8)	347 (4.0)	42 (0.8)	305 (4.1)	8.7 (0.03)
Botswana	2 (0.2)	~ ~	49 (1.0)	414 (4.6)	50 (1.1)	396 (3.2)	8.4 (0.04)
<b>Benchmarking Participants</b>							
Massachusetts, US	35 (2.1)	605 (5.2)	61 (2.0)	552 (5.1)	4 (0.5)	468 (11.9)	11.5 (0.08)
Connecticut, US	32 (1.8)	587 (4.8)	64 (1.8)	514 (4.1)	4 (0.6)	432 (11.5)	11.4 (0.08)
Minnesota, US	32 (2.1)	590 (5.5)	65 (1.9)	539 (4.0)	3 (0.5)	475 (11.6)	11.5 (0.07)
Colorado, US	28 (1.7)	587 (4.4)	63 (1.7)	532 (3.9)	9 (0.9)	472 (7.8)	11.0 (0.08)
Alberta, Canada	27 (1.2)	576 (3.3)	71 (1.1)	536 (2.4)	1 (0.2)	~ ~	11.4 (0.04)
Ontario, Canada	26 (1.4)	555 (3.6)	73 (1.3)	510 (2.4)	1 (0.3)	~ ~	11.4 (0.06)
North Carolina, US	24 (1.9)	583 (8.9)	69 (1.8)	519 (5.4)	7 (0.8)	479 (9.3)	11.0 (0.08)
Indiana, US	21 (1.7)	579 (4.7)	74 (1.5)	525 (4.3)	5 (0.5)	466 (8.3)	10.9 (0.07)
Quebec, Canada	19 (0.8)	560 (3.0)	80 (0.8)	512 (2.6)	1 (0.2)	~ ~	11.1 (0.03)
Florida, US	17 (1.4)	590 (9.2)	76 (1.4)	524 (6.7)	8 (1.0)	481 (14.2)	10.7 (0.08)
Alabama, US	16 (2.0)	544 (8.0)	75 (1.9)	481 (5.8)	9 (0.8)	423 (7.1)	10.5 (0.10)
Dubai, UAE	15 (0.6)	546 (5.6)	76 (0.7)	482 (2.6)	9 (0.4)	415 (6.2)	10.6 (0.03)
California, US	15 (1.1)	564 (5.9)	70 (1.1)	496 (4.6)	15 (1.1)	451 (6.9)	10.3 (0.07)
Abu Dhabi, UAE	11 (0.9)	508 (10.3)	76 (1.0)	463 (3.9)	13 (0.8)	416 (4.7)	10.3 (0.05)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



**Exhibit 4.4: Components of the Home Educational Resources Scale**

Reported by Students

Country	Percent of Students with		
	More than 100 Books in Their Home	Own Room and Internet Connection in Home	At Least One Parent with a University Degree or Higher
Armenia	32 (1.1)	47 (1.2)	59 (1.4)
Australia	42 (1.4)	86 (0.8)	31 (1.8)
Bahrain	19 (0.7)	61 (0.7)	33 (1.1)
Chile	15 (0.7)	53 (1.0)	21 (1.0)
Chinese Taipei	34 (0.8)	57 (0.7)	26 (0.9)
England	33 (1.5)	89 (0.8)	31 (1.8)
Finland	41 (1.1)	91 (0.5)	42 (1.2)
Georgia	37 (1.4)	43 (1.1)	33 (1.5)
Ghana	8 (0.7)	5 (0.5)	10 (0.7)
Hong Kong SAR	24 (1.1)	58 (0.9)	20 (1.4)
Hungary	41 (1.3)	79 (1.0)	26 (1.3)
Indonesia	4 (0.4)	14 (1.1)	12 (1.0)
Iran, Islamic Rep. of	15 (0.9)	24 (1.2)	15 (1.2)
Israel	38 (1.2)	--	48 (1.2)
Italy	34 (0.9)	58 (1.0)	24 (1.1)
Japan	31 (1.2)	73 (1.1)	41 (1.4)
Jordan	16 (0.7)	26 (1.0)	35 (1.1)
Kazakhstan	17 (1.2)	37 (1.7)	36 (1.5)
Korea, Rep. of	56 (1.3)	70 (0.9)	49 (1.7)
Lebanon	16 (1.1)	39 (1.6)	25 (1.4)
Lithuania	24 (1.1)	67 (1.0)	24 (1.1)
Macedonia, Rep. of	13 (1.0)	71 (1.3)	29 (1.7)
Malaysia	10 (0.8)	31 (1.4)	15 (1.3)
Morocco	7 (0.4)	25 (0.9)	22 (0.8)
New Zealand	40 (1.5)	83 (0.9)	x x
Norway	45 (1.4)	96 (0.5)	62 (1.2)
Oman	21 (0.7)	22 (0.8)	24 (0.8)
Palestinian Nat'l Auth.	13 (0.8)	25 (1.0)	28 (1.1)
Qatar	25 (1.2)	67 (1.1)	65 (1.0)
Romania	19 (1.0)	61 (1.4)	20 (1.1)
Russian Federation	31 (1.0)	59 (1.3)	49 (1.5)
Saudi Arabia	14 (0.7)	40 (1.5)	37 (1.7)
Singapore	26 (0.8)	56 (0.7)	30 (0.9)
Slovenia	27 (0.9)	85 (0.8)	31 (1.1)
Sweden	42 (1.1)	94 (0.4)	47 (1.4)
Syrian Arab Republic	10 (0.6)	14 (0.9)	31 (1.3)
Thailand	7 (0.6)	23 (1.1)	17 (1.3)
Tunisia	9 (0.6)	33 (1.5)	19 (1.2)
Turkey	17 (1.1)	32 (1.5)	9 (1.0)
Ukraine	25 (1.1)	48 (1.9)	39 (1.3)
United Arab Emirates	21 (0.6)	55 (0.6)	52 (0.9)
United States	33 (0.9)	79 (0.5)	55 (1.0)
International Avg.	25 (0.2)	53 (0.2)	32 (0.2)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.  
 A dash (–) indicates comparable data not available.  
 An “x” indicates data are available for less than 50% of students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 4.4: Components of the Home Educational Resources Scale (Continued)**

Country	Percent of Students with		
	More than 100 Books in Their Home	Own Room and Internet Connection in Home	At Least One Parent with a University Degree or Higher
<b>Ninth Grade Participants</b>			
Botswana	8 (0.5)	10 (0.6)	19 (0.9)
Honduras	8 (0.6)	24 (1.3)	15 (1.1)
South Africa	9 (0.4)	25 (0.7)	19 (0.7)
<b>Benchmarking Participants</b>			
Alberta, Canada	43 (1.2)	91 (0.8)	52 (1.7)
Ontario, Canada	41 (1.6)	86 (0.9)	51 (1.7)
Quebec, Canada	27 (0.9)	93 (0.6)	51 (1.3)
Abu Dhabi, UAE	21 (0.9)	55 (1.3)	52 (1.7)
Dubai, UAE	27 (1.0)	58 (0.8)	57 (1.1)
Alabama, US	23 (2.0)	79 (1.3)	51 (2.4)
California, US	25 (1.5)	67 (1.4)	40 (1.5)
Colorado, US	39 (1.7)	82 (1.6)	54 (2.0)
Connecticut, US	43 (1.6)	84 (1.0)	68 (2.6)
Florida, US	27 (1.6)	80 (1.3)	52 (2.2)
Indiana, US	32 (1.7)	82 (1.0)	53 (2.6)
Massachusetts, US	46 (2.0)	85 (0.8)	71 (2.1)
Minnesota, US	43 (2.1)	85 (0.9)	70 (1.6)
North Carolina, US	33 (2.0)	84 (1.0)	60 (2.2)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

### *Students Spoke the Language of the Test*

TIMSS has previously shown that, with some exceptions, countries with large proportions of students from homes where the language of the test (and consequently the language of instruction) is not often spoken had lower average science achievement than students who spoke the language of the test more often. Because learning any school subject is dependent on having a mastery of the language of instruction, which in turn is influenced by children's early language experiences, the language or languages spoken at home and how they are used are important factors in subsequent school achievement. As formal science instruction begins, children are likely to be at an initial disadvantage if their knowledge of the language of instruction is substantially below the expected level for their age.

Exhibit 4.5 shows parents' reports about whether students who participated in the fourth grade TIMSS 2011 assessment spoke the language of the test before starting school. For students in the fourth grade, 91 percent across countries, on average, spoke the language of the test before starting school. However, the 9 percent who did not speak the language of the test before starting school had lower average science achievement on TIMSS 2011 (460 vs. 500). The results for the sixth grade and benchmarking students show that only about one-fourth (26%) of the students in Botswana spoke the language of the test before starting school, which is the lowest percentage among all entities that participated in the TIMSS 2011 fourth grade assessment.

In the TIMSS 2011 eighth grade assessment, students themselves reported on how often they speak the language of the test at home. As shown in Exhibit 4.6, for the eighth grade students, on average across countries, 79 percent always or almost always speak the language of the test at home, with 17 percent sometimes speaking it and 4 percent never speaking it. As with the fourth grade, average science achievement was higher for students who frequently speak the language of the test at home (481), compared to those who sometimes (448) or never (424) do so. Among the ninth grade participants, both Botswana and South Africa had very low percentages of students always or almost always speaking the language of the test at home (12% and 26%, respectively). These two countries had the lowest percentages of students speaking the language of the test at home, along with eighth grade participants Ghana (26%) and Tunisia (19%).

**Exhibit 4.5: Students Spoke the Language of the Test Before Starting School\***
*Reported by Parents*

Country	Spoke the Language		Did Not Speak the Language	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Australia	95 (0.6)	531 (3.1)	5 (0.6)	520 (13.1)
Austria	93 (0.6)	537 (2.7)	7 (0.6)	472 (5.5)
Azerbaijan	96 (0.9)	440 (5.4)	4 (0.9)	429 (17.9)
Chinese Taipei	97 (0.3)	554 (2.2)	3 (0.3)	517 (9.0)
Croatia	100 (0.1)	516 (2.1)	0 (0.1)	~ ~
Czech Republic	99 (0.3)	538 (2.3)	1 (0.3)	~ ~
Finland	99 (0.2)	572 (2.5)	1 (0.2)	~ ~
Georgia	98 (0.7)	458 (3.4)	2 (0.7)	~ ~
Germany	97 (0.3)	536 (2.7)	3 (0.3)	477 (7.4)
Hong Kong SAR	97 (0.4)	541 (2.8)	3 (0.4)	535 (7.0)
Hungary	99 (0.2)	537 (3.6)	1 (0.2)	~ ~
Iran, Islamic Rep. of	80 (1.5)	468 (3.4)	20 (1.5)	396 (6.9)
Ireland	93 (0.6)	523 (3.3)	7 (0.6)	481 (7.3)
Italy	94 (0.5)	528 (2.7)	6 (0.5)	501 (6.7)
Lithuania	98 (0.6)	516 (2.5)	2 (0.6)	~ ~
Malta	44 (0.8)	478 (2.6)	56 (0.8)	430 (2.6)
Morocco	83 (1.9)	266 (5.3)	17 (1.9)	253 (7.9)
Northern Ireland	98 (0.4)	530 (3.0)	2 (0.4)	~ ~
Norway	97 (0.4)	496 (2.3)	3 (0.4)	456 (8.2)
Oman	94 (0.3)	378 (4.5)	6 (0.3)	399 (6.1)
Poland	99 (0.1)	506 (2.6)	1 (0.1)	~ ~
Portugal	98 (0.3)	524 (3.5)	2 (0.3)	~ ~
Qatar	73 (1.7)	409 (5.4)	27 (1.7)	437 (6.8)
Romania	97 (1.1)	508 (5.9)	3 (1.1)	456 (11.9)
Russian Federation	96 (1.0)	553 (3.3)	4 (1.0)	534 (12.9)
Saudi Arabia	74 (1.4)	435 (5.7)	26 (1.4)	418 (7.6)
Singapore	82 (0.5)	591 (3.4)	18 (0.5)	555 (4.8)
Slovak Republic	98 (0.6)	535 (3.4)	2 (0.6)	~ ~
Slovenia	97 (0.3)	524 (2.7)	3 (0.3)	456 (8.1)
Spain	87 (1.1)	511 (2.8)	13 (1.1)	486 (4.8)
Sweden	95 (0.4)	541 (2.7)	5 (0.4)	479 (7.0)
United Arab Emirates	77 (0.8)	428 (2.5)	23 (0.8)	443 (4.3)
International Avg.	91 (0.1)	500 (0.6)	9 (0.1)	460 (1.8)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Sixth Grade Participants**

Botswana	26 (1.3)	417 (9.6)	74 (1.3)	358 (5.1)
Honduras	97 (0.5)	431 (6.0)	3 (0.5)	432 (15.2)

**Benchmarking Participants**

Quebec, Canada	94 (0.8)	520 (2.7)	6 (0.8)	503 (6.7)
Abu Dhabi, UAE	81 (1.4)	409 (4.7)	19 (1.4)	436 (8.4)
Dubai, UAE	69 (0.7)	470 (2.8)	31 (0.7)	462 (3.1)

\* Available only for countries that administered both TIMSS and PIRLS to the same fourth grade students because this item was included in the PIRLS Home Questionnaire completed by parents.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

**Exhibit 4.6: Students Speak the Language of the Test at Home**
*Reported by Students*

Country	Always or Almost Always		Sometimes		Never	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	94 (0.5)	439 (3.1)	5 (0.4)	414 (8.3)	1 (0.1)	~ ~
Australia	93 (0.9)	521 (4.8)	6 (0.8)	497 (9.1)	1 (0.2)	~ ~
Bahrain	77 (0.7)	451 (2.5)	18 (0.6)	469 (4.1)	5 (0.5)	431 (10.2)
Chile	96 (0.3)	464 (2.5)	4 (0.3)	413 (7.2)	0 (0.1)	~ ~
Chinese Taipei	92 (0.7)	570 (2.1)	7 (0.6)	501 (5.5)	1 (0.2)	~ ~
England	95 (0.7)	536 (4.9)	4 (0.6)	489 (11.9)	1 (0.2)	~ ~
Finland	97 (0.4)	554 (2.5)	2 (0.3)	~ ~	1 (0.1)	~ ~
Georgia	95 (0.9)	424 (2.9)	4 (0.9)	352 (10.0)	0 (0.1)	~ ~
Ghana	26 (1.1)	308 (6.9)	70 (1.2)	311 (5.4)	4 (0.7)	228 (8.4)
Hong Kong SAR	79 (1.9)	531 (3.3)	17 (1.6)	555 (8.1)	3 (0.5)	538 (14.7)
Hungary	98 (0.3)	524 (3.0)	1 (0.3)	~ ~	0 (0.1)	~ ~
Indonesia	36 (2.9)	409 (8.1)	56 (2.4)	406 (3.9)	7 (0.9)	398 (8.8)
Iran, Islamic Rep. of	64 (2.2)	493 (4.3)	21 (1.5)	443 (6.2)	15 (1.3)	438 (4.7)
Israel	93 (0.9)	516 (3.8)	6 (0.7)	523 (12.0)	1 (0.2)	~ ~
Italy	89 (1.0)	508 (2.3)	9 (0.8)	445 (6.6)	2 (0.3)	~ ~
Japan	99 (0.2)	558 (2.5)	1 (0.2)	~ ~	0 (0.1)	~ ~
Jordan	88 (0.8)	453 (3.7)	9 (0.6)	446 (7.6)	3 (0.4)	396 (13.1)
Kazakhstan	92 (0.8)	492 (4.5)	8 (0.8)	473 (5.9)	1 (0.2)	~ ~
Korea, Rep. of	100 (0.1)	560 (2.0)	0 (0.1)	~ ~	0 (0.1)	~ ~
Lebanon	20 (1.3)	431 (8.2)	64 (1.4)	403 (5.2)	16 (0.7)	385 (7.1)
Lithuania	96 (0.8)	516 (2.5)	3 (0.7)	471 (15.8)	1 (0.2)	~ ~
Macedonia, Rep. of	91 (1.0)	412 (5.5)	6 (0.7)	369 (11.6)	2 (0.5)	~ ~
Malaysia	62 (2.0)	430 (6.5)	25 (1.3)	433 (8.7)	13 (1.1)	400 (13.3)
Morocco	63 (1.2)	373 (2.3)	29 (0.9)	384 (3.1)	8 (0.6)	381 (6.8)
New Zealand	92 (0.9)	516 (4.4)	7 (0.7)	487 (9.4)	1 (0.2)	~ ~
Norway	94 (0.7)	498 (2.5)	5 (0.6)	443 (8.3)	1 (0.2)	~ ~
Oman	65 (1.3)	424 (3.5)	28 (1.1)	423 (3.9)	7 (0.5)	396 (9.2)
Palestinian Nat'l Auth.	93 (1.1)	422 (3.3)	5 (0.7)	406 (9.2)	2 (0.6)	~ ~
Qatar	65 (0.9)	420 (4.4)	29 (0.8)	428 (4.1)	6 (0.5)	360 (10.3)
Romania	98 (0.3)	467 (3.5)	1 (0.3)	~ ~	0 (0.1)	~ ~
Russian Federation	92 (1.9)	544 (3.4)	7 (1.7)	521 (7.8)	1 (0.3)	~ ~
Saudi Arabia	75 (2.0)	441 (3.8)	16 (1.2)	428 (7.6)	9 (1.1)	411 (7.7)
Singapore	57 (0.9)	611 (3.8)	38 (0.8)	565 (5.5)	5 (0.3)	550 (9.3)
Slovenia	88 (1.7)	548 (2.8)	8 (1.0)	494 (7.5)	4 (1.0)	522 (9.0)
Sweden	92 (0.6)	516 (2.5)	6 (0.5)	450 (6.3)	1 (0.2)	~ ~
Syrian Arab Republic	85 (1.5)	428 (3.7)	11 (1.0)	413 (7.9)	4 (0.8)	426 (18.8)
Thailand	66 (2.3)	466 (4.3)	30 (2.1)	423 (5.3)	3 (0.5)	404 (10.4)
Tunisia	19 (0.7)	424 (3.7)	56 (1.1)	441 (2.6)	25 (0.9)	445 (3.8)
Turkey	90 (1.2)	492 (3.8)	8 (1.0)	410 (6.6)	2 (0.3)	~ ~
Ukraine	61 (2.7)	500 (4.5)	27 (1.8)	503 (4.3)	12 (1.4)	502 (5.2)
United Arab Emirates	67 (1.2)	465 (2.4)	27 (0.9)	467 (3.7)	5 (0.4)	448 (5.2)
United States	91 (0.4)	530 (2.6)	8 (0.4)	487 (5.1)	1 (0.1)	~ ~
International Avg.	79 (0.2)	481 (0.6)	17 (0.2)	448 (1.2)	4 (0.1)	424 (2.3)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent. A tilde (~) indicates insufficient data to report achievement.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 4.6: Students Speak the Language of the Test at Home (Continued)**

Country	Always or Almost Always		Sometimes		Never	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
<b>Ninth Grade Participants</b>						
Botswana	12 (0.6)	426 (10.0)	82 (0.7)	406 (3.0)	7 (0.4)	354 (6.4)
Honduras	95 (0.4)	371 (4.0)	4 (0.4)	326 (12.4)	1 (0.1)	~ ~
South Africa	26 (1.0)	412 (5.9)	65 (1.2)	310 (3.4)	9 (0.6)	264 (6.1)
<b>Benchmarking Participants</b>						
Alberta, Canada	86 (1.6)	549 (2.3)	11 (1.2)	527 (5.0)	3 (0.7)	528 (7.6)
Ontario, Canada	89 (0.9)	521 (2.5)	10 (0.8)	521 (7.9)	1 (0.2)	~ ~
Quebec, Canada	89 (1.1)	522 (2.6)	8 (0.8)	501 (5.6)	3 (0.4)	522 (10.2)
Abu Dhabi, UAE	69 (1.8)	461 (4.0)	25 (1.4)	469 (7.1)	6 (0.7)	444 (7.1)
Dubai, UAE	62 (1.4)	492 (2.6)	34 (1.3)	476 (4.1)	4 (0.5)	466 (8.5)
Alabama, US	97 (0.5)	488 (6.4)	3 (0.5)	450 (16.6)	1 (0.2)	~ ~
California, US	81 (1.4)	506 (4.4)	18 (1.3)	474 (7.5)	2 (0.3)	~ ~
Colorado, US	88 (1.1)	550 (4.1)	11 (1.2)	486 (9.1)	1 (0.3)	~ ~
Connecticut, US	91 (0.7)	539 (4.3)	8 (0.6)	480 (7.5)	1 (0.2)	~ ~
Florida, US	88 (1.3)	534 (7.5)	11 (1.2)	522 (13.0)	1 (0.3)	~ ~
Indiana, US	96 (0.5)	536 (4.9)	3 (0.4)	468 (12.2)	1 (0.2)	~ ~
Massachusetts, US	91 (1.0)	573 (4.8)	8 (0.9)	498 (16.9)	1 (0.3)	~ ~
Minnesota, US	96 (0.8)	557 (4.4)	4 (0.8)	489 (10.8)	0 (0.2)	~ ~
North Carolina, US	95 (0.7)	534 (6.4)	5 (0.7)	499 (11.0)	0 (0.1)	~ ~

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011

### *Parents' Educational Expectations for Their Children*

Studies over the past several years have found a positive relationship between parental aspirations for their children and academic achievement. For example, researchers studying longitudinal effects in the United States found that more communication between parents and students as well as higher parents' aspirations resulted in higher student achievement (Hong & Ho, 2005). Across four ethnic groups, parents' educational aspiration was the most powerful predictor of increasing student educational aspiration; ultimately, the greater the student's own educational expectations, the greater the student's academic achievement.

Exhibit 4.7 presents parents' reports about their educational expectations for their children according to four education levels from highest to lowest: postgraduate degree, university degree, post-secondary, and upper secondary (or lower). Results are shown for countries that administered both TIMSS and PIRLS fourth grade assessments to the same fourth grade students. Across the TIMSS 2011 participants, parents have very high educational expectations for their children (to the extent that some parents may have misunderstood the question). Nearly one-third (30%) of the fourth grade students have parents who expect them to attain a postgraduate degree and another third (35%) are expected to graduate from university. Still, there was considerable variation in results across and within countries.

Consistent with other research, the results show a positive relationship between parents' aspirations and students' average science achievement. Across the fourth grade countries, students' average science achievement increased with each successively higher level of education expected by their parents, to the extent that there was a 81-point difference between students whose parents expected a postgraduate degree at one end of the continuum and those whose parents expected upper secondary school (or lower) at the other end of the continuum (524 vs. 443). The results for the sixth grade and benchmarking participants were similar to the results at the fourth grade.

**Exhibit 4.7: Parents' Educational Expectations for Their Children\***
*Reported by Parents*

Country	Parents Expect Their Child to Complete							
	Postgraduate Degree**		University but Not Postgraduate Degree		Post-secondary but Not University		Upper Secondary Education or Less	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Iran, Islamic Rep. of	75 (0.9)	469 (4.1)	12 (0.5)	438 (5.7)	10 (0.6)	399 (7.4)	3 (0.4)	358 (11.7)
United Arab Emirates	59 (0.7)	454 (2.8)	31 (0.6)	413 (2.9)	6 (0.3)	396 (5.4)	5 (0.3)	348 (6.9)
Qatar	58 (1.0)	429 (4.6)	33 (1.1)	375 (5.8)	3 (0.3)	321 (12.6)	6 (0.4)	318 (11.5)
Poland	52 (1.2)	530 (3.0)	25 (0.9)	505 (2.6)	6 (0.5)	479 (6.2)	18 (0.9)	444 (4.7)
Saudi Arabia	49 (1.8)	450 (6.2)	32 (1.3)	424 (6.8)	8 (0.8)	389 (9.4)	11 (1.0)	392 (10.2)
Slovak Republic	48 (1.4)	567 (2.7)	6 (0.4)	539 (5.5)	13 (0.5)	527 (4.0)	33 (1.4)	489 (5.2)
Portugal	48 (1.0)	543 (3.1)	36 (0.9)	519 (3.9)	6 (0.6)	480 (8.3)	10 (0.7)	482 (8.0)
Oman	43 (0.7)	410 (4.3)	40 (0.7)	376 (4.9)	6 (0.3)	338 (9.4)	12 (0.5)	302 (6.9)
Morocco	42 (1.4)	294 (5.2)	21 (0.9)	265 (5.8)	0 (0.0)	~ ~	37 (1.5)	243 (8.7)
Chinese Taipei	42 (1.0)	576 (2.3)	44 (0.7)	545 (2.5)	9 (0.5)	525 (5.3)	5 (0.5)	470 (7.2)
Singapore	34 (0.8)	605 (4.0)	47 (0.8)	597 (3.1)	18 (0.8)	528 (3.8)	2 (0.2)	~ ~
Georgia	32 (1.4)	498 (3.5)	20 (1.0)	466 (5.3)	24 (1.2)	437 (4.7)	24 (1.2)	410 (6.3)
Spain	28 (1.1)	525 (3.5)	52 (1.2)	517 (2.9)	7 (0.5)	476 (5.5)	12 (0.8)	462 (4.7)
Ireland	27 (1.0)	540 (3.6)	42 (1.1)	533 (3.9)	26 (1.3)	493 (3.3)	5 (0.4)	464 (8.5)
Azerbaijan	27 (1.2)	459 (5.4)	40 (1.3)	447 (6.8)	15 (1.1)	417 (9.2)	18 (1.2)	415 (8.3)
Hong Kong SAR	26 (1.1)	554 (3.5)	62 (0.9)	542 (3.1)	6 (0.5)	516 (5.1)	6 (0.5)	502 (5.8)
Finland	26 (1.3)	596 (3.4)	29 (0.8)	578 (2.8)	12 (0.7)	568 (4.7)	33 (1.2)	549 (3.5)
Lithuania	23 (1.0)	554 (3.5)	32 (1.0)	531 (2.6)	34 (1.0)	494 (2.3)	11 (0.7)	452 (6.1)
Czech Republic	22 (1.0)	576 (3.3)	14 (0.7)	564 (3.8)	6 (0.5)	553 (5.8)	58 (1.3)	517 (2.7)
Romania	21 (1.3)	562 (4.4)	29 (1.5)	545 (4.5)	16 (1.0)	507 (6.2)	34 (2.1)	436 (10.7)
Germany	20 (1.1)	579 (3.4)	9 (0.5)	558 (3.5)	16 (0.8)	522 (3.6)	55 (1.3)	519 (3.3)
Northern Ireland	18 (1.1)	562 (4.4)	37 (1.4)	550 (3.6)	13 (0.8)	524 (5.6)	32 (1.5)	493 (4.5)
Australia	18 (1.1)	555 (6.7)	42 (1.5)	554 (3.0)	25 (1.2)	505 (4.3)	15 (0.9)	487 (6.0)
Hungary	16 (1.2)	605 (3.5)	30 (1.0)	570 (2.7)	24 (0.8)	531 (3.3)	30 (1.3)	474 (5.7)
Italy	15 (0.7)	534 (5.0)	49 (0.9)	540 (2.7)	12 (0.6)	505 (5.9)	24 (0.9)	509 (3.9)
Malta	13 (0.6)	508 (4.9)	25 (0.6)	495 (3.1)	29 (0.8)	456 (4.1)	33 (0.8)	395 (3.5)
Croatia	9 (0.4)	541 (4.5)	34 (1.1)	538 (2.3)	48 (1.0)	507 (2.2)	9 (0.6)	465 (5.2)
Slovenia	7 (0.5)	564 (5.5)	42 (1.1)	546 (2.8)	36 (0.9)	505 (3.0)	14 (0.8)	469 (5.3)
Norway	5 (0.5)	485 (7.1)	64 (1.6)	507 (2.5)	26 (1.4)	480 (3.0)	5 (0.6)	467 (7.4)
Russian Federation	3 (0.3)	594 (8.3)	69 (1.2)	566 (3.3)	23 (1.0)	519 (4.1)	6 (0.6)	516 (8.4)
Austria	--	--	--	--	--	--	--	--
Sweden	--	--	--	--	--	--	--	--
International Avg.	30 (0.2)	524 (0.8)	35 (0.2)	505 (0.7)	16 (0.1)	479 (1.1)	19 (0.2)	443 (1.3)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Sixth Grade Participants**

Botswana	r	52 (1.9)	401 (8.1)	15 (0.8)	381 (9.2)	19 (1.1)	344 (7.6)	14 (1.0)	316 (6.0)
Honduras	r	36 (1.8)	465 (8.0)	22 (1.3)	445 (7.1)	14 (0.9)	430 (7.4)	28 (1.6)	395 (6.9)

**Benchmarking Participants**

Dubai, UAE		66 (0.8)	486 (2.4)	25 (0.8)	448 (4.3)	6 (0.5)	425 (8.1)	3 (0.3)	363 (9.7)
Abu Dhabi, UAE		59 (1.3)	438 (5.2)	32 (1.0)	393 (5.1)	5 (0.5)	371 (9.7)	5 (0.5)	333 (11.9)
Quebec, Canada		18 (1.4)	533 (4.5)	43 (1.3)	529 (2.5)	33 (1.5)	503 (3.2)	6 (0.7)	485 (6.6)

\* Available only for countries that administered both TIMSS and PIRLS to the same fourth grade students because this item was included in the PIRLS Home Questionnaire completed by parents.

\*\* For example, doctorate, master's, or other postgraduate degree or diploma.

() Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

Exhibit 4.8 presents students' reports of their educational aspirations from the TIMSS 2011 eighth grade assessment. As shown on the first page and similar to the parents of the fourth grade students, the eighth grade students had high expectations for further education, such that some students also may have misunderstood the question. However, looking at the countries that administered TIMSS and PIRLS to the same students at the fourth grade and also participated at the eighth grade, there was some degree of correspondence between the parents' responses and those by eighth grade students. Almost one-third (29%) of the eighth grade students expect to attain a postgraduate degree and more than one-fourth (27%) expect to graduate from university. Fifteen percent of the eighth grade students indicated that they did not know how far in school they would go.

The eighth grade results also show a positive relationship between educational aspirations (in this case those of the students themselves) and average science achievement. Across the eighth grade countries, the students at each higher level of education expectation had higher average science achievement than the level below. Students expecting a postgraduate degree had a 99-point advantage in average achievement compared to those expecting to go no further than upper secondary school, about a full standard deviation on the TIMSS achievement scale (513 vs. 412). The results for the ninth grade and benchmarking participants were similar to the results at the eighth grade.

### *Students Attended Preprimary Education*

Preprimary education, in the form of preschool, kindergarten, or an early childhood education program, plays an important role in preparing children for primary school. For example, recent PIRLS assessments have found a positive relationship between years of preprimary education and reading achievement in the fourth grade. Also, recent analyses of longitudinal data in the United States and England found that preschool attendance was positively related to enhanced school performance, and that the duration of attendance was associated with greater academic improvement (Tucker-Drob, 2012; Sammons, et al., 2002). Besides giving students an early start in school and life, there are also broader reasons for countries to invest in preschool (Economist Intelligence Unit, 2012). For example, preprimary education provides an avenue for overcoming children's disadvantages and can help to break the generational repetitive cycle of poverty and low achievement.

Although there is considerable variation across countries, according to the *TIMSS 2011 Encyclopedia*, some countries already have mandatory preprimary education (e.g., Austria, Hungary, and the Netherlands), some have nearly 100 percent enrollment even though attendance is not mandatory (e.g., Australia, Croatia, and Singapore), and a number of the remaining countries are working to increase enrollment in preprimary education. Of course, school policies of entering primary school at older ages (e.g., age 7 in Finland, Lithuania, and Sweden) permit opportunities for more years of preschool attendance than when children start primary school at younger ages (e.g., age 4 or 5 in England, Ireland, the Netherlands, New Zealand, and Northern Ireland). Exhibit C.1 in Appendix C contains information across countries, about the different policies and practices about the age of entry to primary school.

Exhibit 4.9 presents the TIMSS 2011 parents' reports on the number of years their children participated in preprimary education for countries that administered both TIMSS and PIRLS to the same fourth grade students. In addition, for all participants in the fourth grade TIMSS 2011 assessment, the exhibit presents National Research Coordinators' reports of whether or not there was a national preprimary curriculum that includes science skills. It is noted that these preprimary curricula may involve only rudimentary observation and classification skills as well as perhaps experiencing some technology, yet two-thirds of the TIMSS 2011 fourth grade countries indicated that their preprimary curriculum made such provision, as did all of the benchmarking participants. None of the three sixth grade countries reported a preprimary curriculum that included science skills.

Although attendance in preprimary education differed dramatically from country to country, on average, 43 percent of the fourth grade students had at least three years of preprimary education and another 33 percent had less than three years but more than one year; eleven percent had only one year or less of preprimary education. Students with three years had higher average achievement (505) than their counterparts with less than three but more than one year (497) or one year or less of preprimary education (478). Most notably, however, the 13 percent of students, on average, that did not attend preschool had much lower average science achievement (454). There was a range across countries, but the majority of students did not attend preschool in Azerbaijan (64%) and Saudi Arabia (52%). Also, among the sixth grade participants, the majority of students in Botswana (56%) did not attend preprimary education.

**Exhibit 4.8: Students' Educational Expectations**

Reported by Students

Country	Postgraduate Degree*		University but Not Postgraduate Degree		Post-secondary but Not University		Upper Secondary Education or Less		Do Not Know	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Saudi Arabia	62 (1.3)	454 (3.7)	14 (0.7)	433 (5.7)	0 (0.0)	~ ~	10 (0.8)	372 (7.5)	15 (0.9)	408 (4.8)
Qatar	54 (1.0)	456 (4.3)	25 (0.9)	411 (5.4)	4 (0.4)	351 (10.6)	8 (0.5)	287 (7.4)	9 (0.6)	373 (8.1)
Iran, Islamic Rep. of	53 (1.0)	501 (4.7)	15 (0.6)	465 (3.3)	6 (0.3)	425 (5.6)	5 (0.4)	383 (6.4)	20 (0.7)	451 (4.4)
Israel	51 (1.2)	546 (3.9)	19 (0.8)	536 (3.6)	10 (0.6)	474 (5.6)	10 (0.8)	431 (6.3)	10 (0.5)	493 (6.7)
Palestinian Nat'l Auth.	49 (0.9)	452 (3.9)	11 (0.7)	440 (5.4)	6 (0.4)	411 (6.6)	12 (0.8)	348 (7.4)	22 (1.1)	390 (5.0)
Tunisia	49 (1.0)	457 (3.2)	5 (0.4)	442 (5.8)	13 (0.6)	418 (3.5)	7 (0.4)	401 (4.1)	27 (0.9)	426 (2.5)
United Arab Emirates	48 (0.7)	497 (2.3)	21 (0.5)	470 (3.1)	9 (0.3)	440 (3.3)	7 (0.3)	364 (4.7)	14 (0.5)	429 (3.4)
Oman	45 (0.8)	465 (3.1)	17 (0.5)	430 (4.4)	5 (0.3)	382 (8.7)	11 (0.5)	338 (7.0)	23 (0.7)	391 (4.0)
Jordan	45 (0.9)	487 (3.0)	19 (0.7)	462 (4.0)	6 (0.4)	405 (7.4)	9 (0.6)	367 (7.9)	21 (0.8)	429 (4.9)
Lebanon	42 (1.4)	441 (5.9)	29 (1.1)	415 (4.7)	8 (0.6)	348 (6.7)	6 (0.6)	334 (10.6)	15 (0.9)	366 (6.0)
Indonesia	42 (1.6)	418 (5.7)	19 (0.9)	415 (4.7)	7 (0.5)	399 (7.0)	13 (0.9)	390 (5.7)	20 (1.2)	387 (5.2)
United States	40 (0.7)	547 (2.8)	43 (0.5)	521 (2.6)	4 (0.2)	490 (4.8)	6 (0.3)	463 (5.7)	7 (0.3)	508 (4.1)
Bahrain	39 (0.9)	497 (2.6)	16 (0.6)	464 (4.2)	9 (0.5)	432 (5.9)	15 (0.5)	363 (5.8)	21 (0.8)	438 (4.9)
Morocco	37 (0.8)	409 (2.5)	16 (0.6)	377 (3.5)	0 (0.0)	~ ~	16 (0.7)	336 (3.6)	30 (1.0)	369 (2.6)
Singapore	33 (0.7)	625 (3.6)	36 (0.8)	600 (3.7)	18 (0.9)	521 (6.4)	1 (0.1)	~ ~	12 (0.5)	578 (7.3)
Macedonia, Rep. of	33 (1.3)	455 (5.8)	43 (1.1)	416 (5.2)	3 (0.3)	360 (14.1)	13 (0.8)	337 (7.0)	8 (0.6)	353 (11.6)
Hong Kong SAR	32 (1.2)	560 (4.1)	40 (1.1)	542 (3.0)	11 (0.7)	503 (5.4)	8 (0.8)	466 (7.7)	10 (0.5)	522 (6.5)
Armenia	29 (1.1)	480 (3.7)	8 (0.5)	462 (6.5)	13 (0.6)	417 (6.2)	22 (0.9)	391 (5.2)	29 (0.8)	434 (3.7)
Malaysia	28 (1.6)	474 (6.1)	20 (1.0)	452 (5.3)	24 (1.1)	406 (5.3)	10 (1.1)	337 (11.5)	17 (1.0)	400 (8.3)
Turkey	28 (1.1)	549 (6.0)	44 (0.9)	490 (3.0)	5 (0.3)	451 (5.5)	16 (0.8)	393 (3.8)	7 (0.4)	427 (6.2)
Chinese Taipei	27 (1.0)	617 (3.1)	46 (0.8)	563 (2.0)	5 (0.3)	534 (4.9)	12 (0.7)	474 (4.2)	10 (0.5)	552 (5.3)
Ghana	27 (1.7)	367 (7.2)	42 (1.4)	312 (4.9)	18 (1.0)	267 (6.8)	8 (0.6)	208 (7.9)	5 (0.6)	293 (16.6)
Thailand	25 (1.4)	489 (5.9)	32 (1.0)	465 (3.5)	7 (0.5)	430 (5.1)	22 (1.0)	417 (4.3)	13 (0.8)	422 (4.8)
Syrian Arab Republic	25 (1.0)	453 (4.7)	34 (1.2)	431 (4.9)	4 (0.3)	410 (7.4)	14 (1.2)	396 (7.0)	22 (0.9)	417 (4.7)
Hungary	22 (1.0)	580 (3.1)	20 (0.8)	550 (2.6)	23 (0.9)	512 (3.9)	26 (1.1)	461 (4.3)	8 (0.5)	525 (5.7)
Italy	22 (1.0)	530 (4.3)	28 (0.9)	528 (2.3)	12 (0.6)	494 (4.3)	31 (1.1)	467 (3.5)	8 (0.5)	484 (5.8)
England	20 (1.4)	574 (5.8)	17 (1.1)	570 (6.1)	25 (1.1)	520 (4.7)	21 (1.2)	494 (5.6)	16 (0.8)	520 (8.0)
Kazakhstan	20 (0.9)	503 (5.8)	40 (1.1)	504 (4.9)	15 (0.7)	481 (5.3)	18 (0.9)	463 (5.6)	7 (0.5)	475 (7.0)
Georgia	20 (1.2)	482 (3.5)	7 (0.7)	452 (6.6)	22 (1.1)	438 (4.4)	36 (1.2)	377 (4.3)	15 (0.9)	414 (5.1)
New Zealand	20 (0.9)	550 (5.5)	13 (0.7)	551 (5.5)	20 (0.6)	511 (4.1)	21 (1.0)	473 (4.7)	26 (0.9)	508 (5.2)
Australia	20 (1.2)	570 (7.8)	14 (0.7)	552 (6.3)	30 (1.0)	508 (4.2)	22 (1.1)	470 (4.6)	15 (0.7)	534 (6.7)
Lithuania	19 (0.8)	557 (3.8)	17 (0.8)	548 (3.4)	32 (0.9)	506 (3.3)	14 (0.7)	454 (5.0)	18 (0.7)	499 (4.3)
Korea, Rep. of	18 (0.6)	588 (4.1)	55 (0.7)	571 (1.8)	11 (0.5)	528 (3.9)	4 (0.3)	465 (6.4)	11 (0.6)	528 (3.5)
Romania	17 (0.9)	516 (5.1)	28 (1.0)	499 (3.8)	15 (0.6)	465 (4.4)	29 (1.3)	417 (4.5)	10 (0.6)	438 (6.6)
Chile	17 (0.8)	515 (3.9)	52 (1.0)	470 (2.3)	18 (0.7)	433 (3.5)	10 (0.6)	411 (4.1)	4 (0.3)	444 (8.8)
Slovenia	15 (0.8)	586 (4.1)	20 (0.8)	583 (3.5)	46 (1.0)	525 (3.2)	8 (0.5)	478 (6.6)	12 (0.6)	539 (4.5)
Finland	12 (0.7)	596 (4.2)	10 (0.5)	573 (3.5)	8 (0.4)	545 (4.7)	41 (1.2)	533 (2.2)	29 (1.0)	560 (3.2)
Norway	9 (0.6)	516 (6.2)	39 (1.0)	513 (3.4)	22 (0.7)	489 (3.4)	7 (0.5)	443 (8.1)	23 (0.9)	487 (4.0)
Russian Federation	6 (0.5)	585 (4.8)	53 (1.1)	561 (3.3)	18 (0.8)	520 (4.5)	15 (0.9)	502 (6.4)	7 (0.4)	515 (4.8)
Ukraine	4 (0.5)	556 (9.2)	30 (1.2)	532 (3.8)	21 (0.9)	497 (4.5)	38 (1.5)	480 (5.3)	6 (0.6)	481 (7.2)
Japan	2 (0.2)	~ ~	46 (1.0)	582 (2.7)	20 (0.7)	547 (3.3)	20 (0.8)	507 (3.6)	12 (0.6)	550 (4.3)
Sweden	--	--	--	--	--	--	--	--	--	--
International Avg.	29 (0.2)	513 (0.8)	27 (0.1)	492 (0.7)	14 (0.1)	456 (0.9)	15 (0.1)	412 (1.0)	15 (0.1)	457 (1.0)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

\* For example, doctorate, master's, or other postgraduate degree or diploma.  
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.  
A dash (-) indicates comparable data not available. A tilde (~) indicates insufficient data to report achievement.

**Exhibit 4.8: Students' Educational Expectations (Continued)**

Country	Postgraduate Degree*		University but Not Postgraduate Degree		Post-secondary but Not University		Upper Secondary Education or Less		Do Not Know	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
<b>Ninth Grade Participants</b>										
South Africa	45 (1.0)	394 (3.6)	9 (0.4)	360 (7.3)	15 (0.4)	308 (4.3)	25 (0.7)	274 (3.9)	6 (0.6)	275 (7.9)
Honduras	29 (1.3)	393 (6.3)	35 (0.8)	368 (4.9)	21 (1.0)	365 (4.4)	6 (0.5)	327 (6.4)	9 (0.7)	348 (7.2)
Botswana	27 (1.0)	477 (3.9)	19 (0.7)	427 (3.8)	28 (0.8)	392 (4.6)	20 (0.9)	330 (4.0)	4 (0.3)	373 (9.1)
<b>Benchmarking Participants</b>										
Dubai, UAE	51 (1.2)	513 (2.6)	19 (0.7)	486 (4.4)	12 (0.6)	455 (4.9)	5 (0.3)	357 (7.2)	13 (0.6)	463 (4.6)
Abu Dhabi, UAE	50 (1.1)	492 (4.0)	20 (0.8)	462 (5.9)	8 (0.6)	436 (6.1)	7 (0.5)	371 (6.8)	15 (0.7)	424 (6.0)
North Carolina, US	46 (1.9)	551 (6.8)	42 (1.5)	523 (5.5)	2 (0.5)	~ ~	4 (0.5)	459 (10.4)	6 (0.5)	522 (18.0)
Florida, US	46 (2.1)	549 (9.2)	39 (1.3)	526 (6.3)	3 (0.5)	486 (18.7)	6 (1.2)	493 (14.6)	7 (0.6)	515 (12.9)
Alberta, Canada	42 (1.1)	564 (2.7)	22 (0.8)	547 (3.1)	17 (0.8)	524 (2.9)	4 (0.5)	502 (5.7)	14 (0.6)	534 (4.7)
Massachusetts, US	42 (1.6)	590 (5.3)	43 (1.5)	559 (5.5)	3 (0.3)	526 (10.3)	3 (0.4)	492 (12.4)	9 (0.8)	547 (8.5)
Ontario, Canada	41 (1.3)	544 (3.1)	23 (0.8)	523 (3.6)	21 (1.0)	490 (3.8)	2 (0.3)	~ ~	14 (0.6)	506 (4.5)
Connecticut, US	41 (1.8)	558 (5.2)	41 (1.4)	528 (4.5)	3 (0.3)	503 (12.8)	5 (0.6)	448 (11.3)	9 (0.9)	524 (7.8)
Alabama, US	41 (1.8)	511 (7.3)	40 (1.3)	481 (5.7)	4 (0.5)	449 (15.4)	8 (1.0)	421 (8.3)	7 (0.6)	480 (9.4)
Colorado, US	41 (1.4)	566 (4.5)	43 (1.5)	538 (4.9)	3 (0.4)	495 (14.4)	6 (0.6)	473 (7.2)	7 (0.8)	518 (8.5)
Indiana, US	40 (1.8)	555 (5.1)	44 (1.2)	528 (4.3)	4 (0.5)	488 (10.7)	5 (0.6)	469 (9.0)	7 (0.5)	516 (8.7)
California, US	39 (1.6)	525 (4.9)	41 (1.2)	493 (5.0)	4 (0.5)	476 (12.4)	7 (0.8)	448 (11.1)	8 (0.4)	475 (7.9)
Minnesota, US	37 (1.3)	575 (5.3)	48 (1.2)	549 (5.1)	3 (0.4)	525 (9.8)	4 (0.6)	484 (12.1)	8 (0.7)	531 (6.0)
Quebec, Canada	34 (1.2)	538 (3.1)	26 (0.8)	528 (3.3)	23 (0.9)	495 (2.8)	4 (0.4)	474 (7.4)	13 (0.7)	518 (4.2)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 4.9: Students Attended Preprimary Education\***

Curriculum Reported by National Research Coordinators and Preprimary Attendance Reported by Parents

Country	National Preprimary Curriculum Includes Science Skills	Students Attended Preprimary Education							
		3 Years or More		Less than 3 Years but More than 1 Year		1 Year or Less		Did Not Attend	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Hungary	●	86 (0.9)	545 (3.3)	12 (0.7)	494 (6.7)	1 (0.3)	~ ~	0 (0.1)	~ ~
Italy	●	74 (0.9)	532 (2.7)	23 (0.8)	513 (3.6)	1 (0.2)	~ ~	1 (0.2)	~ ~
Germany	○	74 (0.9)	538 (2.9)	23 (0.9)	527 (3.6)	1 (0.2)	~ ~	1 (0.2)	~ ~
Sweden	●	74 (1.1)	545 (2.6)	20 (1.0)	528 (3.6)	2 (0.4)	~ ~	3 (0.4)	496 (10.6)
Norway	●	72 (1.6)	499 (2.2)	24 (1.4)	485 (4.1)	2 (0.2)	~ ~	3 (0.5)	488 (12.5)
Austria	○	69 (1.5)	534 (2.7)	27 (1.3)	534 (4.5)	3 (0.7)	531 (8.9)	1 (0.1)	~ ~
Russian Federation	○	68 (1.3)	556 (3.4)	14 (0.8)	552 (5.4)	3 (0.3)	543 (9.1)	15 (1.0)	540 (5.2)
Hong Kong SAR	●	68 (1.0)	543 (3.1)	31 (1.0)	539 (3.1)	1 (0.1)	~ ~	0 (0.1)	~ ~
Czech Republic	○	68 (1.1)	541 (2.7)	28 (0.9)	533 (4.0)	3 (0.4)	536 (7.2)	1 (0.2)	~ ~
Spain	●	66 (1.1)	515 (2.9)	28 (1.0)	498 (3.6)	4 (0.4)	487 (7.3)	3 (0.3)	490 (7.6)
Slovak Republic	●	65 (1.3)	545 (2.9)	24 (0.8)	524 (4.4)	8 (0.7)	506 (6.9)	4 (0.7)	484 (18.1)
Singapore	○	64 (0.7)	597 (3.4)	34 (0.7)	567 (4.0)	1 (0.1)	~ ~	1 (0.1)	~ ~
Slovenia	●	59 (1.3)	527 (2.9)	26 (1.1)	519 (4.1)	5 (0.5)	509 (5.5)	9 (0.7)	506 (5.5)
Romania	●	57 (1.9)	532 (5.0)	33 (1.3)	490 (7.2)	4 (0.7)	446 (16.2)	6 (1.0)	393 (18.5)
Lithuania	●	52 (1.2)	526 (2.6)	17 (0.6)	516 (4.8)	7 (0.5)	509 (5.3)	24 (1.3)	492 (4.5)
Finland	●	46 (1.3)	572 (2.7)	31 (1.0)	569 (3.4)	21 (1.1)	575 (4.2)	1 (0.3)	~ ~
Portugal	○	46 (1.3)	530 (3.6)	37 (1.3)	527 (4.5)	8 (0.7)	509 (5.9)	9 (0.8)	499 (6.2)
Croatia	○	44 (1.6)	528 (2.2)	19 (0.8)	517 (2.6)	10 (1.2)	497 (5.0)	27 (1.6)	504 (3.8)
Georgia	●	42 (1.3)	462 (4.0)	29 (0.9)	462 (4.9)	7 (0.6)	462 (6.3)	22 (1.3)	439 (5.5)
Chinese Taipei	●	38 (0.9)	558 (2.7)	56 (0.9)	551 (2.3)	4 (0.4)	536 (8.5)	1 (0.2)	~ ~
Poland	○	34 (1.3)	528 (3.1)	23 (1.0)	510 (3.2)	16 (1.1)	490 (4.2)	28 (1.9)	484 (3.6)
Morocco	●	21 (0.9)	287 (5.3)	39 (1.6)	269 (6.8)	17 (1.0)	249 (6.9)	23 (1.7)	255 (10.7)
Australia	Varies by state	14 (0.9)	541 (6.4)	55 (1.4)	534 (3.2)	25 (1.2)	524 (4.2)	5 (0.5)	506 (9.0)
Qatar	●	12 (0.9)	393 (8.2)	51 (1.5)	422 (4.9)	19 (0.8)	389 (7.3)	18 (1.2)	360 (8.9)
United Arab Emirates	●	12 (0.3)	421 (5.4)	49 (0.9)	436 (2.3)	16 (0.4)	443 (4.0)	22 (0.7)	424 (4.1)
Malta	●	11 (0.6)	458 (5.0)	86 (0.6)	450 (2.1)	3 (0.3)	452 (10.4)	1 (0.2)	~ ~
Iran, Islamic Rep. of	●	10 (0.8)	476 (8.6)	29 (1.1)	473 (4.0)	40 (1.2)	456 (3.8)	21 (1.5)	413 (6.2)
Oman	●	8 (0.4)	383 (7.0)	36 (0.8)	401 (5.0)	25 (0.6)	376 (5.2)	31 (0.8)	356 (5.5)
Azerbaijan	○	7 (0.6)	446 (6.8)	20 (1.3)	445 (6.7)	8 (0.5)	430 (9.2)	64 (1.7)	439 (6.4)
Ireland	●	7 (0.6)	505 (7.0)	56 (1.4)	526 (3.5)	25 (1.1)	521 (4.6)	12 (0.7)	498 (8.1)
Northern Ireland	○	4 (0.5)	546 (11.7)	49 (1.7)	532 (3.6)	44 (1.7)	527 (3.3)	3 (0.4)	501 (10.7)
Saudi Arabia	●	3 (0.3)	439 (11.9)	20 (1.4)	451 (5.8)	25 (1.3)	441 (6.4)	52 (2.2)	416 (7.5)
Armenia	○								
Bahrain	○								
Belgium (Flemish)	●								
Chile	●								
Denmark	●								
England	●								
Japan	●								
Kazakhstan	●								
Korea, Rep. of	●								
Kuwait	○								
Netherlands	●								
New Zealand	●								
Serbia	●								
Thailand	○								
Tunisia	●								
Turkey	●								
United States	Varies by state								
Yemen	○								
International Avg.		43 (0.2)	505 (0.9)	33 (0.2)	497 (0.8)	11 (0.1)	478 (1.4)	13 (0.2)	454 (1.9)

● Yes ○ No

\* Available only for countries that administered both TIMSS and PIRLS to the same fourth grade students because this item was included in the PIRLS Home Questionnaire completed by parents.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 4.9: Students Attended Preprimary Education\* (Continued)**

Country	National Preprimary Curriculum Includes Science Skills	Students Attended Preprimary Education							
		3 Years or More		Less than 3 Years but More than 1 Year		1 Year or Less		Did Not Attend	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
<b>Sixth Grade Participants</b>									
Honduras	<input type="radio"/>	21 (1.6)	411 (10.1)	36 (1.7)	448 (7.2)	28 (1.6)	438 (6.0)	15 (1.0)	419 (8.0)
Botswana	<input type="radio"/>	15 (0.8)	420 (10.2)	22 (1.2)	433 (9.4)	7 (0.6)	401 (11.5)	56 (1.9)	339 (5.6)
Yemen	<input type="radio"/>								
<b>Benchmarking Participants</b>									
Dubai, UAE	<input checked="" type="radio"/>	14 (0.6)	457 (5.2)	46 (0.8)	479 (2.7)	17 (0.6)	485 (5.7)	23 (1.0)	445 (4.8)
Abu Dhabi, UAE	<input checked="" type="radio"/>	12 (0.6)	412 (10.1)	50 (1.6)	419 (4.9)	18 (0.8)	420 (6.4)	21 (1.0)	405 (6.6)
Quebec, Canada	<input checked="" type="radio"/>	11 (0.7)	525 (4.5)	32 (1.5)	516 (2.8)	51 (1.6)	521 (3.0)	5 (0.5)	507 (8.0)
Alberta, Canada	<input checked="" type="radio"/>								
Ontario, Canada	<input checked="" type="radio"/>								
Florida, US	<input checked="" type="radio"/>								
North Carolina, US	<input checked="" type="radio"/>								

Yes  No

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



# Chapter 5

## School Resources for Teaching Science

The most successful schools tend to have students that are relatively economically affluent and speak the language of instruction. Successful schools also are likely to have better working conditions and facilities as well as more instructional materials, such as books, computers, technological support, and supplies.

The learning environment of the school can be a positive influence, encouraging a positive attitude toward academic excellence and facilitating classroom instruction. Considerable research has shown that higher levels of school resources are associated with higher achievement. However, the relationship between resources and achievement is complicated. First, a school can have a more socioeconomically advantaged student population, for example, because of its location or because it competes for students. Second, the school system can invest more money into schools for such things as facilities, teachers' salaries, equipment, and materials. It follows that the most successful schools are likely to have more socioeconomically advantaged students and better resources.

### Schools with Students from Advantaged Home Backgrounds

The home backgrounds of students attending a school can be closely related to the learning environment, with the two reinforcing each other and being strongly linked to academic achievement. Students from home backgrounds supportive of learning are likely to have more positive attitudes toward learning and, perhaps, even better discipline. Beyond that, parents that have high educational expectations for their children are more likely to take an active interest in the quality of teachers and school facilities.

#### *School Location*

Depending on each country's characteristics, a school's location can have a substantial impact on whether the students attending that school typically are from economically and educationally advantaged home backgrounds. Also, depending on the country, the location of the school can provide access to important additional resources (e.g., libraries, media centers, or museums) or mean that the school is relatively isolated.

To provide some information about the urbanicity of each school's location, TIMSS 2011 asked principals to describe the population size of the city, town, or area in which their schools were located. For the fourth grade science assessment, Exhibit 5.1 shows the percentages of students together with their average achievement for schools located in cities, towns, or areas of three different population sizes: cities of more than 100,000; cities or towns of 15,001 to 100,000; and small towns, villages, or rural areas of 15,000 or fewer people. Countries are presented in alphabetical order with the fourth grade on

the first page of the exhibit, followed by the sixth grade and the benchmarking participants on the second page.

On average, across the fourth grade countries, 31 percent of students attended schools in cities with more than 100,000 people, 27 percent attended schools in cities or towns of 15,001 to 100,000, and 42 percent in small towns, villages, or rural areas. In general, the fourth grade students attending schools in the largest cities had the highest average science achievement (497), followed by students in medium sized cities (484), and then those in smaller towns and rural areas (475). While this pattern held for the majority of the countries in the fourth grade assessment, there were also other patterns. In some countries, students attending schools in medium sized cities of 15,001 to 100,000 had higher average achievement than students in schools in larger cities, or there was not much difference in average achievement between the two. There were also a number of countries where average science achievement was highest among students attending schools in small towns or rural areas. The countries that assessed TIMSS 2011 in the sixth grade had relatively large percentages of students (64–77%) attending schools small towns or rural areas, and these students had lower average science achievement than students in schools in large or medium sized cities.

Exhibit 5.2 shows principals' reports about school location for the TIMSS 2011 eighth grade assessment, with percentages of students and average achievement for the eighth grade countries on the first page and results for the ninth grade and benchmarking participants on the second page. Compared to the fourth grade assessment, the results indicated a slight shift away from small towns and rural areas into large cities. For the eighth grade assessment, 37 percent of students were attending schools in cities with more than 100,000 people, 28 percent attended schools in cities or towns of 15,001 to 100,000, and 35 percent in small towns, villages, or rural areas. On average across countries, science achievement differences among students attending the three types of schools were somewhat more pronounced than at the fourth grade, with average achievement highest in the big-city schools (492), next highest in schools in medium sized cities (473), and lowest in schools in rural areas or small towns (463). As with the fourth grade, this pattern did not hold in all countries and there was considerable variation.

**Exhibit 5.1: School Location**
*Reported by Principals*

Country	Population Size of City, Town, or Area Where School Is Located					
	More than 100,000		15,001 to 100,000		15,000 or Fewer	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	27 (3.0)	429 (5.7)	26 (3.4)	418 (6.1)	46 (3.2)	407 (6.7)
Australia	42 (3.3)	530 (4.0)	30 (3.9)	504 (5.7)	28 (4.1)	510 (5.2)
Austria	24 (1.5)	520 (5.7)	9 (1.9)	522 (6.1)	66 (2.3)	537 (3.3)
Azerbaijan	16 (2.9)	441 (7.9)	21 (2.9)	459 (12.6)	63 (3.5)	430 (7.4)
Bahrain	11 (3.3)	457 (11.1)	28 (5.1)	440 (9.5)	61 (5.5)	451 (5.2)
Belgium (Flemish)	6 (1.9)	493 (14.6)	55 (4.1)	505 (2.6)	39 (3.8)	519 (2.9)
Chile	56 (3.5)	493 (4.2)	28 (3.3)	474 (6.2)	16 (2.5)	458 (5.6)
Chinese Taipei	56 (3.5)	564 (2.5)	39 (3.3)	537 (3.4)	6 (2.0)	530 (12.3)
Croatia	16 (2.2)	532 (3.6)	23 (3.3)	518 (3.2)	61 (3.7)	511 (2.8)
Czech Republic	15 (2.5)	542 (8.8)	33 (3.1)	538 (3.8)	52 (3.2)	533 (3.4)
Denmark	r 15 (2.6)	516 (8.2)	37 (3.6)	537 (5.1)	48 (3.2)	529 (3.4)
England	40 (5.2)	518 (6.4)	38 (5.0)	521 (6.5)	23 (3.9)	555 (6.1)
Finland	31 (3.9)	569 (3.9)	39 (4.2)	574 (3.0)	30 (3.3)	567 (4.9)
Georgia	37 (2.9)	474 (5.3)	17 (2.3)	457 (7.2)	46 (2.4)	439 (5.9)
Germany	25 (3.2)	515 (5.3)	33 (3.7)	527 (4.7)	42 (3.5)	539 (2.8)
Hong Kong SAR	r 84 (3.4)	537 (5.6)	15 (3.2)	543 (7.4)	1 (1.2)	~ ~
Hungary	25 (2.6)	557 (7.3)	29 (3.2)	553 (4.6)	46 (2.2)	512 (6.3)
Iran, Islamic Rep. of	45 (3.5)	481 (5.8)	18 (2.9)	456 (10.1)	36 (3.4)	417 (5.7)
Ireland	16 (3.0)	503 (8.5)	27 (3.2)	507 (6.5)	57 (3.0)	526 (4.5)
Italy	16 (2.3)	525 (6.1)	34 (3.2)	521 (5.3)	50 (3.3)	525 (4.1)
Japan	64 (2.9)	563 (2.3)	33 (3.0)	553 (2.5)	3 (1.4)	536 (12.3)
Kazakhstan	26 (3.0)	508 (10.2)	21 (2.8)	480 (8.7)	54 (3.0)	492 (7.4)
Korea, Rep. of	86 (2.8)	590 (2.1)	9 (2.1)	571 (2.5)	5 (2.2)	561 (8.8)
Kuwait	12 (2.7)	344 (16.0)	38 (4.2)	352 (8.3)	50 (4.2)	350 (7.5)
Lithuania	35 (1.7)	536 (3.7)	19 (2.8)	513 (3.6)	46 (2.9)	499 (3.9)
Malta	0 (0.0)	~ ~	13 (0.1)	423 (4.7)	87 (0.1)	450 (2.1)
Morocco	r 30 (3.4)	299 (7.3)	27 (3.6)	254 (7.9)	43 (3.9)	245 (8.2)
Netherlands	r 25 (4.9)	525 (4.2)	59 (5.5)	535 (3.0)	16 (3.7)	536 (4.0)
New Zealand	40 (3.6)	507 (4.1)	23 (3.2)	475 (6.2)	37 (3.1)	501 (3.8)
Northern Ireland	r 23 (3.6)	521 (7.7)	29 (4.9)	516 (7.0)	48 (4.4)	522 (4.1)
Norway	20 (2.8)	495 (6.1)	45 (3.8)	497 (2.6)	34 (3.5)	487 (3.9)
Oman	r 4 (1.4)	345 (15.5)	17 (2.5)	388 (8.1)	79 (2.5)	369 (5.7)
Poland	24 (0.9)	524 (5.6)	24 (2.1)	509 (4.4)	52 (2.3)	496 (3.2)
Portugal	14 (2.6)	536 (8.3)	28 (4.6)	513 (4.6)	58 (4.6)	521 (6.1)
Qatar	34 (3.0)	440 (10.3)	24 (2.7)	378 (10.8)	42 (3.1)	365 (7.8)
Romania	21 (2.7)	567 (5.4)	15 (2.4)	541 (7.2)	65 (2.5)	477 (8.2)
Russian Federation	48 (1.6)	566 (4.1)	22 (2.3)	549 (5.5)	30 (2.0)	533 (6.1)
Saudi Arabia	57 (3.7)	426 (8.3)	15 (2.9)	437 (9.7)	28 (3.9)	432 (10.4)
Serbia	28 (3.2)	534 (4.7)	34 (3.7)	515 (5.8)	38 (3.2)	501 (5.3)
Singapore	100 (0.0)	583 (3.4)	0 (0.0)	~ ~	0 (0.0)	~ ~
Slovak Republic	11 (2.1)	567 (5.9)	35 (3.3)	544 (3.7)	54 (2.9)	516 (5.8)
Slovenia	14 (2.8)	532 (6.7)	21 (3.4)	521 (4.8)	65 (3.6)	517 (3.2)
Spain	37 (3.6)	510 (4.8)	34 (3.6)	509 (4.6)	30 (3.6)	498 (4.7)
Sweden	16 (3.5)	538 (7.5)	38 (4.5)	531 (4.9)	46 (5.0)	531 (3.9)
Thailand	8 (2.2)	541 (15.7)	22 (2.7)	487 (11.6)	70 (3.1)	459 (6.5)
Tunisia	12 (2.7)	376 (12.4)	28 (3.5)	363 (8.7)	60 (3.3)	331 (7.3)
Turkey	52 (2.4)	481 (5.6)	21 (2.3)	471 (7.9)	28 (2.4)	420 (10.0)
United Arab Emirates	50 (1.8)	444 (3.9)	22 (1.7)	414 (6.2)	28 (1.8)	404 (6.2)
United States	33 (2.1)	539 (5.4)	36 (2.6)	550 (3.2)	31 (2.4)	548 (3.7)
Yemen	15 (3.1)	244 (17.8)	10 (2.2)	240 (19.1)	75 (3.5)	198 (8.7)
International Avg.	31 (0.4)	497 (1.1)	27 (0.5)	484 (1.0)	42 (0.5)	475 (0.9)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 5.1: School Location (Continued)**

Country	Population Size of City, Town, or Area Where School Is Located					
	More than 100,000		15,001 to 100,000		15,000 or Fewer	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
<b>Sixth Grade Participants</b>						
Botswana	3 (1.6)	449 (53.4)	20 (3.2)	423 (17.8)	77 (3.3)	348 (5.3)
Honduras	21 (4.0)	478 (13.4)	15 (2.6)	468 (3.4)	64 (3.8)	409 (7.1)
Yemen	18 (3.6)	372 (13.3)	13 (2.8)	361 (17.7)	69 (3.9)	329 (8.5)
<b>Benchmarking Participants</b>						
Alberta, Canada	46 (4.4)	545 (4.2)	21 (3.7)	543 (4.2)	33 (3.6)	537 (4.4)
Ontario, Canada	62 (3.7)	532 (4.2)	21 (3.8)	523 (4.6)	16 (3.1)	524 (5.3)
Quebec, Canada	37 (4.0)	515 (4.4)	35 (4.4)	522 (3.9)	28 (4.5)	511 (4.2)
Abu Dhabi, UAE	46 (3.9)	430 (8.4)	21 (3.5)	381 (13.3)	33 (3.6)	393 (7.5)
Dubai, UAE	65 (0.3)	468 (3.2)	19 (0.2)	467 (2.2)	16 (0.2)	425 (3.6)
Florida, US	52 (6.6)	541 (7.3)	36 (6.0)	548 (7.6)	13 (4.2)	543 (15.8)
North Carolina, US	23 (5.5)	550 (14.6)	33 (7.1)	537 (10.7)	45 (6.7)	537 (6.4)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 5.2: School Location**
*Reported by Principals*

Country	Population Size of City, Town, or Area Where School Is Located					
	More than 100,000		15,001 to 100,000		15,000 or Fewer	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	24 (2.8)	458 (6.3)	24 (3.5)	441 (7.4)	52 (3.5)	425 (4.8)
Australia	55 (3.2)	532 (6.5)	28 (3.5)	521 (9.4)	16 (2.9)	489 (5.8)
Bahrain	17 (0.3)	453 (5.0)	42 (0.3)	448 (3.5)	41 (0.3)	459 (3.0)
Chile	55 (3.5)	474 (3.9)	29 (3.8)	449 (6.4)	16 (2.9)	450 (6.3)
Chinese Taipei	63 (3.5)	575 (2.5)	34 (3.6)	547 (5.5)	3 (1.3)	529 (20.7)
England	49 (5.0)	530 (7.2)	36 (4.6)	531 (9.0)	15 (3.2)	567 (13.9)
Finland	24 (3.3)	554 (6.1)	42 (4.1)	551 (3.2)	34 (3.4)	553 (3.9)
Georgia	31 (2.4)	438 (4.5)	17 (2.4)	423 (9.5)	52 (2.5)	409 (4.7)
Ghana	19 (3.0)	359 (9.4)	13 (2.5)	329 (18.1)	68 (3.2)	285 (6.6)
Hong Kong SAR	88 (3.1)	536 (3.9)	9 (2.9)	518 (18.8)	3 (1.8)	573 (17.0)
Hungary	27 (2.4)	541 (6.9)	27 (3.1)	539 (4.7)	46 (2.4)	503 (3.8)
Indonesia	68 (4.1)	414 (6.2)	20 (4.1)	393 (9.1)	12 (3.0)	383 (11.3)
Iran, Islamic Rep. of	48 (3.4)	501 (6.2)	20 (2.7)	465 (7.0)	32 (3.4)	440 (5.9)
Israel	26 (3.0)	540 (7.1)	45 (4.0)	507 (8.1)	29 (3.2)	515 (7.3)
Italy	17 (2.7)	510 (6.6)	39 (3.4)	495 (4.8)	43 (3.7)	502 (3.9)
Japan	67 (3.2)	560 (3.0)	27 (3.4)	557 (3.5)	5 (1.8)	544 (18.4)
Jordan	26 (3.0)	461 (6.9)	31 (3.4)	454 (6.7)	42 (3.4)	441 (7.3)
Kazakhstan	26 (3.3)	514 (7.3)	21 (3.2)	485 (8.7)	53 (3.2)	480 (6.6)
Korea, Rep. of	87 (2.6)	562 (2.1)	10 (2.0)	550 (5.6)	3 (1.7)	531 (6.7)
Lebanon	21 (3.2)	434 (11.7)	37 (4.3)	399 (10.0)	42 (4.0)	393 (7.4)
Lithuania	31 (2.3)	540 (4.4)	19 (3.1)	513 (4.4)	50 (3.1)	498 (4.1)
Macedonia, Rep. of	21 (3.1)	444 (14.5)	36 (3.2)	411 (9.3)	43 (3.0)	388 (8.5)
Malaysia	18 (3.1)	446 (14.8)	49 (4.4)	431 (8.8)	33 (3.4)	407 (11.2)
Morocco	47 (2.7)	383 (3.2)	32 (2.9)	376 (4.2)	21 (2.5)	359 (4.7)
New Zealand	48 (5.0)	520 (7.8)	32 (4.7)	521 (7.2)	20 (3.1)	485 (8.6)
Norway	25 (2.0)	504 (5.0)	43 (3.2)	494 (4.2)	32 (2.8)	487 (3.9)
Oman	8 (1.2)	461 (9.2)	21 (2.8)	432 (8.6)	70 (3.0)	411 (3.6)
Palestinian Nat'l Auth.	22 (3.2)	422 (7.9)	35 (4.1)	412 (6.4)	43 (3.5)	426 (5.8)
Qatar	29 (0.7)	450 (9.0)	32 (0.5)	421 (6.0)	39 (0.3)	404 (4.2)
Romania	24 (2.8)	500 (7.2)	16 (2.9)	475 (5.6)	60 (2.8)	448 (5.3)
Russian Federation	48 (2.1)	553 (4.5)	20 (2.4)	544 (6.4)	31 (2.2)	525 (6.9)
Saudi Arabia	57 (3.2)	444 (5.2)	18 (2.8)	437 (8.3)	24 (3.0)	416 (8.1)
Singapore	100 (0.0)	590 (4.3)	0 (0.0)	~ ~	0 (0.0)	~ ~
Slovenia	13 (2.1)	554 (9.1)	21 (3.5)	539 (6.1)	66 (3.7)	543 (3.0)
Sweden	22 (3.6)	515 (7.5)	42 (4.4)	512 (4.4)	36 (4.5)	509 (4.8)
Syrian Arab Republic	26 (3.2)	432 (6.3)	26 (3.9)	423 (7.1)	47 (3.5)	424 (7.0)
Thailand	11 (2.6)	487 (14.6)	36 (3.5)	453 (6.6)	53 (3.5)	440 (5.3)
Tunisia	16 (2.8)	451 (8.1)	44 (3.4)	443 (2.8)	39 (3.5)	428 (3.8)
Turkey	54 (2.3)	492 (5.6)	21 (2.4)	488 (7.4)	25 (2.0)	459 (6.6)
Ukraine	31 (3.0)	527 (5.2)	18 (2.7)	499 (5.9)	52 (2.9)	486 (5.5)
United Arab Emirates	48 (2.4)	483 (4.6)	23 (2.0)	451 (4.2)	30 (2.3)	445 (4.1)
United States	30 (2.4)	511 (6.9)	43 (2.7)	531 (3.7)	27 (1.8)	535 (5.8)
International Avg.	37 (0.5)	492 (1.1)	28 (0.5)	473 (1.2)	35 (0.4)	463 (1.3)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 5.2: School Location (Continued)**

Country	Population Size of City, Town, or Area Where School Is Located					
	More than 100,000		15,001 to 100,000		15,000 or Fewer	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
<b>Ninth Grade Participants</b>						
Botswana	15 (2.6)	443 (9.9)	60 (3.9)	402 (4.7)	25 (3.5)	383 (5.9)
Honduras	24 (3.6)	393 (10.1)	27 (4.1)	369 (7.6)	49 (4.2)	355 (5.0)
South Africa	19 (2.5)	391 (14.0)	32 (3.1)	342 (7.0)	50 (3.3)	300 (6.5)
<b>Benchmarking Participants</b>						
Alberta, Canada	53 (3.7)	546 (3.4)	18 (3.3)	551 (4.5)	29 (3.2)	543 (4.5)
Ontario, Canada	63 (3.5)	522 (3.7)	20 (3.7)	523 (4.4)	17 (3.0)	518 (4.6)
Quebec, Canada	45 (3.5)	519 (4.6)	39 (4.0)	518 (3.6)	16 (2.4)	529 (7.9)
Abu Dhabi, UAE	43 (4.2)	484 (8.9)	26 (4.1)	438 (7.0)	31 (4.1)	450 (7.4)
Dubai, UAE	66 (0.4)	495 (3.8)	16 (0.4)	509 (5.1)	18 (0.2)	438 (3.8)
Alabama, US	10 (5.1)	497 (22.5)	42 (9.2)	482 (13.8)	48 (6.7)	485 (6.9)
California, US	41 (6.3)	484 (10.6)	53 (6.8)	509 (7.8)	7 (2.4)	503 (12.0)
Colorado, US	40 (6.4)	535 (8.5)	45 (7.3)	544 (7.5)	15 (3.0)	551 (14.9)
Connecticut, US	12 (2.9)	462 (9.8)	64 (5.6)	537 (8.4)	24 (5.0)	555 (13.2)
Florida, US	58 (5.1)	526 (13.5)	36 (4.8)	537 (10.6)	6 (3.4)	517 (23.6)
Indiana, US	17 (5.1)	506 (19.1)	51 (6.0)	540 (8.0)	32 (5.1)	538 (7.7)
Massachusetts, US	9 (2.9)	497 (16.1)	67 (6.5)	573 (7.0)	24 (5.7)	583 (8.3)
Minnesota, US	13 (4.5)	522 (25.5)	43 (5.6)	558 (7.5)	44 (5.6)	560 (6.2)
North Carolina, US	30 (4.6)	530 (15.6)	36 (7.9)	527 (9.9)	35 (6.9)	536 (13.5)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

### *School Composition by Student Background*

Ever since the Coleman report (Coleman, et al., 1966), researchers have recognized that the compositional characteristics of a school's student body can affect student achievement, and specifically that students from disadvantaged backgrounds typically have higher achievement if they attend schools in which the majority of students are from advantaged backgrounds. To provide information on this topic, TIMSS routinely asks school principals to report on two demographic characteristics of their schools:

- ◆ Economic home background; and
- ◆ Language home background.

Previous assessments have found both to be strongly related to average science achievement. For example, in TIMSS 2007 the science achievement of students attending schools with a higher proportion of economically advantaged students was higher than for those attending schools with large proportions of disadvantaged students. Also, science achievement was highest for students in schools where most students spoke the language of the TIMSS assessment as their first language, and was progressively lower as percentages of students not having the TIMSS language as their first language increased.

Exhibit 5.3 presents, for participants in the TIMSS 2011 fourth grade assessment, principals' economic categorizations of their schools according to three categories that are fully described on the second page of the exhibit. To summarize, the **More Affluent** schools had more than one-fourth of their students from affluent home backgrounds and not more than one-fourth from disadvantaged home backgrounds, and the **More Disadvantaged** schools had the reverse situation. The other schools were "in between." Across the fourth grade countries, students were distributed relatively equally across three types of schools. On average, across countries at the fourth grade, 36 percent of the students attended schools with relatively more affluent students than disadvantaged students, and students in these schools had the highest average achievement (505). At the other end of the range, 30 percent of the students attended schools with relatively more disadvantaged students than affluent students, and students in these schools had the lowest average achievement (463). Although this overall achievement pattern was observed in most countries and benchmarking participants, there was a wide variation among participants in the percentages of students attending the three different economic categories of schools.

Exhibit 5.4 presents the results for school composition by student economic background for participants in the TIMSS 2011 eighth grade assessment. Similar to the fourth grade assessment, internationally students were distributed relatively equally across three categories of schools, with 32 percent of the eighth grade students attending schools with relatively more affluent than disadvantaged students and 36 percent attending schools with relatively more disadvantaged than affluent students. Again, the percentages of students in each school category varied considerably across countries. Also similar to the fourth grade assessment, average science achievement was highest among the eighth grade students attending schools with relatively more affluent students than disadvantaged students (501), and lowest among students attending schools with relatively more disadvantaged students (458).

Exhibit 5.5 presents, for participants in the fourth grade assessment, principals' reports of the percentage of students in their schools who had the language of the TIMSS 2011 test as their native language. Approximately three-fourths of the fourth grade students (73%) were in schools where almost all students (more than 90%) spoke the language of the TIMSS test as their native language, 15 percent were in schools where the majority of students (51–90%) were native speakers of the TIMSS test language, and 13 percent were in schools where half the students (or less) spoke the language of the test as their native language. Among countries participating at the sixth grade, Botswana was notable for having almost all students (92%) in schools in which 50 percent or fewer of students had the language of the TIMSS test as their native language. On average across the fourth grade countries, science achievement was highest among students in schools where almost all students had the language of the TIMSS test as their native language (488). Achievement was next highest in schools where 51–90% of students had the language of the TIMSS test as their native language (477), and was lowest in schools where half the students or less had the language of the TIMSS test as their native language (457). Among countries participating at the sixth grade, Botswana was notable for having almost all students (92%) in schools with half or less native speakers.

Exhibit 5.6 presents, for participants in the eighth grade assessment, principals' reports of the percentage of students in their schools who had the language of the TIMSS 2011 test as their native language. Similar to the fourth grade results, across countries, the majority of eighth grade students (69%) were in schools where almost all students (more than 90%) spoke the language of the TIMSS test as their native language, 13 percent were in schools where the

**Exhibit 5.3: School Composition by Student Economic Background**

Reported by Principals

Country	More Affluent - Schools Where More than 25% of Students Come from Economically Affluent Homes and Not More than 25% from Economically Disadvantaged Homes		Neither More Affluent nor More Disadvantaged		More Disadvantaged - Schools Where More than 25% of Students Come from Economically Disadvantaged Homes and Not More than 25% from Economically Affluent homes	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	38 (3.9)	423 (6.1)	20 (3.3)	418 (8.7)	42 (4.0)	408 (5.8)
Australia	32 (3.9)	542 (4.5)	41 (4.0)	518 (4.2)	27 (3.4)	486 (5.7)
Austria	31 (4.0)	540 (3.8)	48 (3.8)	538 (3.0)	21 (3.9)	502 (6.3)
Azerbaijan r	11 (2.5)	452 (15.4)	32 (4.7)	455 (14.4)	57 (4.9)	431 (8.7)
Bahrain r	46 (6.1)	465 (6.0)	35 (5.7)	444 (7.8)	19 (3.7)	421 (14.9)
Belgium (Flemish)	64 (4.6)	516 (1.9)	26 (4.2)	503 (4.5)	10 (2.6)	483 (10.1)
Chile r	11 (2.2)	530 (8.7)	33 (4.6)	505 (4.7)	57 (4.2)	465 (3.9)
Chinese Taipei	22 (3.3)	561 (4.8)	67 (3.5)	554 (2.7)	11 (2.0)	519 (7.1)
Croatia	38 (4.0)	522 (2.9)	38 (4.2)	514 (3.2)	24 (3.2)	514 (4.8)
Czech Republic	37 (3.7)	541 (3.9)	46 (4.4)	539 (2.8)	17 (3.1)	513 (6.9)
Denmark r	60 (3.9)	537 (3.4)	31 (3.9)	528 (4.1)	9 (2.5)	504 (11.8)
England r	34 (4.8)	561 (6.7)	29 (4.5)	528 (5.8)	36 (4.2)	507 (5.4)
Finland	43 (4.2)	577 (3.5)	47 (4.3)	570 (3.5)	10 (2.6)	545 (6.3)
Georgia	16 (3.0)	468 (8.9)	41 (4.3)	461 (6.8)	43 (4.0)	448 (5.7)
Germany	21 (2.8)	542 (3.7)	53 (3.7)	539 (3.6)	26 (3.3)	496 (5.4)
Hong Kong SAR r	21 (3.5)	537 (13.5)	29 (4.5)	541 (6.1)	50 (4.7)	535 (4.7)
Hungary	21 (3.6)	573 (5.9)	31 (4.3)	554 (5.0)	48 (4.0)	508 (6.3)
Iran, Islamic Rep. of	27 (3.6)	489 (9.3)	27 (4.1)	458 (8.5)	46 (4.2)	429 (5.6)
Ireland r	39 (4.5)	536 (4.7)	30 (3.8)	518 (7.3)	31 (3.7)	485 (5.5)
Italy	37 (3.8)	524 (5.3)	43 (3.7)	527 (3.6)	20 (2.9)	512 (6.7)
Japan	46 (4.3)	562 (3.0)	45 (4.4)	557 (2.3)	9 (2.6)	545 (8.0)
Kazakhstan	73 (3.6)	497 (5.5)	19 (3.4)	483 (12.6)	8 (2.3)	501 (30.0)
Korea, Rep. of	17 (3.7)	608 (5.0)	62 (4.7)	587 (2.0)	21 (3.2)	571 (3.3)
Kuwait r	57 (3.7)	360 (7.3)	28 (3.8)	326 (10.6)	15 (3.2)	323 (12.2)
Lithuania	19 (3.3)	539 (5.9)	43 (4.6)	519 (4.1)	38 (3.5)	501 (3.4)
Malta	47 (0.1)	454 (2.3)	43 (0.1)	443 (2.8)	10 (0.1)	397 (5.5)
Morocco s	12 (2.1)	315 (19.9)	13 (2.9)	260 (16.1)	75 (2.9)	254 (7.3)
Netherlands r	70 (5.2)	539 (2.4)	21 (5.0)	529 (5.4)	9 (2.5)	497 (8.9)
New Zealand	33 (3.0)	532 (3.6)	41 (3.3)	498 (3.1)	26 (2.8)	454 (5.4)
Northern Ireland r	36 (4.7)	541 (4.2)	38 (4.3)	515 (3.8)	26 (3.8)	484 (7.1)
Norway	53 (5.2)	498 (3.0)	44 (5.2)	490 (3.7)	3 (1.3)	469 (13.7)
Oman r	44 (3.4)	385 (5.5)	25 (2.9)	363 (7.2)	31 (2.9)	366 (9.8)
Poland	8 (2.1)	517 (10.9)	61 (3.8)	511 (3.4)	31 (3.7)	491 (4.3)
Portugal	31 (4.6)	531 (4.8)	39 (5.1)	530 (5.4)	31 (4.9)	499 (7.2)
Qatar r	68 (3.0)	392 (6.3)	21 (2.3)	414 (6.6)	11 (1.9)	319 (15.9)
Romania	19 (3.1)	549 (9.9)	24 (4.0)	510 (10.6)	57 (4.8)	494 (8.3)
Russian Federation	58 (3.2)	563 (4.5)	29 (3.3)	540 (6.0)	13 (2.1)	537 (10.1)
Saudi Arabia r	42 (4.7)	447 (11.5)	30 (4.3)	437 (6.6)	29 (4.0)	403 (12.9)
Serbia	18 (3.6)	521 (6.8)	37 (4.3)	515 (5.4)	45 (4.4)	515 (4.6)
Singapore	40 (0.0)	610 (5.5)	50 (0.0)	569 (4.9)	10 (0.0)	556 (14.2)
Slovak Republic	24 (3.3)	550 (4.4)	56 (3.4)	538 (3.4)	20 (3.2)	486 (12.3)
Slovenia	42 (4.0)	523 (4.5)	40 (4.0)	522 (3.2)	18 (3.0)	511 (8.7)
Spain	51 (4.1)	516 (4.0)	31 (3.7)	509 (4.8)	18 (3.2)	474 (7.0)
Sweden r	77 (4.1)	541 (3.3)	17 (4.1)	516 (7.8)	7 (1.5)	479 (8.1)
Thailand r	18 (3.8)	525 (12.4)	17 (3.3)	497 (11.5)	65 (4.2)	454 (7.5)
Tunisia	30 (3.4)	374 (7.8)	27 (3.9)	357 (11.2)	43 (4.3)	313 (7.1)
Turkey	14 (2.3)	527 (8.1)	24 (3.0)	477 (11.8)	63 (3.4)	442 (5.4)
United Arab Emirates r	68 (2.2)	429 (3.9)	20 (1.6)	435 (5.5)	12 (1.7)	400 (6.6)
United States r	19 (2.2)	581 (5.8)	31 (2.5)	560 (3.5)	50 (2.6)	523 (2.8)
Yemen r	8 (2.9)	283 (14.4)	12 (3.5)	241 (18.6)	81 (4.3)	194 (8.9)
International Avg.	36 (0.5)	505 (1.0)	35 (0.6)	489 (1.0)	30 (0.5)	463 (1.3)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

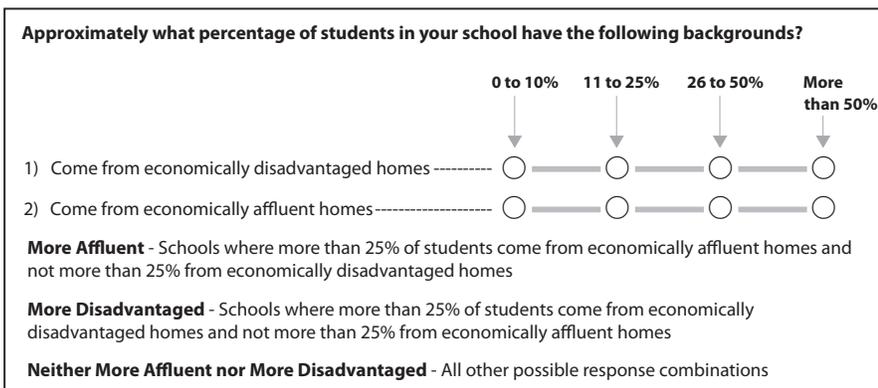
An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 5.3: School Composition by Student Economic Background (Continued)**

Country	More Affluent - Schools Where More than 25% of Students Come from Economically Affluent Homes and Not More than 25% from Economically Disadvantaged Homes		Neither More Affluent nor More Disadvantaged		More Disadvantaged - Schools Where More than 25% of Students Come from Economically Disadvantaged Homes and Not More than 25% from Economically Affluent homes	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
<b>Sixth Grade Participants</b>						
Botswana	32 (3.6)	416 (10.6)	25 (4.0)	349 (12.9)	43 (4.3)	328 (6.7)
Honduras	r 16 (4.0)	507 (17.1)	13 (3.8)	409 (18.4)	71 (4.9)	426 (5.9)
Yemen	r 7 (2.9)	412 (9.4)	13 (3.2)	363 (21.7)	80 (3.6)	340 (8.9)
<b>Benchmarking Participants</b>						
Alberta, Canada	37 (4.3)	550 (3.9)	51 (4.5)	542 (3.2)	12 (2.8)	517 (10.1)
Ontario, Canada	36 (4.4)	541 (4.9)	36 (4.3)	532 (3.6)	28 (4.4)	508 (5.1)
Quebec, Canada	60 (4.1)	521 (2.9)	25 (4.0)	512 (6.2)	15 (2.7)	502 (6.2)
Abu Dhabi, UAE	s 75 (4.5)	409 (7.9)	12 (3.2)	421 (20.6)	13 (3.5)	387 (8.9)
Dubai, UAE	r 67 (0.4)	457 (3.2)	22 (0.3)	485 (5.3)	11 (0.2)	396 (5.2)
Florida, US	r 11 (4.4)	595 (12.5)	20 (4.7)	567 (12.2)	69 (4.6)	529 (3.6)
North Carolina, US	r 21 (6.0)	574 (8.2)	16 (5.3)	531 (5.8)	64 (7.5)	531 (7.1)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



**Exhibit 5.4: School Composition by Student Economic Background**

Reported by Principals

Country	More Affluent - Schools Where More than 25% of Students Come from Economically Affluent Homes and Not More than 25% from Economically Disadvantaged Homes		Neither More Affluent nor More Disadvantaged		More Disadvantaged - Schools Where More than 25% of Students Come from Economically Disadvantaged Homes and Not More than 25% from Economically Affluent homes	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	35 (3.7)	454 (7.2)	24 (3.6)	428 (6.9)	41 (3.7)	427 (5.0)
Australia	32 (3.4)	553 (9.7)	39 (3.7)	521 (5.5)	29 (3.1)	493 (7.9)
Bahrain	45 (0.3)	457 (3.1)	28 (0.2)	456 (2.7)	27 (0.3)	444 (3.7)
Chile	r 12 (2.3)	514 (11.4)	32 (4.1)	483 (5.4)	56 (3.9)	445 (4.2)
Chinese Taipei	17 (2.7)	592 (5.6)	69 (3.8)	560 (2.8)	14 (2.9)	544 (9.8)
England	28 (4.1)	578 (8.9)	50 (4.5)	527 (8.2)	22 (4.3)	512 (10.1)
Finland	r 30 (3.4)	555 (3.7)	67 (3.8)	553 (3.2)	3 (1.5)	526 (5.4)
Georgia	11 (2.0)	425 (11.3)	44 (4.4)	425 (5.2)	45 (4.2)	410 (5.6)
Ghana	7 (2.0)	385 (17.0)	18 (3.4)	305 (14.1)	75 (3.6)	293 (6.6)
Hong Kong SAR	11 (3.0)	567 (10.9)	37 (5.1)	551 (8.6)	53 (4.8)	517 (6.4)
Hungary	16 (2.7)	550 (6.5)	33 (4.1)	544 (4.1)	50 (4.3)	500 (5.0)
Indonesia	16 (3.3)	439 (9.5)	28 (4.6)	418 (7.7)	56 (4.6)	392 (6.7)
Iran, Islamic Rep. of	20 (2.7)	523 (9.6)	25 (3.5)	487 (8.0)	54 (3.8)	452 (5.3)
Israel	28 (3.5)	551 (7.4)	30 (4.5)	526 (7.1)	42 (3.9)	485 (7.9)
Italy	40 (3.7)	518 (3.8)	47 (3.9)	499 (4.0)	13 (2.6)	462 (8.6)
Japan	46 (4.4)	566 (4.0)	44 (4.5)	555 (3.4)	10 (2.9)	540 (7.9)
Jordan	r 32 (3.5)	474 (6.8)	25 (2.9)	449 (9.9)	43 (3.9)	431 (7.5)
Kazakhstan	75 (3.5)	493 (4.8)	20 (3.4)	487 (9.9)	5 (1.8)	466 (28.0)
Korea, Rep. of	18 (3.3)	589 (4.0)	51 (4.3)	559 (2.1)	32 (3.9)	545 (3.6)
Lebanon	r 21 (4.1)	466 (11.2)	34 (4.2)	413 (11.2)	45 (5.0)	387 (7.6)
Lithuania	23 (3.6)	545 (6.5)	39 (4.4)	509 (4.0)	38 (4.0)	502 (4.3)
Macedonia, Rep. of	r 38 (3.6)	443 (8.2)	30 (4.1)	409 (10.4)	32 (3.9)	383 (10.7)
Malaysia	26 (3.2)	458 (12.0)	23 (3.3)	440 (13.1)	52 (4.1)	408 (10.4)
Morocco	r 6 (1.4)	416 (14.0)	13 (2.5)	396 (9.0)	81 (2.9)	367 (2.8)
New Zealand	30 (5.6)	542 (4.9)	47 (5.8)	516 (7.0)	24 (4.0)	472 (10.7)
Norway	--	--	--	--	--	--
Oman	43 (3.1)	440 (5.0)	26 (2.6)	413 (6.5)	31 (3.1)	395 (7.0)
Palestinian Nat'l Auth.	44 (4.2)	426 (6.0)	23 (3.9)	419 (9.2)	33 (3.7)	411 (6.8)
Qatar	r 81 (0.2)	412 (4.3)	16 (0.2)	466 (12.5)	3 (0.1)	425 (3.6)
Romania	18 (2.9)	478 (9.8)	29 (4.2)	475 (6.1)	52 (4.3)	456 (5.3)
Russian Federation	58 (3.5)	555 (4.7)	25 (2.8)	532 (3.8)	16 (3.1)	518 (9.4)
Saudi Arabia	r 40 (4.4)	446 (6.1)	30 (4.4)	437 (8.6)	29 (4.1)	427 (7.5)
Singapore	27 (0.0)	631 (6.9)	61 (0.0)	581 (5.7)	11 (0.0)	538 (13.6)
Slovenia	40 (3.8)	548 (4.8)	45 (4.3)	545 (3.2)	15 (2.7)	524 (7.4)
Sweden	r 74 (4.4)	518 (3.3)	21 (4.1)	494 (7.4)	5 (1.8)	479 (15.1)
Syrian Arab Republic	r 37 (4.2)	431 (6.4)	27 (4.3)	438 (9.0)	36 (4.4)	417 (6.6)
Thailand	20 (3.0)	485 (12.1)	24 (3.6)	461 (9.2)	57 (4.4)	435 (5.4)
Tunisia	23 (3.3)	449 (7.8)	29 (3.3)	446 (3.8)	48 (3.5)	428 (2.6)
Turkey	17 (2.6)	550 (10.5)	25 (3.3)	484 (5.2)	59 (3.8)	463 (4.6)
Ukraine	13 (2.7)	509 (12.0)	29 (3.9)	506 (6.8)	59 (4.5)	494 (4.5)
United Arab Emirates	r 70 (2.0)	468 (3.6)	17 (1.9)	450 (7.3)	13 (1.4)	446 (6.2)
United States	22 (1.9)	560 (4.9)	23 (1.9)	542 (5.6)	55 (1.9)	505 (3.5)
International Avg.	32 (0.5)	501 (1.3)	33 (0.6)	481 (1.2)	36 (0.5)	458 (1.3)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

A dash (-) indicates comparable data not available.

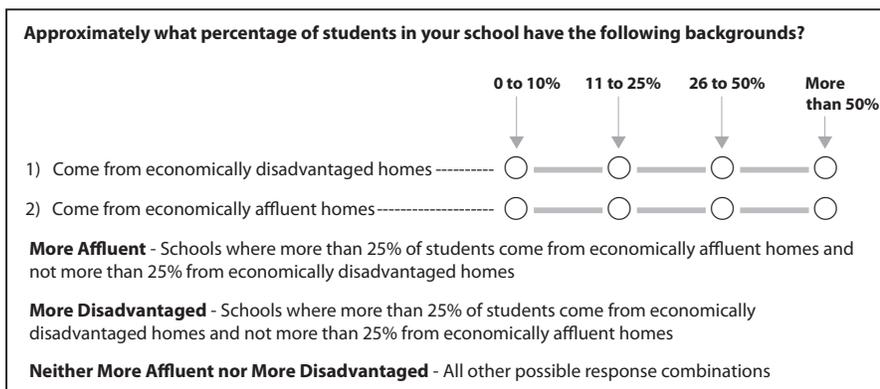
An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011

**Exhibit 5.4: School Composition by Student Economic Background (Continued)**

Country	More Affluent - Schools Where More than 25% of Students Come from Economically Affluent Homes and Not More than 25% from Economically Disadvantaged Homes		Neither More Affluent nor More Disadvantaged		More Disadvantaged - Schools Where More than 25% of Students Come from Economically Disadvantaged Homes and Not More than 25% from Economically Affluent homes	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
<b>Ninth Grade Participants</b>						
Botswana	13 (3.0)	452 (12.0)	24 (4.0)	410 (6.7)	63 (4.6)	388 (4.2)
Honduras	5 (1.6)	422 (14.5)	14 (3.4)	391 (12.4)	82 (3.6)	363 (5.0)
South Africa	8 (1.3)	502 (17.0)	12 (2.6)	336 (21.0)	80 (2.7)	317 (4.9)
<b>Benchmarking Participants</b>						
Alberta, Canada	39 (4.1)	556 (3.9)	43 (4.8)	545 (3.4)	18 (3.8)	526 (5.5)
Ontario, Canada	37 (4.1)	531 (5.0)	36 (4.7)	522 (3.6)	27 (4.5)	509 (4.7)
Quebec, Canada	51 (4.1)	529 (4.4)	32 (3.8)	515 (5.7)	17 (3.5)	501 (6.4)
Abu Dhabi, UAE	76 (4.1)	465 (6.4)	17 (3.6)	443 (9.2)	7 (2.4)	455 (16.0)
Dubai, UAE	71 (0.3)	492 (3.6)	12 (0.2)	459 (5.0)	16 (0.2)	439 (5.9)
Alabama, US	17 (4.4)	508 (18.2)	5 (3.4)	500 (45.1)	78 (5.6)	476 (7.1)
California, US	16 (4.2)	551 (10.5)	20 (5.2)	544 (11.4)	64 (5.4)	470 (6.0)
Colorado, US	21 (5.7)	546 (7.7)	34 (6.6)	553 (10.3)	46 (7.4)	524 (11.4)
Connecticut, US	43 (6.1)	579 (7.0)	27 (6.1)	543 (9.3)	30 (5.9)	471 (10.6)
Florida, US	6 (3.4)	522 (24.3)	37 (5.6)	552 (10.9)	58 (6.0)	513 (11.0)
Indiana, US	13 (4.5)	581 (6.5)	29 (5.3)	540 (10.0)	58 (5.9)	520 (6.6)
Massachusetts, US	29 (6.8)	599 (7.6)	45 (6.6)	575 (8.5)	26 (4.2)	510 (14.9)
Minnesota, US	18 (3.2)	583 (13.2)	45 (7.1)	555 (5.5)	37 (7.6)	540 (11.0)
North Carolina, US	14 (5.6)	556 (15.4)	23 (6.4)	545 (12.2)	63 (6.7)	514 (9.4)

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011



**Exhibit 5.5: Schools with Students Having the Language of the Test as Their Native Language**

Reported by Principals

Country	More than 90% of Students		51–90% of Students		50% of Students or Less	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	95 (1.6)	415 (3.9)	5 (1.6)	433 (18.8)	0 (0.0)	~ ~
Australia	63 (3.8)	523 (3.2)	21 (2.8)	508 (7.1)	16 (3.1)	502 (9.7)
Austria	33 (4.1)	549 (3.5)	52 (4.7)	530 (3.8)	16 (1.9)	499 (8.1)
Azerbaijan	90 (2.6)	438 (5.3)	5 (1.9)	436 (22.8)	4 (1.8)	440 (54.6)
Bahrain	65 (3.8)	443 (4.1)	13 (2.3)	444 (13.0)	22 (3.0)	458 (10.4)
Belgium (Flemish)	52 (3.7)	522 (2.0)	36 (4.1)	502 (2.9)	12 (2.3)	479 (8.7)
Chile	99 (0.9)	483 (2.6)	1 (0.8)	~ ~	0 (0.0)	~ ~
Chinese Taipei	49 (3.8)	557 (3.0)	36 (3.8)	548 (3.5)	15 (2.6)	542 (7.5)
Croatia	95 (1.7)	518 (2.0)	3 (1.2)	492 (9.4)	1 (1.1)	~ ~
Czech Republic	96 (1.5)	538 (2.3)	2 (1.1)	~ ~	1 (1.0)	~ ~
Denmark	r 95 (1.6)	531 (3.0)	4 (1.5)	525 (17.7)	1 (0.6)	~ ~
England	56 (4.7)	532 (4.3)	22 (4.4)	527 (11.2)	22 (4.6)	520 (7.9)
Finland	85 (3.2)	572 (2.5)	15 (3.1)	558 (5.8)	1 (0.8)	~ ~
Georgia	92 (2.3)	455 (3.7)	7 (2.0)	470 (13.0)	1 (1.1)	~ ~
Germany	49 (2.9)	539 (2.5)	37 (2.8)	527 (4.2)	13 (2.4)	497 (8.0)
Hong Kong SAR	94 (1.2)	541 (2.9)	3 (1.6)	440 (83.1)	3 (1.1)	447 (75.4)
Hungary	96 (1.5)	536 (3.9)	3 (1.4)	524 (35.2)	1 (0.0)	~ ~
Iran, Islamic Rep. of	48 (3.4)	487 (4.9)	15 (3.5)	449 (9.1)	37 (2.9)	411 (6.2)
Ireland	64 (3.6)	525 (4.4)	33 (3.9)	505 (5.3)	3 (1.7)	474 (20.1)
Italy	64 (3.7)	526 (3.5)	30 (3.3)	521 (4.3)	6 (1.9)	508 (9.6)
Japan	99 (0.8)	559 (2.0)	1 (0.0)	~ ~	0 (0.0)	~ ~
Kazakhstan	56 (3.7)	478 (7.3)	30 (3.6)	512 (8.6)	14 (2.8)	522 (13.8)
Korea, Rep. of	100 (0.0)	587 (2.0)	0 (0.0)	~ ~	0 (0.0)	~ ~
Kuwait	93 (2.1)	347 (5.0)	6 (1.9)	356 (21.8)	2 (0.8)	~ ~
Lithuania	88 (2.5)	516 (2.8)	8 (1.5)	520 (5.7)	4 (2.0)	479 (22.9)
Malta	6 (0.1)	498 (7.1)	12 (0.1)	487 (4.3)	82 (0.1)	439 (2.2)
Morocco	60 (4.1)	273 (7.1)	13 (2.3)	260 (13.1)	27 (4.1)	242 (9.6)
Netherlands	r 75 (4.3)	536 (2.5)	15 (3.7)	529 (7.7)	10 (2.8)	505 (7.5)
New Zealand	58 (3.5)	507 (3.5)	25 (3.1)	498 (5.8)	17 (2.5)	469 (8.5)
Northern Ireland	88 (3.1)	518 (3.4)	7 (2.4)	510 (7.8)	4 (1.9)	511 (11.5)
Norway	64 (4.5)	495 (2.7)	29 (4.6)	492 (4.3)	8 (2.9)	492 (13.6)
Oman	85 (1.9)	374 (5.3)	10 (1.8)	358 (10.5)	5 (1.2)	338 (15.3)
Poland	100 (0.0)	505 (2.6)	0 (0.0)	~ ~	0 (0.0)	~ ~
Portugal	92 (1.9)	524 (4.2)	6 (1.5)	489 (11.8)	2 (1.0)	~ ~
Qatar	r 40 (3.2)	378 (7.7)	9 (2.6)	456 (30.5)	51 (3.2)	431 (5.6)
Romania	88 (2.5)	506 (6.6)	8 (2.3)	498 (14.1)	4 (1.7)	506 (20.0)
Russian Federation	73 (3.7)	554 (3.5)	17 (2.8)	550 (5.6)	9 (2.3)	550 (14.4)
Saudi Arabia	88 (2.3)	432 (6.2)	8 (2.2)	402 (14.7)	5 (1.4)	414 (14.5)
Serbia	89 (3.1)	516 (3.6)	10 (2.9)	513 (9.7)	2 (1.0)	~ ~
Singapore	2 (0.0)	~ ~	32 (0.0)	601 (5.3)	65 (0.0)	572 (4.7)
Slovak Republic	89 (2.4)	535 (3.7)	7 (2.2)	521 (21.5)	4 (1.3)	479 (18.6)
Slovenia	70 (2.8)	524 (3.2)	28 (2.9)	513 (4.8)	2 (0.9)	~ ~
Spain	60 (2.8)	513 (4.0)	24 (3.0)	504 (4.3)	16 (2.5)	483 (5.4)
Sweden	56 (3.6)	545 (3.5)	29 (3.2)	532 (5.0)	15 (2.9)	487 (9.6)
Thailand	84 (3.3)	483 (4.8)	4 (1.9)	404 (13.4)	13 (3.3)	415 (20.3)
Tunisia	75 (3.3)	351 (6.4)	5 (2.0)	338 (15.8)	20 (2.6)	332 (13.3)
Turkey	78 (2.5)	473 (5.0)	7 (1.8)	473 (10.0)	15 (2.2)	402 (12.2)
United Arab Emirates	47 (1.4)	402 (3.4)	8 (0.8)	450 (10.2)	45 (1.4)	446 (4.1)
United States	55 (2.5)	558 (3.0)	30 (2.1)	538 (4.0)	15 (2.1)	515 (4.9)
Yemen	92 (2.2)	208 (8.3)	3 (1.2)	207 (13.8)	5 (2.0)	192 (34.8)
International Avg.	73 (0.4)	488 (0.6)	15 (0.4)	477 (2.6)	13 (0.3)	457 (3.4)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.  
A tilde (~) indicates insufficient data to report achievement.  
An "r" indicates data are available for at least 70% but less than 85% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 5.5: Schools with Students Having the Language of the Test as Their Native Language (Continued)**

Country	More than 90% of Students		51–90% of Students		50% of Students or Less	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
<b>Sixth Grade Participants</b>						
Botswana	5 (1.9)	324 (21.1)	4 (1.7)	438 (49.7)	92 (2.5)	367 (6.0)
Honduras	95 (2.2)	435 (6.2)	3 (1.3)	388 (15.9)	2 (1.7)	~ ~
Yemen	92 (2.4)	346 (7.7)	4 (1.7)	304 (34.3)	4 (2.0)	345 (47.3)
<b>Benchmarking Participants</b>						
Alberta, Canada	56 (4.2)	545 (3.6)	33 (4.2)	541 (3.7)	11 (2.6)	528 (8.4)
Ontario, Canada	50 (3.9)	531 (4.0)	28 (3.9)	535 (5.7)	22 (3.2)	513 (7.0)
Quebec, Canada	69 (3.8)	517 (3.1)	20 (3.2)	520 (4.9)	11 (2.4)	506 (6.8)
Abu Dhabi, UAE	59 (2.5)	386 (5.6)	3 (1.5)	455 (41.7)	38 (2.6)	436 (9.1)
Dubai, UAE	15 (0.2)	427 (5.2)	15 (0.4)	468 (4.1)	69 (0.4)	467 (2.9)
Florida, US	43 (6.2)	552 (6.1)	33 (5.9)	547 (7.7)	24 (5.6)	524 (6.1)
North Carolina, US	61 (7.9)	544 (6.7)	34 (8.1)	535 (10.2)	5 (3.6)	531 (25.2)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 5.6: Schools with Students Having the Language of the Test as Their Native Language**

Reported by Principals

Country	More than 90% of Students		51–90% of Students		50% of Students or Less	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	95 (1.6)	436 (3.2)	5 (1.6)	457 (12.4)	0 (0.0)	~ ~
Australia	65 (3.6)	520 (6.1)	25 (3.2)	527 (9.3)	10 (2.2)	522 (10.7)
Bahrain	76 (0.2)	442 (2.3)	9 (0.1)	450 (5.4)	14 (0.2)	512 (3.8)
Chile	99 (0.5)	463 (2.8)	1 (0.0)	~ ~	0 (0.2)	~ ~
Chinese Taipei	62 (4.0)	566 (3.2)	23 (3.1)	563 (5.5)	15 (2.9)	555 (8.9)
England	66 (3.9)	543 (6.4)	21 (3.2)	524 (13.6)	13 (2.9)	504 (15.5)
Finland	87 (3.1)	553 (2.6)	13 (3.1)	546 (5.6)	0 (0.0)	~ ~
Georgia	94 (1.7)	421 (3.2)	6 (1.6)	419 (10.4)	0 (0.0)	~ ~
Ghana	0 (0.0)	~ ~	2 (1.6)	~ ~	98 (1.6)	300 (5.4)
Hong Kong SAR	49 (4.4)	522 (5.5)	3 (1.7)	475 (25.7)	48 (4.3)	549 (6.7)
Hungary	98 (1.1)	522 (3.2)	2 (1.1)	~ ~	0 (0.1)	~ ~
Indonesia	23 (3.8)	416 (13.1)	33 (4.4)	393 (8.0)	43 (3.9)	409 (5.1)
Iran, Islamic Rep. of	50 (2.7)	503 (4.9)	10 (2.0)	448 (7.5)	40 (2.8)	446 (4.5)
Israel	64 (4.0)	517 (5.2)	25 (3.6)	510 (9.4)	11 (2.5)	541 (14.9)
Italy	64 (3.5)	502 (3.3)	31 (3.2)	506 (3.9)	5 (1.5)	467 (14.4)
Japan	98 (1.3)	558 (2.5)	0 (0.0)	~ ~	2 (1.3)	~ ~
Jordan	93 (1.9)	452 (3.8)	4 (1.3)	461 (15.8)	3 (1.3)	368 (58.1)
Kazakhstan	53 (3.6)	470 (5.6)	33 (3.6)	505 (7.5)	14 (3.1)	529 (11.8)
Korea, Rep. of	100 (0.0)	560 (2.0)	0 (0.0)	~ ~	0 (0.0)	~ ~
Lebanon	6 (2.1)	404 (26.9)	8 (2.5)	428 (15.9)	87 (3.1)	404 (5.4)
Lithuania	91 (2.0)	514 (2.8)	6 (1.3)	528 (7.7)	4 (1.6)	479 (30.7)
Macedonia, Rep. of	71 (3.4)	414 (7.2)	19 (3.2)	400 (9.8)	10 (1.9)	389 (18.5)
Malaysia	40 (3.3)	429 (9.7)	24 (3.2)	412 (13.2)	36 (3.6)	433 (11.5)
Morocco	75 (2.9)	378 (2.6)	12 (2.2)	375 (7.7)	13 (2.0)	367 (5.8)
New Zealand	64 (5.2)	518 (4.6)	28 (4.3)	508 (10.6)	9 (3.4)	498 (20.5)
Norway	73 (3.7)	496 (2.9)	21 (3.7)	499 (4.8)	6 (2.1)	465 (15.3)
Oman	84 (1.9)	415 (3.6)	5 (0.9)	425 (13.2)	11 (1.7)	460 (8.7)
Palestinian Nat'l Auth.	96 (1.7)	422 (3.4)	3 (1.6)	398 (19.0)	1 (0.6)	~ ~
Qatar	46 (0.6)	390 (5.1)	5 (1.1)	521 (21.7)	49 (1.0)	431 (4.6)
Romania	90 (2.5)	464 (3.7)	6 (1.8)	461 (13.8)	4 (1.7)	485 (14.4)
Russian Federation	74 (3.9)	544 (3.4)	17 (2.9)	543 (8.9)	9 (2.4)	530 (9.1)
Saudi Arabia	89 (2.4)	437 (4.2)	7 (2.0)	435 (12.6)	3 (1.4)	424 (11.4)
Singapore	7 (0.0)	663 (8.5)	15 (0.0)	611 (11.0)	77 (0.0)	579 (5.1)
Slovenia	72 (3.9)	546 (2.5)	26 (3.8)	541 (6.7)	2 (1.0)	~ ~
Sweden	53 (4.5)	522 (3.2)	36 (4.6)	500 (5.5)	11 (2.8)	497 (11.9)
Syrian Arab Republic	90 (2.8)	429 (4.2)	9 (2.7)	407 (14.3)	1 (0.6)	~ ~
Thailand	89 (2.3)	454 (4.1)	2 (0.9)	~ ~	9 (2.4)	427 (10.9)
Tunisia	91 (2.0)	438 (2.6)	7 (1.7)	447 (11.5)	3 (1.3)	453 (6.1)
Turkey	80 (2.1)	491 (4.3)	7 (1.9)	481 (9.7)	13 (2.0)	432 (8.5)
Ukraine	76 (3.7)	502 (4.2)	18 (3.4)	497 (6.7)	6 (2.0)	499 (14.4)
United Arab Emirates	56 (1.7)	444 (2.9)	8 (1.1)	489 (11.3)	36 (1.6)	489 (4.4)
United States	65 (1.8)	537 (3.6)	23 (1.9)	517 (5.5)	12 (1.4)	482 (7.8)
International Avg.	69 (0.4)	483 (1.0)	13 (0.4)	478 (1.9)	17 (0.3)	466 (2.8)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 5.6: Schools with Students Having the Language of the Test as Their Native Language (Continued)**

Country	More than 90% of Students		51–90% of Students		50% of Students or Less	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
<b>Ninth Grade Participants</b>						
Botswana	4 (1.8)	377 (11.1)	1 (0.7)	~ ~	95 (2.0)	404 (3.6)
Honduras	97 (1.8)	370 (4.3)	2 (1.7)	~ ~	1 (0.4)	~ ~
South Africa	7 (1.3)	462 (13.5)	7 (1.4)	446 (17.6)	85 (1.7)	314 (4.5)
<b>Benchmarking Participants</b>						
Alberta, Canada	51 (4.2)	550 (3.2)	36 (4.2)	546 (4.0)	13 (3.3)	530 (5.4)
Ontario, Canada	51 (3.6)	525 (3.0)	27 (3.1)	520 (5.3)	22 (3.0)	515 (6.4)
Quebec, Canada	66 (3.8)	524 (3.1)	24 (3.2)	523 (7.4)	11 (2.4)	491 (6.7)
Abu Dhabi, UAE	67 (2.6)	444 (4.3)	4 (1.6)	486 (25.9)	30 (2.5)	496 (9.4)
Dubai, UAE	24 (0.3)	442 (3.8)	12 (0.3)	533 (9.5)	64 (0.4)	493 (3.4)
Alabama, US	r 84 (6.0)	489 (8.9)	10 (4.9)	486 (12.0)	6 (3.7)	460 (22.0)
California, US	r 14 (5.8)	545 (15.3)	47 (6.0)	511 (6.6)	38 (5.7)	466 (8.8)
Colorado, US	45 (5.1)	566 (6.7)	39 (5.5)	532 (8.4)	16 (5.3)	502 (20.9)
Connecticut, US	r 73 (4.5)	555 (6.9)	21 (4.3)	488 (15.3)	6 (3.7)	453 (45.9)
Florida, US	43 (6.5)	530 (10.2)	47 (6.6)	537 (11.2)	9 (4.2)	478 (24.6)
Indiana, US	r 85 (5.2)	538 (6.4)	15 (5.2)	513 (17.2)	0 (0.0)	~ ~
Massachusetts, US	76 (3.8)	586 (5.2)	10 (3.9)	536 (21.2)	14 (4.5)	484 (16.1)
Minnesota, US	67 (6.5)	559 (5.2)	28 (6.2)	549 (7.2)	5 (3.6)	513 (104.9)
North Carolina, US	69 (6.1)	543 (10.0)	27 (5.6)	506 (7.8)	3 (2.4)	531 (60.1)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

majority of students (51–90%) were native speakers of the TIMSS test language, and 17 percent were in schools where half the students (or less) spoke the language of the test as their native language. For the eighth grade students, on average across countries, the relationship between language composition of the school and average science achievement also was similar to the fourth grade. Science achievement was highest among students in schools where almost all students had the language of the TIMSS test as their native language (483), next highest in schools where 51–90% of students had the language of the TIMSS test as their native language (478), and lowest in schools where 50 percent or fewer of the students had the language of the TIMSS test as their native language (466).

### Schools with Sufficient Facilities, Books, and Technology

Studies have shown that resources are crucial for improving schooling, perhaps even more so in developing countries than in economically developed countries, where adequate school structures and material resources can be taken for granted (Lee & Zuze, 2011). The extent and quality of school resources can have an important impact on the quality of classroom instruction.

#### *School Resources*

TIMSS collects information on the extent to which school resources are available to support science instruction by asking school principals about the degree of shortages or inadequacies in general school resources (materials, supplies, heating/cooling/lighting, buildings, space, staff, and computers) as well as about resources specifically targeted to support science instruction (specialized teachers, science equipment and materials, computer software, library materials, audio-visual resources, and calculators). Although “adequacy” can be relative, in each previous TIMSS assessment there has been a strong positive relationship between principals’ perceptions of the absence of school resource shortages and average science achievement.

Exhibit 5.7 presents the results for the Science Resources Shortages scale for participants in the TIMSS 2011 fourth grade assessment. Students were scored according to their principals’ responses concerning twelve school and classroom resources (see the second page of the exhibit for details). Countries are ordered according to the percentage of students (from most to least) in schools **Not Affected** by resource shortages. Schools in this category had principals who reported that shortages affected instruction “not at all” for six of the twelve resources and only “a little” for the other six, on average. There was

substantial variation across the fourth grade countries—from 0 to 63 percent, with an average of 22 percent of students attending well-resourced schools.

Students in schools where instruction was **Affected A Lot** had principals who reported that shortages affected instruction “a lot” for six of the twelve resources and “some” for the other six, on average. All other students attended schools where instruction was **Somewhat Affected** by resource shortages. Countries are ordered according to the percentage of students (from highest to lowest) in schools **Not Affected** by resource shortages. Only two countries (Korea and Slovenia) had more than 50 percent of their students in schools **Not Affected** by resource shortages; a large majority of countries and benchmarking participants had more than 50 percent of their students in schools that were **Somewhat Affected** by resource shortages. Only eight of the 50 fourth grade countries and one benchmarking participant had more than 15 percent of their students in schools that were **Affected a Lot**. On average across countries, students in schools that were **Affected a Lot** by science resource shortages had lower science achievement (460 points) than students in schools that were **Not Affected** (495) or **Somewhat Affected** (485).

Exhibit 5.8 presents the results for the Science Resource Shortages scale for participants in the TIMSS 2011 eighth grade assessment. As shown on the second page of the exhibit, the eighth grade scale was based on principals’ responses concerning 13 school and classroom resources. The results were similar to the fourth grade results, with wide variation across countries in the percentage of eighth grade students attending schools that were **Not Affected** by resource shortages (1–64%), and only three countries having more than 50 percent of their students in such schools (Singapore, Slovenia, and Korea). Again, a large majority of countries and benchmarking participants had more than 50 percent of their students in schools that were **Somewhat Affected** by resource shortages, and only four of the 42 eighth grade countries and one benchmarking participant had more than 15 percent of their students in schools that were **Affected a Lot**. Also as at fourth grade, on average across countries, students in schools that were **Affected a Lot** by science resource shortages had lower science achievement (464) than students in schools that were **Not Affected** (494) or **Somewhat Affected** (474).

## Exhibit 5.7: Instruction Affected by Science Resource Shortages

Reported by Principals

Students were scored according to their principals' responses concerning twelve school and classroom resources on the *Science Resource Shortages* scale. Students in schools where instruction was **Not Affected** by resource shortages had a score on the scale of at least 11.3, which corresponds to their principals reporting that shortages affected instruction "not at all" for six of the twelve resources and "a little" for the other six, on average. Students in schools where instruction was **Affected A Lot** had a score no higher than 7.1, which corresponds to their principals reporting that shortages affected instruction "a lot" for six of the twelve resources and "some" for the other six, on average. All other students attended schools where instruction was **Somewhat Affected** by resource shortages.

Country	Not Affected		Somewhat Affected		Affected A Lot		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Korea, Rep. of	63 (4.4)	587 (2.5)	36 (4.3)	586 (3.7)	1 (0.6)	~ ~	12.1 (0.18)
Slovenia	57 (4.0)	521 (3.5)	43 (4.0)	519 (3.9)	0 (0.0)	~ ~	11.8 (0.12)
England	37 (4.7)	527 (6.4)	63 (4.7)	529 (4.4)	0 (0.0)	~ ~	11.1 (0.17)
Spain	37 (4.4)	511 (4.9)	62 (4.3)	503 (4.0)	2 (1.0)	~ ~	10.9 (0.16)
Singapore	36 (0.0)	580 (5.4)	57 (0.0)	586 (4.7)	7 (0.0)	575 (14.5)	10.5 (0.00)
United States	34 (2.8)	555 (4.0)	65 (2.9)	542 (2.9)	2 (0.7)	~ ~	10.8 (0.13)
Poland	33 (3.8)	513 (4.2)	67 (3.8)	502 (3.3)	0 (0.0)	~ ~	10.9 (0.14)
Kazakhstan	32 (3.8)	490 (8.9)	57 (4.0)	497 (7.3)	11 (2.7)	499 (20.0)	10.2 (0.22)
Australia	32 (3.7)	529 (5.1)	68 (3.7)	511 (3.7)	1 (0.5)	~ ~	10.6 (0.14)
Czech Republic	31 (3.7)	537 (5.3)	66 (3.8)	536 (2.8)	3 (1.5)	537 (9.8)	10.9 (0.15)
Qatar	31 (3.0)	419 (11.5)	41 (3.2)	402 (7.7)	29 (3.1)	364 (9.9)	9.3 (0.24)
Netherlands	30 (4.9)	537 (4.6)	70 (4.9)	531 (2.4)	0 (0.0)	~ ~	10.5 (0.14)
United Arab Emirates	29 (1.9)	449 (5.7)	58 (2.3)	419 (3.4)	13 (1.6)	417 (8.6)	9.9 (0.10)
Croatia	29 (4.0)	516 (3.8)	69 (3.9)	515 (2.6)	2 (1.2)	~ ~	10.6 (0.16)
Belgium (Flemish)	29 (4.2)	512 (4.5)	70 (4.2)	508 (2.1)	1 (0.6)	~ ~	10.6 (0.13)
Hungary	28 (3.9)	541 (5.7)	68 (4.1)	532 (5.3)	4 (1.8)	548 (10.1)	10.5 (0.18)
Sweden	28 (4.0)	541 (6.0)	71 (4.0)	530 (3.3)	1 (0.7)	~ ~	10.5 (0.15)
Georgia	27 (3.8)	453 (7.7)	73 (3.8)	455 (4.5)	0 (0.0)	~ ~	10.6 (0.14)
Armenia	26 (3.5)	422 (7.1)	74 (3.5)	415 (4.5)	1 (0.0)	~ ~	10.5 (0.12)
Austria	25 (3.8)	531 (5.1)	75 (3.8)	532 (3.5)	0 (0.0)	~ ~	10.6 (0.14)
Malta	25 (0.1)	462 (3.8)	72 (0.1)	441 (2.0)	3 (0.0)	449 (8.9)	10.2 (0.00)
Germany	25 (2.5)	534 (4.6)	75 (2.5)	527 (3.3)	0 (0.0)	~ ~	10.6 (0.09)
New Zealand	24 (3.5)	501 (7.0)	76 (3.5)	496 (3.3)	0 (0.0)	~ ~	10.5 (0.09)
Northern Ireland	23 (4.1)	523 (6.9)	74 (4.0)	516 (3.6)	3 (2.4)	501 (8.0)	10.3 (0.18)
Japan	23 (3.4)	558 (3.0)	75 (3.7)	560 (2.3)	2 (1.4)	~ ~	10.3 (0.14)
Norway	21 (4.4)	485 (5.5)	79 (4.4)	496 (2.6)	0 (0.0)	~ ~	10.4 (0.12)
Russian Federation	20 (3.0)	567 (6.1)	72 (3.5)	546 (4.4)	8 (2.1)	550 (9.9)	9.9 (0.15)
Finland	19 (3.1)	577 (3.9)	79 (3.3)	569 (2.8)	2 (1.2)	~ ~	10.1 (0.14)
Lithuania	18 (3.2)	513 (6.3)	82 (3.2)	515 (2.9)	0 (0.0)	~ ~	10.3 (0.11)
Slovak Republic	17 (2.3)	534 (6.6)	83 (2.3)	530 (4.2)	0 (0.0)	~ ~	10.2 (0.10)
Bahrain	17 (4.8)	471 (9.1)	62 (5.2)	439 (5.9)	21 (3.7)	458 (9.9)	9.3 (0.35)
Serbia	17 (3.2)	529 (7.3)	75 (4.1)	515 (3.6)	8 (2.7)	495 (16.7)	9.5 (0.14)
Chile	17 (2.5)	520 (8.9)	79 (2.9)	474 (3.3)	4 (1.7)	481 (12.8)	9.7 (0.15)
Ireland	17 (3.4)	518 (8.6)	81 (3.6)	517 (4.0)	2 (1.2)	~ ~	10.2 (0.13)
Yemen	16 (3.2)	213 (15.4)	81 (3.5)	206 (8.0)	3 (1.5)	290 (23.8)	10.1 (0.12)
Kuwait	14 (3.0)	327 (10.1)	51 (4.0)	349 (6.7)	35 (4.0)	356 (8.8)	8.3 (0.21)
Morocco	14 (2.6)	270 (10.8)	82 (2.8)	260 (5.8)	4 (1.2)	325 (20.3)	10.1 (0.10)
Romania	12 (2.8)	536 (16.1)	85 (2.8)	502 (6.3)	3 (0.5)	471 (72.3)	9.8 (0.13)
Portugal	11 (1.9)	534 (9.8)	87 (2.2)	520 (4.4)	2 (0.9)	~ ~	9.6 (0.14)
Italy	10 (2.2)	533 (9.3)	88 (2.3)	523 (2.7)	1 (0.9)	~ ~	9.7 (0.09)
Chinese Taipei	9 (2.5)	563 (6.4)	71 (3.4)	551 (2.6)	19 (3.0)	551 (4.5)	8.6 (0.17)
Tunisia	9 (2.0)	347 (14.6)	89 (2.1)	345 (5.5)	2 (1.1)	~ ~	10.0 (0.08)
Denmark	8 (1.9)	537 (5.9)	90 (2.2)	529 (3.5)	2 (1.1)	~ ~	9.9 (0.09)
Saudi Arabia	7 (2.5)	442 (11.6)	83 (2.4)	428 (6.2)	10 (2.4)	431 (20.1)	9.2 (0.15)
Oman	7 (1.4)	379 (12.6)	74 (2.5)	365 (4.6)	19 (2.0)	380 (9.6)	8.6 (0.09)
Thailand	4 (1.8)	537 (16.8)	63 (4.3)	477 (5.7)	33 (4.1)	453 (12.1)	8.2 (0.15)
Iran, Islamic Rep. of	4 (1.7)	480 (26.2)	73 (3.5)	451 (4.7)	23 (3.2)	450 (7.8)	8.4 (0.15)
Turkey	2 (0.7)	~ ~	70 (3.1)	464 (5.5)	28 (3.1)	449 (8.2)	7.9 (0.08)
Azerbaijan	1 (0.8)	~ ~	87 (2.7)	433 (6.2)	11 (2.7)	474 (16.7)	8.7 (0.12)
Hong Kong SAR	0 (0.0)	~ ~	91 (2.6)	535 (4.6)	9 (2.6)	536 (8.7)	8.3 (0.08)
International Avg.	22 (0.4)	495 (1.3)	72 (0.5)	485 (0.6)	7 (0.3)	460 (4.0)	

Centerpoint of scale set at 10.

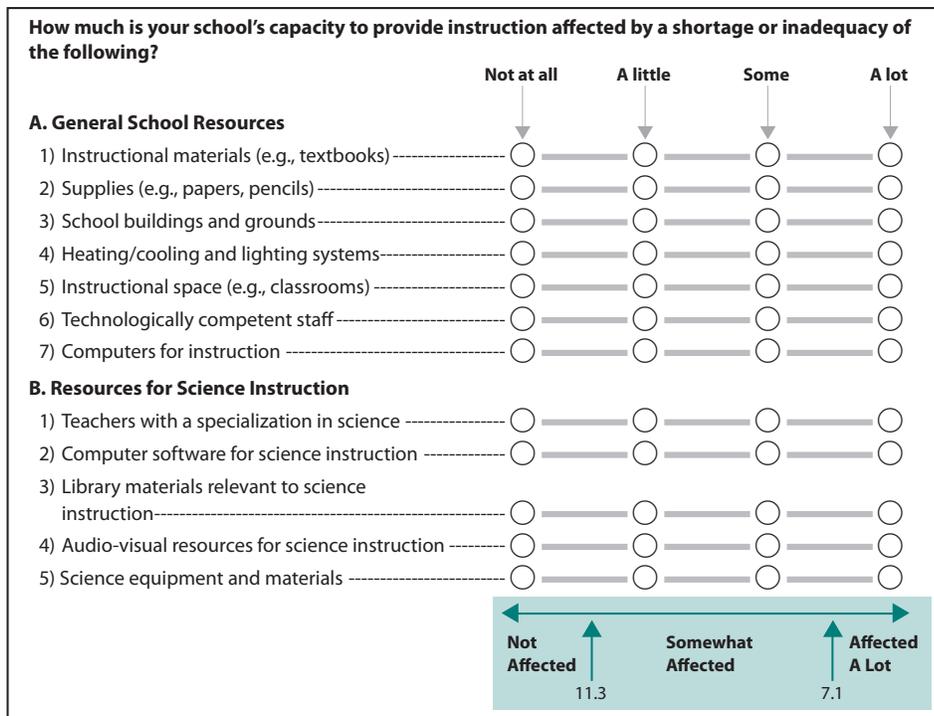
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students.

**Exhibit 5.7: Instruction Affected by Science Resource Shortages (Continued)**

Country	Not Affected		Somewhat Affected		Affected A Lot		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Sixth Grade Participants</b>							
Honduras	20 (4.1)	443 (18.2)	69 (4.4)	432 (6.3)	11 (2.7)	409 (14.8)	9.4 (0.23)
Yemen	15 (2.8)	326 (16.9)	82 (3.0)	344 (7.4)	3 (1.5)	392 (12.7)	10.0 (0.13)
Botswana	2 (1.2)	~ ~	87 (2.9)	360 (5.3)	10 (2.6)	402 (32.1)	8.9 (0.11)
<b>Benchmarking Participants</b>							
Dubai, UAE	47 (0.4)	480 (3.8)	42 (0.3)	453 (2.6)	11 (0.2)	428 (10.1)	10.7 (0.02)
Alberta, Canada	42 (4.3)	545 (4.3)	58 (4.3)	540 (3.1)	0 (0.0)	~ ~	11.3 (0.16)
Florida, US	37 (5.6)	541 (5.1)	62 (5.3)	543 (5.0)	2 (0.1)	~ ~	11.0 (0.25)
Quebec, Canada	30 (4.4)	525 (3.9)	69 (4.3)	513 (3.3)	1 (0.7)	~ ~	10.7 (0.15)
North Carolina, US	30 (7.8)	541 (10.0)	64 (8.6)	538 (6.6)	6 (4.1)	541 (11.8)	10.7 (0.35)
Abu Dhabi, UAE	24 (4.0)	428 (12.1)	59 (4.6)	403 (6.9)	17 (3.6)	399 (11.9)	9.5 (0.23)
Ontario, Canada	20 (3.7)	525 (7.2)	79 (3.6)	529 (3.4)	1 (0.7)	~ ~	10.4 (0.14)



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

## Exhibit 5.8: Instruction Affected by Science Resource Shortages

Reported by Principals

Students were scored according to their principals' responses concerning thirteen school and classroom resources on the *Science Resource Shortages* scale. Students in schools where instruction was **Not Affected** by resource shortages had a score on the scale of at least 11.2, which corresponds to their principals reporting that shortages affected instruction "not at all" for seven of the thirteen resources and "a little" for the other six, on average. Students in schools where instruction was **Affected A Lot** had a score no higher than 7.3, which corresponds to their principals reporting that shortages affected instruction "a lot" for seven of the thirteen resources and "some" for the other six, on average. All other students attended schools where instruction was **Somewhat Affected** by resource shortages.

Country	Not Affected		Somewhat Affected		Affected A Lot		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Singapore	64 (0.0)	593 (5.2)	28 (0.0)	578 (7.6)	8 (0.0)	604 (14.5)	11.7 (0.00)
Slovenia	59 (4.5)	544 (3.8)	41 (4.5)	543 (3.2)	0 (0.0)	~ ~	11.8 (0.12)
Korea, Rep. of	57 (4.1)	563 (2.7)	42 (4.2)	556 (3.0)	2 (1.1)	~ ~	11.6 (0.17)
England	47 (4.0)	525 (7.8)	53 (4.0)	542 (7.3)	0 (0.0)	~ ~	11.3 (0.16)
Australia	45 (3.0)	531 (8.0)	52 (2.9)	514 (5.8)	3 (1.5)	523 (31.0)	11.2 (0.16)
New Zealand	43 (3.8)	524 (7.2)	56 (3.6)	506 (7.0)	2 (1.3)	~ ~	11.4 (0.16)
Norway	41 (4.5)	495 (4.2)	59 (4.5)	494 (3.3)	0 (0.0)	~ ~	11.1 (0.10)
Sweden	40 (5.1)	517 (3.7)	60 (5.0)	508 (4.3)	0 (0.2)	~ ~	11.0 (0.13)
Hong Kong SAR	39 (4.2)	545 (7.9)	55 (4.8)	529 (5.3)	7 (2.5)	511 (23.0)	10.9 (0.19)
United States	39 (2.5)	538 (4.6)	59 (2.6)	517 (3.8)	3 (0.9)	543 (12.6)	11.0 (0.10)
Qatar	32 (1.0)	434 (8.3)	30 (0.7)	446 (5.6)	38 (0.5)	379 (4.0)	9.1 (0.06)
Japan	31 (4.3)	571 (4.8)	69 (4.3)	552 (2.6)	1 (0.0)	~ ~	10.7 (0.14)
Chinese Taipei	31 (4.0)	570 (6.3)	68 (4.1)	561 (2.8)	2 (1.1)	~ ~	10.6 (0.16)
Israel	29 (3.8)	538 (7.9)	59 (4.1)	519 (5.5)	12 (2.2)	458 (13.1)	10.1 (0.19)
Kazakhstan	27 (3.8)	505 (7.8)	65 (4.3)	484 (5.8)	8 (2.4)	490 (17.4)	10.2 (0.19)
United Arab Emirates	26 (1.8)	493 (5.0)	59 (2.2)	454 (3.8)	15 (1.6)	454 (6.1)	9.7 (0.10)
Finland	25 (3.7)	556 (4.4)	75 (3.7)	551 (2.6)	1 (0.6)	~ ~	10.7 (0.10)
Armenia	25 (3.2)	448 (7.5)	75 (3.3)	434 (4.1)	1 (0.0)	~ ~	10.5 (0.10)
Hungary	24 (3.8)	531 (5.1)	71 (3.8)	518 (4.4)	4 (1.9)	535 (10.2)	10.4 (0.15)
Russian Federation	22 (3.5)	547 (10.5)	74 (3.8)	543 (3.2)	4 (1.4)	515 (13.8)	10.1 (0.13)
Lebanon	19 (3.1)	454 (15.0)	72 (3.4)	389 (5.5)	9 (2.1)	441 (15.0)	9.8 (0.17)
Malaysia	18 (2.6)	454 (14.0)	69 (3.5)	420 (6.8)	14 (2.5)	422 (16.5)	9.4 (0.15)
Lithuania	16 (3.4)	524 (7.6)	84 (3.4)	511 (3.2)	0 (0.0)	~ ~	10.3 (0.10)
Chile	15 (2.3)	501 (6.8)	82 (2.8)	455 (3.3)	3 (1.4)	464 (15.4)	9.7 (0.10)
Romania	14 (2.8)	480 (13.3)	84 (3.1)	462 (3.9)	2 (1.4)	~ ~	9.9 (0.12)
Bahrain	14 (0.1)	524 (5.4)	77 (0.2)	440 (2.1)	9 (0.2)	451 (6.3)	9.5 (0.01)
Georgia	12 (2.3)	422 (10.7)	86 (2.5)	420 (3.3)	2 (1.2)	~ ~	10.1 (0.10)
Oman	12 (1.4)	453 (10.4)	76 (2.4)	413 (4.0)	12 (2.3)	435 (8.4)	9.0 (0.10)
Italy	11 (2.1)	525 (7.5)	88 (2.1)	498 (2.9)	1 (0.0)	~ ~	10.0 (0.08)
Jordan	10 (2.0)	470 (13.7)	80 (2.8)	444 (4.6)	11 (2.1)	469 (14.3)	9.1 (0.12)
Saudi Arabia	9 (2.4)	418 (15.4)	86 (2.8)	438 (4.0)	5 (1.8)	445 (11.4)	9.4 (0.12)
Ghana	8 (2.1)	306 (15.2)	89 (2.4)	305 (5.6)	3 (1.5)	347 (37.2)	10.0 (0.09)
Macedonia, Rep. of	6 (2.2)	444 (25.2)	89 (2.1)	407 (5.8)	5 (1.3)	392 (39.8)	9.4 (0.11)
Thailand	5 (1.6)	466 (19.1)	76 (3.4)	453 (4.8)	19 (3.0)	438 (8.3)	8.5 (0.11)
Indonesia	5 (2.9)	353 (30.6)	89 (2.9)	406 (3.9)	7 (2.1)	438 (12.7)	9.0 (0.13)
Palestinian Nat'l Auth.	4 (1.2)	426 (9.5)	90 (2.3)	419 (3.7)	6 (2.0)	439 (8.9)	9.0 (0.10)
Morocco	4 (1.0)	433 (16.1)	93 (1.3)	371 (2.4)	3 (0.8)	456 (16.7)	9.5 (0.07)
Iran, Islamic Rep. of	3 (1.1)	550 (25.6)	85 (2.4)	474 (4.2)	12 (2.2)	457 (9.9)	8.8 (0.09)
Tunisia	2 (0.9)	~ ~	96 (1.5)	439 (2.6)	2 (1.2)	~ ~	9.4 (0.08)
Ukraine	1 (1.1)	~ ~	80 (3.4)	500 (3.9)	19 (3.2)	504 (8.2)	8.5 (0.10)
Turkey	1 (0.6)	~ ~	80 (2.7)	480 (3.6)	19 (2.6)	478 (9.8)	8.3 (0.09)
Syrian Arab Republic	1 (0.9)	~ ~	91 (2.5)	424 (4.2)	8 (2.3)	442 (8.4)	9.2 (0.09)
International Avg.	22 (0.4)	494 (1.9)	71 (0.5)	474 (0.7)	7 (0.3)	464 (3.3)	

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

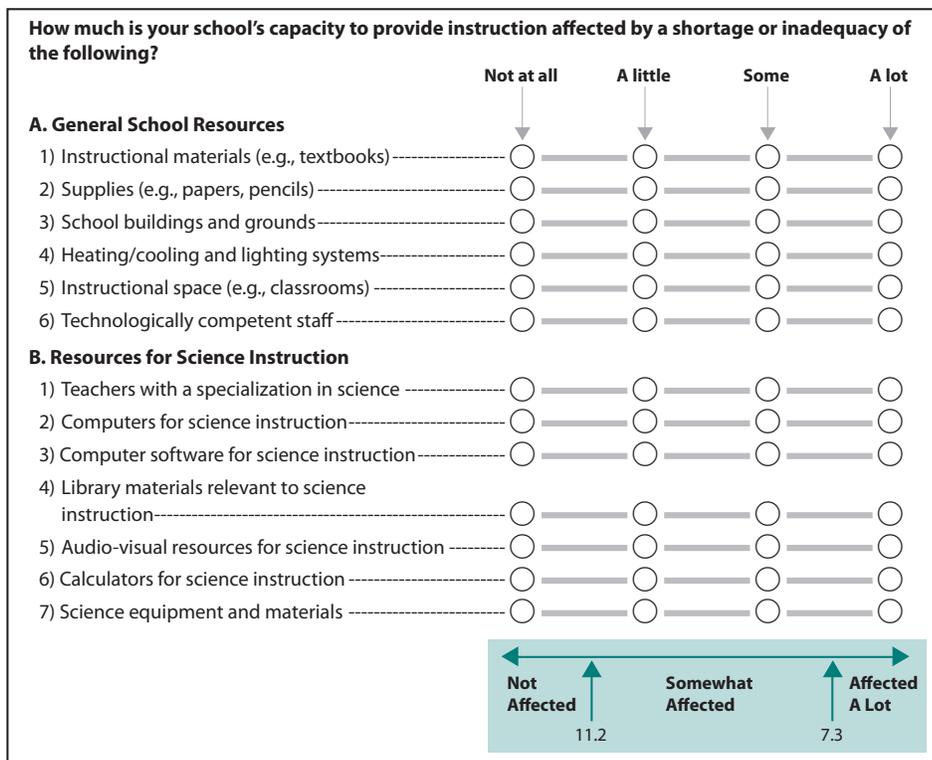
An "r" indicates data are available for at least 70% but less than 85% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 5.8: Instruction Affected by Science Resource Shortages (Continued)**

Country	Not Affected		Somewhat Affected		Affected A Lot		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Ninth Grade Participants</b>							
Honduras	13 (2.6)	410 (16.8)	78 (3.3)	364 (4.0)	9 (2.3)	344 (9.7)	9.3 (0.13)
South Africa	5 (1.0)	499 (24.0)	87 (2.2)	321 (4.3)	9 (2.1)	333 (13.6)	9.4 (0.10)
Botswana	1 (0.7)	~ ~	95 (2.0)	402 (3.9)	4 (1.8)	425 (20.1)	8.9 (0.09)
<b>Benchmarking Participants</b>							
Quebec, Canada	65 (3.4)	526 (3.5)	35 (3.4)	510 (4.3)	0 (0.0)	~ ~	12.0 (0.13)
Connecticut, US	57 (7.1)	547 (8.5)	42 (6.9)	516 (12.5)	2 (1.8)	~ ~	11.3 (0.24)
Florida, US	54 (8.0)	529 (11.8)	43 (7.9)	532 (13.0)	3 (2.4)	469 (15.8)	11.3 (0.35)
Indiana, US	52 (8.1)	534 (9.1)	48 (8.1)	538 (7.6)	0 (0.0)	~ ~	11.5 (0.25)
Dubai, UAE	43 (0.5)	510 (4.7)	42 (0.4)	466 (2.7)	15 (0.3)	469 (6.0)	10.4 (0.03)
Massachusetts, US	42 (6.9)	584 (10.2)	57 (6.6)	555 (9.1)	1 (0.1)	~ ~	11.0 (0.27)
Minnesota, US	40 (6.8)	561 (7.3)	60 (6.8)	549 (7.8)	0 (0.0)	~ ~	11.1 (0.26)
Alberta, Canada	38 (4.2)	553 (3.7)	59 (4.2)	542 (3.0)	3 (1.7)	540 (12.3)	11.0 (0.16)
California, US	36 (5.7)	500 (9.7)	64 (5.7)	498 (7.5)	0 (0.0)	~ ~	10.8 (0.23)
Alabama, US	33 (6.6)	505 (14.8)	65 (7.1)	479 (8.8)	2 (0.2)	~ ~	10.9 (0.25)
Ontario, Canada	28 (3.8)	529 (5.0)	71 (4.0)	519 (3.0)	1 (0.0)	~ ~	10.7 (0.14)
Colorado, US	22 (5.7)	554 (13.3)	76 (6.0)	539 (5.8)	2 (0.1)	~ ~	10.3 (0.26)
North Carolina, US	20 (6.3)	509 (16.7)	78 (6.5)	536 (8.2)	2 (0.1)	~ ~	10.3 (0.29)
Abu Dhabi, UAE	18 (3.0)	505 (12.6)	64 (3.8)	453 (6.4)	18 (3.0)	449 (7.7)	9.2 (0.18)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



### *Teacher Working Conditions*

There is evidence that, in some countries, teacher shortages may exist partly as a result of poor working conditions. For example, a review of research from the United States suggests that teachers who leave the profession after just a few years are more likely to leave because of poor working conditions than because of low pay (Johnson, 2006). Although teachers' reports across countries are related to their expectations and need to be considered in the context of variations in economic situations, TIMSS 2011 asked the students' teachers to provide their views on the adequacy of their working conditions. More specifically, teachers were asked about five potential problem areas:

- ◆ The school building needing significant repair;
- ◆ Classrooms being overcrowded;
- ◆ Teachers having too many teaching hours;
- ◆ Teachers not having adequate workspace; and
- ◆ Teachers not having adequate instructional materials and supplies.

Exhibit 5.9 presents the results for the TIMSS 2011 fourth grade assessment for the Teacher Working Conditions scale (see the second page of the exhibit for details about the scale). Countries are ordered by the percentage of students whose teachers reported few problems with their working conditions. Teachers with **Hardly Any Problems** with their working conditions reported “not a problem” for three of the five areas and only “minor problems” for the other two, on average. There was a range of results across the fourth grade countries—from 5 to 51 percent, with about one-fourth of students in schools where teachers had **Hardly Any Problems**.

For this scale, the remaining two categories were **Minor Problems** and **Moderate Problems**. Teachers with **Moderate Problems** reported “moderate problem” for three of five conditions and “minor problem” for the other two, on average. All other students had teachers that reported **Minor Problems** with their working conditions. About half of the students, on average, across the fourth grade countries were in schools where teachers had **Minor Problems** and about one-fourth were in schools with **Moderate Problems**. Students whose teachers reported **Moderate Problems** had somewhat lower science achievement, on average, than those whose teachers reported **Minor Problems**, and those students in turn had lower achievement than students whose teachers reported **Hardly Any Problems** (481, 487, and 494, respectively). In general,

the results for the sixth grade and benchmarking participants followed a similar pattern. However, substantial percentages of students (ranging from 45–56%) in the sixth grade countries had teachers reporting moderate problems with school conditions.

Exhibit 5.10 presents the results for the Teacher Working Conditions scale for the TIMSS 2011 eighth grade assessment. The eighth grade scale was based on responses by the students' science teachers to statements about the same five problem areas as the fourth grade. Eighth grade science teachers expressed about the same level of satisfaction with working conditions as fourth grade teachers, with 20 percent of students in schools whose teachers reported **Hardly Any Problems** and 32 percent in schools with **Moderate Problems**. On average across countries, the science achievement difference between these two groups of students was 16 points (489 vs. 473).

### *Difficulties Filling Vacancies for Science Teachers*

Recent research suggests that teachers are in relatively short supply in some countries, and that the impending retirement of aging teachers will further contribute to this shortage (Ingersoll & Perda, 2010). TIMSS Advanced 2008 noted that, in several countries, not only were teachers of physics nearing retirement age, but relatively few students were considering physics as a career option, suggesting that there also may be a shortage of students entering science education careers (Mullis, Martin, Robitaille, & Foy, 2009).

Exhibit 5.11 summarizes school principals' reports from the TIMSS 2011 eighth grade assessment about difficulties in filling vacancies for science teachers. In most countries, on average, eighth grade students were in schools where principals reported that there were no vacancies (56%) or that vacancies were easy to fill (25%). Average science achievement was similar for these two groups of students (477 and 479, respectively). However, average achievement was somewhat lower among the 15 percent of students in schools where vacancies were somewhat difficult to fill (468) and among the 4 percent in schools where vacancies were very difficult to fill (459).

## Exhibit 5.9: Teacher Working Conditions

Reported by Teachers

Students were scored according to their teachers' responses concerning five potential problem areas on the *Teacher Working Conditions* scale. Students whose teachers had **Hardly Any Problems** with their working conditions had a score on the scale of at least 11.3, which corresponds to their teachers reporting "not a problem" for three of five areas and "minor problem" for the other two, on average. Students whose teachers had **Moderate Problems** had a score no higher than 8.7, which corresponds to their teachers reporting "moderate problem" for three of five conditions and "minor problem" for the other two, on average. All other students had teachers that reported **Minor Problems** with their working conditions.

Country	Hardly Any Problems		Minor Problems		Moderate Problems		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
United States	r 51 (2.2)	550 (2.6)	39 (2.3)	544 (3.4)	10 (1.5)	522 (6.8)	11.2 (0.09)
Poland	49 (3.6)	498 (3.1)	44 (3.5)	513 (3.6)	7 (1.5)	507 (7.8)	11.2 (0.13)
Czech Republic	45 (4.4)	537 (4.7)	46 (4.3)	535 (3.1)	9 (2.3)	544 (4.7)	11.0 (0.15)
Australia	r 45 (4.1)	528 (5.6)	37 (4.3)	514 (5.9)	18 (2.6)	507 (8.1)	10.9 (0.17)
United Arab Emirates	43 (2.2)	438 (4.6)	40 (2.3)	424 (4.7)	17 (1.7)	422 (6.2)	10.8 (0.10)
England	41 (4.2)	528 (5.4)	52 (4.5)	533 (4.9)	7 (2.2)	518 (12.3)	11.0 (0.14)
New Zealand	41 (3.3)	500 (4.4)	44 (3.1)	498 (3.7)	15 (2.3)	487 (7.5)	10.7 (0.13)
Slovak Republic	38 (3.5)	529 (5.6)	49 (3.3)	529 (5.4)	13 (2.3)	548 (6.6)	10.6 (0.11)
Ireland	38 (4.0)	522 (5.4)	47 (3.8)	510 (4.9)	15 (2.5)	522 (8.2)	10.8 (0.17)
Belgium (Flemish)	37 (3.6)	510 (3.1)	47 (3.9)	511 (2.6)	16 (2.8)	499 (6.7)	10.6 (0.14)
Kuwait	36 (3.9)	350 (8.2)	43 (4.2)	341 (7.6)	21 (3.0)	351 (9.8)	10.5 (0.17)
Chile	35 (4.2)	500 (5.8)	38 (3.9)	472 (5.9)	27 (3.5)	468 (6.5)	10.2 (0.17)
Northern Ireland	r 34 (4.7)	522 (5.6)	50 (4.3)	517 (4.3)	16 (3.5)	506 (7.4)	10.6 (0.19)
Qatar	34 (3.6)	399 (11.5)	54 (4.1)	407 (6.9)	13 (2.1)	333 (13.7)	10.6 (0.14)
Singapore	33 (2.5)	592 (6.0)	50 (2.9)	578 (5.4)	17 (2.1)	583 (8.2)	10.5 (0.10)
Spain	32 (3.8)	508 (4.8)	46 (4.1)	506 (4.3)	22 (3.1)	502 (4.7)	10.3 (0.13)
Hungary	31 (3.4)	520 (7.2)	50 (3.5)	543 (5.4)	19 (2.8)	533 (7.3)	10.4 (0.15)
Austria	30 (3.6)	537 (4.3)	45 (3.7)	534 (3.7)	24 (3.5)	521 (5.2)	10.3 (0.18)
Lithuania	30 (3.2)	511 (4.6)	60 (3.2)	515 (3.3)	10 (2.0)	516 (4.6)	10.5 (0.11)
Malta	30 (0.1)	449 (2.8)	49 (0.1)	455 (2.9)	21 (0.1)	422 (3.0)	10.3 (0.00)
Netherlands	r 29 (4.3)	530 (4.6)	53 (5.0)	531 (3.5)	18 (3.7)	527 (6.0)	10.3 (0.17)
Slovenia	29 (3.6)	523 (4.5)	44 (4.0)	522 (3.4)	27 (3.2)	514 (4.8)	10.0 (0.14)
Kazakhstan	29 (3.8)	504 (10.6)	44 (3.9)	499 (8.9)	27 (3.7)	480 (9.0)	10.0 (0.19)
Croatia	27 (3.0)	509 (4.4)	51 (3.5)	519 (2.7)	21 (3.0)	518 (3.7)	10.2 (0.14)
Thailand	27 (4.0)	482 (7.8)	50 (4.3)	473 (6.9)	23 (3.8)	463 (17.3)	10.2 (0.16)
Romania	26 (3.4)	505 (10.5)	44 (4.2)	504 (7.6)	30 (3.6)	504 (11.7)	9.9 (0.15)
Bahrain	26 (4.3)	477 (8.4)	39 (4.5)	433 (7.1)	35 (5.0)	448 (5.2)	9.9 (0.21)
Georgia	25 (3.2)	459 (7.7)	56 (4.1)	448 (4.9)	19 (2.8)	470 (7.7)	10.1 (0.14)
Russian Federation	24 (3.1)	554 (6.3)	54 (4.0)	553 (4.3)	23 (2.9)	548 (6.7)	10.0 (0.12)
Chinese Taipei	23 (3.4)	551 (5.1)	55 (3.9)	555 (2.8)	22 (3.3)	546 (5.6)	10.1 (0.16)
Finland	21 (3.0)	574 (5.1)	62 (4.2)	569 (2.9)	17 (3.4)	572 (4.0)	10.1 (0.12)
Italy	r 20 (2.6)	535 (5.6)	47 (3.6)	527 (4.0)	34 (3.8)	517 (5.3)	9.7 (0.11)
Azerbaijan	19 (2.9)	448 (14.9)	46 (3.8)	438 (8.2)	35 (3.4)	434 (8.2)	9.7 (0.14)
Japan	19 (3.3)	564 (4.6)	38 (3.9)	556 (3.3)	43 (3.5)	559 (2.3)	9.4 (0.15)
Turkey	18 (2.3)	491 (7.6)	43 (3.0)	473 (6.9)	39 (3.1)	438 (8.1)	9.4 (0.13)
Iran, Islamic Rep. of	18 (2.4)	471 (10.1)	51 (4.2)	451 (6.0)	31 (4.3)	447 (8.4)	9.7 (0.15)
Denmark	17 (2.8)	537 (4.9)	56 (3.9)	529 (3.9)	27 (3.5)	527 (4.3)	9.9 (0.13)
Saudi Arabia	16 (2.4)	462 (10.4)	49 (4.0)	430 (7.0)	35 (3.8)	413 (10.7)	9.4 (0.17)
Serbia	16 (3.1)	514 (5.6)	48 (3.9)	514 (4.5)	36 (3.8)	517 (4.4)	9.5 (0.13)
Hong Kong SAR	r 16 (3.7)	539 (8.0)	50 (4.2)	536 (3.9)	34 (4.1)	531 (10.1)	9.5 (0.17)
Portugal	16 (4.7)	513 (17.3)	46 (4.9)	528 (5.5)	38 (4.8)	519 (4.8)	9.3 (0.26)
Armenia	16 (2.5)	416 (9.2)	49 (3.6)	416 (5.5)	35 (3.7)	417 (6.1)	9.5 (0.11)
Norway	15 (3.4)	497 (6.0)	49 (5.1)	493 (2.9)	36 (5.0)	495 (3.9)	9.4 (0.17)
Oman	15 (2.0)	390 (9.3)	47 (3.2)	376 (4.8)	38 (3.3)	373 (6.8)	9.3 (0.11)
Korea, Rep. of	15 (3.1)	583 (4.6)	52 (4.0)	586 (2.9)	33 (4.0)	590 (3.3)	9.5 (0.15)
Germany	r 15 (1.9)	536 (6.8)	49 (3.1)	534 (3.3)	37 (3.1)	518 (5.1)	9.4 (0.13)
Sweden	10 (2.6)	534 (8.9)	47 (4.1)	539 (3.7)	44 (4.6)	530 (4.7)	9.1 (0.16)
Yemen	9 (2.7)	201 (20.6)	43 (4.4)	205 (9.6)	48 (4.6)	213 (11.5)	8.9 (0.14)
Morocco	5 (1.0)	371 (16.8)	19 (3.4)	285 (16.2)	75 (3.4)	252 (4.9)	7.9 (0.11)
Tunisia	5 (1.2)	396 (12.7)	25 (4.0)	352 (10.3)	70 (4.1)	340 (6.0)	8.0 (0.17)
International Avg.	26 (0.5)	494 (1.2)	47 (0.5)	487 (0.8)	27 (0.5)	481 (1.1)	

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

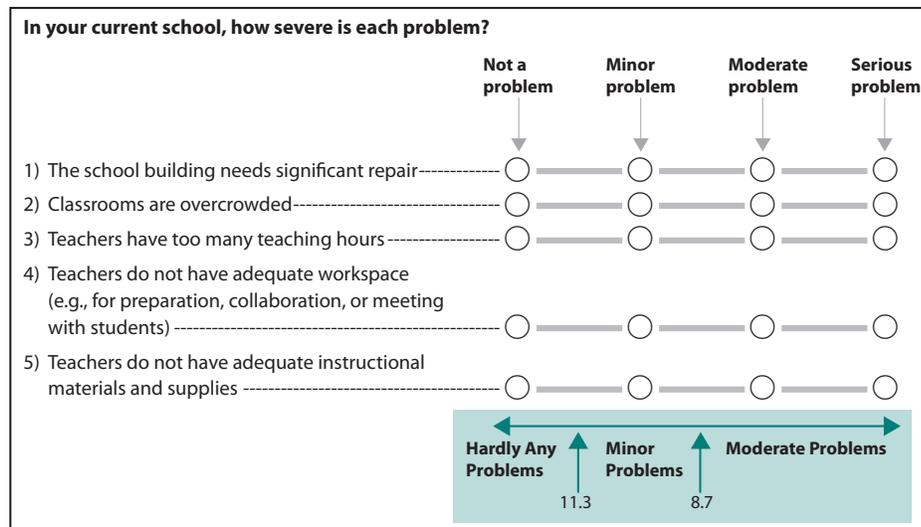
An "r" indicates data are available for at least 70% but less than 85% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 5.9: Teacher Working Conditions (Continued)**

Country	Hardly Any Problems		Minor Problems		Moderate Problems		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Sixth Grade Participants</b>							
Honduras	15 (3.1)	475 (18.0)	40 (4.5)	434 (7.3)	45 (4.4)	415 (8.5)	9.3 (0.17)
Yemen	11 (3.1)	341 (21.2)	33 (4.3)	332 (11.7)	56 (4.8)	354 (9.6)	8.7 (0.17)
Botswana	7 (1.7)	456 (42.5)	38 (4.0)	377 (12.3)	55 (3.9)	355 (6.3)	8.6 (0.13)
<b>Benchmarking Participants</b>							
Florida, US	r 58 (5.6)	544 (4.7)	34 (5.7)	549 (10.2)	7 (2.9)	520 (11.2)	11.5 (0.20)
Dubai, UAE	r 45 (3.0)	481 (5.7)	45 (3.1)	462 (6.9)	10 (1.0)	426 (12.0)	11.0 (0.11)
Abu Dhabi, UAE	44 (4.5)	424 (8.1)	38 (4.5)	404 (9.1)	18 (3.2)	408 (13.6)	10.9 (0.19)
Alberta, Canada	r 44 (4.7)	541 (5.0)	46 (4.4)	544 (3.8)	10 (2.6)	535 (6.2)	10.8 (0.16)
Ontario, Canada	40 (4.0)	524 (4.1)	52 (4.1)	530 (4.1)	8 (2.1)	535 (7.5)	10.8 (0.13)
Quebec, Canada	36 (4.7)	523 (4.5)	49 (4.6)	515 (3.2)	15 (3.7)	507 (7.5)	10.6 (0.17)
North Carolina, US	35 (6.5)	532 (8.4)	57 (6.8)	537 (4.6)	7 (2.3)	572 (13.0)	10.6 (0.24)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



## Exhibit 5.10: Teacher Working Conditions

Reported by Teachers

Students were scored according to their teachers' responses concerning five potential problem areas on the *Teacher Working Conditions* scale. Students whose teachers had **Hardly Any Problems** with their working conditions had a score on the scale of at least 11.7, which corresponds to their teachers reporting "not a problem" for three of five areas and "minor problem" for the other two, on average. Students whose teachers had **Moderate Problems** had a score no higher than 8.9, which corresponds to their teachers reporting "moderate problem" for three of five conditions and "minor problem" for the other two, on average. All other students had teachers that reported **Minor Problems** with their working conditions.

Country	Hardly Any Problems		Minor Problems		Moderate Problems		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Qatar	51 (4.2)	420 (9.1)	34 (4.6)	408 (10.5)	16 (2.1)	435 (15.8)	11.4 (0.14)
United States	r 40 (2.6)	538 (5.8)	48 (2.5)	522 (3.8)	12 (1.5)	508 (8.1)	11.2 (0.10)
Lebanon	37 (3.6)	427 (8.1)	45 (3.6)	399 (6.7)	19 (2.9)	383 (11.4)	10.8 (0.16)
United Arab Emirates	36 (2.4)	467 (3.9)	44 (2.1)	457 (4.0)	19 (2.1)	460 (5.6)	10.8 (0.12)
Hungary	29 (2.5)	510 (4.2)	49 (2.5)	526 (4.1)	22 (2.3)	531 (5.2)	10.5 (0.11)
Romania	29 (2.5)	465 (5.8)	50 (2.3)	465 (4.5)	21 (2.0)	465 (4.9)	10.5 (0.10)
Slovenia	28 (2.3)	542 (3.4)	46 (2.3)	542 (3.3)	25 (2.0)	544 (3.3)	10.5 (0.10)
Singapore	28 (2.5)	595 (8.9)	56 (2.6)	591 (6.2)	16 (1.8)	579 (10.0)	10.6 (0.09)
Australia	s 27 (3.4)	527 (10.0)	54 (3.0)	522 (6.0)	18 (2.7)	533 (9.9)	10.6 (0.16)
Italy	26 (3.2)	503 (5.4)	55 (4.0)	501 (3.8)	19 (3.0)	502 (7.5)	10.4 (0.12)
Lithuania	26 (2.5)	511 (3.9)	57 (2.2)	513 (2.8)	17 (2.0)	521 (5.4)	10.5 (0.10)
Bahrain	25 (2.3)	495 (5.4)	37 (3.3)	451 (4.9)	38 (2.6)	427 (4.4)	10.1 (0.11)
England	r 23 (3.0)	536 (9.5)	48 (3.5)	531 (7.3)	28 (3.3)	529 (9.9)	10.2 (0.14)
Russian Federation	23 (2.2)	550 (4.1)	60 (2.6)	543 (3.9)	17 (1.9)	532 (5.8)	10.5 (0.09)
New Zealand	23 (3.3)	511 (8.0)	56 (4.1)	514 (6.6)	21 (3.5)	501 (12.0)	10.3 (0.16)
Kazakhstan	21 (2.6)	515 (8.7)	46 (2.9)	491 (6.0)	33 (3.2)	474 (5.3)	10.0 (0.15)
Georgia	21 (2.4)	422 (6.3)	51 (3.0)	417 (4.3)	29 (2.8)	426 (4.4)	10.1 (0.12)
Macedonia, Rep. of	20 (2.5)	431 (10.0)	46 (2.6)	412 (7.7)	34 (2.7)	395 (6.9)	10.0 (0.12)
Saudi Arabia	20 (3.4)	448 (8.9)	48 (4.3)	437 (4.8)	32 (3.7)	428 (8.0)	9.8 (0.16)
Chile	20 (2.8)	479 (7.5)	36 (3.6)	464 (4.6)	44 (4.0)	451 (5.1)	9.7 (0.16)
Ukraine	18 (2.6)	502 (5.9)	64 (2.9)	506 (4.4)	17 (2.5)	483 (6.1)	10.3 (0.11)
Japan	18 (3.2)	567 (7.9)	42 (4.5)	559 (3.7)	40 (4.2)	552 (3.6)	9.8 (0.18)
Finland	18 (2.5)	558 (4.7)	58 (2.5)	549 (2.8)	24 (2.4)	554 (3.5)	10.1 (0.11)
Iran, Islamic Rep. of	18 (2.3)	495 (9.6)	49 (3.4)	469 (6.0)	33 (3.3)	473 (5.9)	9.9 (0.10)
Turkey	18 (2.1)	497 (13.4)	44 (3.4)	481 (4.8)	38 (3.0)	478 (6.3)	9.7 (0.10)
Israel	17 (3.4)	524 (9.9)	43 (4.4)	511 (6.8)	39 (4.1)	522 (6.4)	9.7 (0.17)
Chinese Taipei	17 (3.0)	561 (7.5)	61 (4.2)	563 (3.4)	21 (3.2)	569 (6.1)	10.1 (0.11)
Jordan	17 (2.9)	484 (9.0)	37 (4.1)	453 (6.7)	46 (3.9)	432 (7.3)	9.4 (0.18)
Thailand	17 (3.2)	446 (12.0)	57 (4.4)	451 (5.4)	26 (3.8)	453 (9.6)	10.0 (0.13)
Hong Kong SAR	16 (3.6)	541 (12.5)	58 (4.1)	532 (4.5)	25 (4.1)	541 (9.7)	10.1 (0.15)
Norway	12 (2.6)	497 (4.8)	60 (3.8)	493 (3.0)	28 (3.2)	494 (4.9)	9.7 (0.12)
Palestinian Nat'l Auth.	12 (2.6)	437 (10.2)	49 (4.1)	422 (5.3)	39 (3.7)	413 (6.2)	9.5 (0.13)
Syrian Arab Republic	12 (2.0)	423 (11.3)	45 (3.6)	428 (5.8)	42 (3.9)	425 (5.9)	9.5 (0.16)
Indonesia	12 (2.6)	428 (9.5)	39 (4.2)	414 (5.4)	50 (4.3)	393 (7.6)	9.3 (0.16)
Tunisia	11 (2.4)	442 (11.4)	47 (3.9)	439 (3.7)	42 (3.9)	437 (4.1)	9.3 (0.14)
Malaysia	10 (2.1)	433 (20.8)	56 (3.5)	419 (9.0)	34 (3.5)	435 (9.5)	9.6 (0.11)
Armenia	9 (1.6)	459 (8.3)	50 (2.6)	440 (4.3)	41 (3.1)	432 (4.8)	9.5 (0.10)
Oman	9 (1.6)	439 (12.7)	34 (3.1)	431 (5.7)	57 (3.1)	410 (5.2)	9.0 (0.11)
Korea, Rep. of	7 (2.0)	569 (6.2)	40 (3.7)	557 (3.0)	53 (3.8)	561 (2.7)	9.1 (0.13)
Morocco	7 (1.0)	443 (9.2)	25 (2.1)	374 (4.1)	68 (2.3)	371 (2.4)	8.6 (0.09)
Sweden	r 5 (1.6)	527 (9.9)	54 (3.2)	515 (3.6)	41 (3.4)	503 (4.2)	9.2 (0.11)
Ghana	5 (1.7)	366 (20.3)	35 (4.0)	322 (8.4)	60 (4.2)	293 (7.3)	8.6 (0.15)
International Avg.	20 (0.4)	489 (1.5)	48 (0.5)	477 (0.8)	32 (0.5)	473 (1.1)	

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

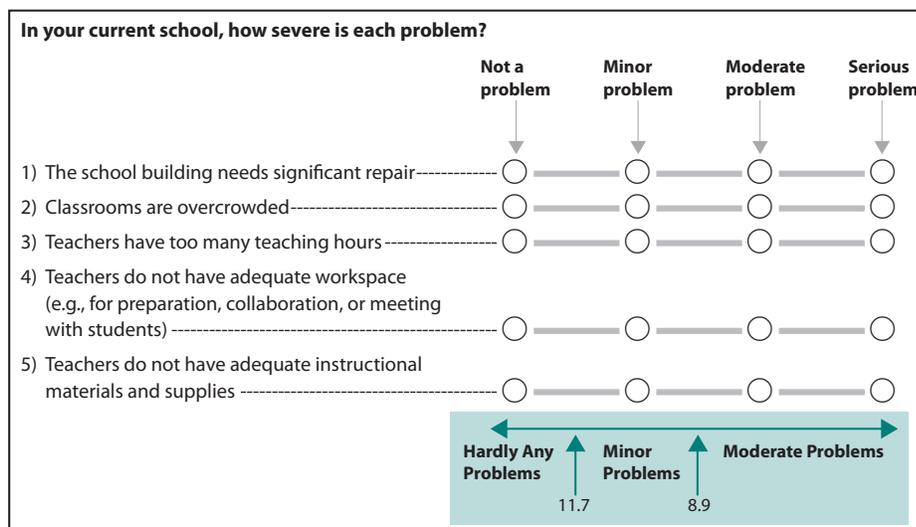
An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

An "x" indicates data are available for less than 50% of students.

**Exhibit 5.10: Teacher Working Conditions (Continued)**

Country	Hardly Any Problems		Minor Problems		Moderate Problems		Average Scale Score	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement		
<b>Ninth Grade Participants</b>								
Honduras	13 (3.0)	397 (10.3)	39 (4.0)	372 (6.6)	48 (3.9)	359 (5.6)	9.4 (0.16)	
South Africa	5 (0.9)	505 (13.2)	30 (3.3)	349 (9.4)	64 (3.3)	306 (4.6)	8.4 (0.12)	
Botswana	2 (1.0)	~ ~	26 (3.6)	403 (8.4)	72 (3.6)	401 (4.0)	7.8 (0.16)	
<b>Benchmarking Participants</b>								
Indiana, US	r	52 (6.6)	539 (6.8)	40 (6.2)	532 (7.3)	8 (3.7)	525 (15.5)	11.7 (0.32)
Ontario, Canada		50 (4.2)	521 (3.8)	37 (3.9)	521 (4.4)	13 (3.0)	525 (8.8)	11.4 (0.20)
Dubai, UAE	r	45 (3.0)	501 (4.0)	43 (3.5)	464 (6.1)	12 (1.8)	450 (11.9)	11.2 (0.12)
Massachusetts, US	r	41 (7.0)	575 (11.1)	53 (6.6)	560 (10.5)	6 (3.3)	514 (26.9)	11.1 (0.26)
North Carolina, US	s	38 (6.4)	531 (8.2)	47 (6.8)	532 (16.6)	14 (5.1)	493 (18.8)	10.8 (0.27)
Minnesota, US	r	36 (6.9)	563 (7.2)	48 (6.5)	543 (9.3)	16 (4.3)	564 (14.9)	10.9 (0.30)
Alabama, US	r	36 (6.6)	501 (8.5)	46 (6.0)	476 (10.1)	18 (4.4)	465 (11.9)	10.7 (0.34)
Colorado, US		35 (6.9)	550 (9.1)	57 (6.6)	538 (8.7)	7 (2.8)	524 (13.1)	11.2 (0.30)
California, US	s	33 (5.1)	504 (8.9)	52 (5.0)	496 (7.3)	14 (3.8)	504 (19.1)	10.8 (0.18)
Quebec, Canada		33 (4.1)	529 (4.9)	57 (4.4)	519 (4.4)	10 (2.2)	500 (7.7)	10.7 (0.12)
Connecticut, US	r	33 (6.0)	574 (9.5)	48 (6.8)	524 (11.9)	20 (5.6)	486 (16.3)	10.7 (0.26)
Alberta, Canada		32 (3.6)	548 (4.5)	50 (3.9)	548 (3.3)	19 (3.1)	537 (3.5)	10.8 (0.15)
Abu Dhabi, UAE		29 (4.0)	463 (6.6)	52 (3.8)	456 (6.4)	19 (3.3)	467 (8.9)	10.6 (0.19)
Florida, US		x x	x x	x x	x x	x x	x x	x x

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



**Exhibit 5.11: Schools with Difficulties Filling Vacancies for Science Teachers**

Reported by Principals

Country	No Vacancies		Vacancies Are Easy to Fill		Vacancies Are Somewhat Difficult to Fill		Vacancies Are Very Difficult to Fill	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	94 (2.2)	436 (3.3)	4 (1.7)	477 (19.5)	2 (1.4)	~ ~	0 (0.0)	~ ~
Australia	25 (2.7)	520 (8.1)	37 (3.2)	535 (8.0)	32 (3.3)	507 (7.0)	7 (2.1)	526 (28.4)
Bahrain	37 (0.3)	457 (3.2)	33 (0.3)	458 (2.8)	26 (0.3)	440 (5.1)	5 (0.1)	447 (9.6)
Chile	69 (3.9)	468 (3.7)	10 (2.5)	450 (12.1)	16 (3.1)	447 (6.7)	4 (1.8)	463 (13.7)
Chinese Taipei	41 (3.8)	566 (4.0)	36 (3.9)	564 (5.0)	18 (2.5)	562 (6.5)	4 (1.7)	554 (11.4)
England	28 (4.0)	546 (11.8)	41 (5.0)	538 (8.9)	27 (4.3)	518 (12.2)	4 (2.0)	518 (32.2)
Finland	57 (3.8)	555 (2.7)	37 (3.5)	550 (4.6)	6 (1.9)	546 (4.5)	0 (0.0)	~ ~
Georgia	86 (2.9)	421 (3.4)	4 (1.6)	410 (17.2)	7 (2.0)	421 (12.1)	3 (1.1)	416 (20.8)
Ghana	44 (3.6)	312 (8.9)	23 (3.5)	321 (13.5)	26 (3.9)	275 (7.4)	7 (2.1)	306 (24.5)
Hong Kong SAR	55 (5.1)	531 (5.9)	38 (5.1)	538 (7.9)	6 (2.4)	553 (12.3)	0 (0.0)	~ ~
Hungary	--	--	--	--	--	--	--	--
Indonesia	45 (4.5)	425 (6.4)	23 (4.0)	394 (8.3)	27 (3.9)	380 (10.4)	6 (1.9)	409 (13.1)
Iran, Islamic Rep. of	37 (3.4)	489 (6.9)	41 (3.4)	462 (5.5)	19 (2.8)	472 (7.8)	3 (1.2)	490 (22.2)
Israel	44 (3.6)	515 (7.2)	15 (3.1)	512 (14.9)	22 (3.4)	517 (9.0)	19 (3.7)	520 (11.0)
Italy	71 (3.4)	502 (3.3)	21 (3.0)	498 (6.7)	8 (1.4)	503 (6.9)	0 (0.4)	~ ~
Japan	83 (3.3)	558 (2.6)	3 (1.6)	562 (9.7)	6 (2.1)	562 (7.2)	8 (2.1)	550 (7.9)
Jordan	46 (3.6)	448 (6.9)	30 (3.6)	455 (6.5)	21 (3.0)	442 (7.7)	3 (1.3)	437 (31.7)
Kazakhstan	68 (3.9)	492 (4.7)	21 (3.4)	489 (12.7)	10 (2.7)	483 (10.3)	1 (0.6)	~ ~
Korea, Rep. of	69 (4.0)	559 (2.3)	20 (3.0)	565 (4.7)	11 (2.9)	552 (5.9)	0 (0.0)	~ ~
Lebanon	38 (4.3)	411 (9.2)	37 (4.4)	413 (10.0)	24 (3.5)	382 (9.8)	2 (1.1)	~ ~
Lithuania	93 (2.2)	514 (2.8)	4 (1.8)	517 (12.0)	2 (0.9)	~ ~	1 (0.9)	~ ~
Macedonia, Rep. of	56 (3.9)	422 (7.8)	33 (3.9)	414 (8.6)	9 (1.9)	335 (16.4)	1 (1.0)	~ ~
Malaysia	38 (3.2)	428 (9.2)	52 (3.3)	431 (9.0)	8 (1.8)	413 (30.1)	2 (1.2)	~ ~
Morocco	66 (2.9)	375 (3.0)	13 (2.2)	385 (8.5)	15 (2.6)	376 (6.9)	6 (1.7)	372 (8.5)
New Zealand	31 (4.2)	506 (7.6)	47 (5.1)	527 (6.2)	22 (4.2)	490 (9.7)	0 (0.3)	~ ~
Norway	37 (4.6)	497 (5.2)	36 (4.6)	497 (3.8)	24 (3.7)	490 (5.0)	3 (1.6)	479 (6.2)
Oman	54 (3.2)	412 (5.3)	22 (2.8)	434 (6.2)	17 (2.1)	425 (9.4)	8 (1.6)	420 (13.1)
Palestinian Nat'l Auth.	64 (3.8)	425 (4.8)	30 (3.6)	407 (7.1)	4 (1.7)	439 (20.2)	1 (0.9)	~ ~
Qatar	40 (0.3)	412 (5.3)	24 (0.3)	453 (7.0)	31 (0.5)	400 (7.2)	6 (0.1)	422 (9.0)
Romania	64 (4.3)	472 (5.0)	34 (4.4)	453 (5.7)	1 (1.0)	~ ~	1 (1.0)	~ ~
Russian Federation	79 (3.5)	545 (3.4)	11 (2.6)	529 (10.1)	8 (1.8)	534 (11.5)	2 (1.0)	~ ~
Saudi Arabia	53 (4.2)	439 (5.4)	32 (3.7)	429 (7.5)	12 (2.3)	444 (6.9)	3 (1.2)	443 (16.3)
Singapore	57 (0.0)	581 (6.0)	39 (0.0)	603 (6.3)	4 (0.0)	579 (17.0)	0 (0.0)	~ ~
Slovenia	83 (3.1)	543 (3.0)	14 (2.9)	544 (6.4)	1 (0.4)	~ ~	2 (1.2)	~ ~
Sweden	48 (4.6)	510 (4.0)	26 (3.8)	503 (6.6)	13 (2.9)	520 (9.9)	13 (3.6)	519 (6.1)
Syrian Arab Republic	37 (4.2)	425 (7.5)	32 (3.9)	432 (6.9)	20 (3.8)	432 (9.6)	10 (2.1)	406 (12.5)
Thailand	38 (3.9)	441 (6.7)	11 (2.1)	464 (14.8)	36 (3.9)	457 (7.7)	15 (2.9)	449 (10.4)
Tunisia	67 (3.3)	440 (3.3)	27 (3.2)	433 (4.5)	6 (1.7)	447 (17.8)	0 (0.0)	~ ~
Turkey	66 (3.0)	491 (4.4)	15 (2.5)	482 (9.6)	11 (2.3)	466 (7.7)	7 (1.6)	439 (9.7)
Ukraine	87 (3.3)	502 (3.5)	5 (1.8)	493 (13.6)	8 (2.8)	495 (17.3)	0 (0.0)	~ ~
United Arab Emirates	47 (2.2)	447 (3.4)	30 (2.0)	475 (5.3)	21 (1.7)	485 (5.7)	2 (0.6)	~ ~
United States	61 (2.6)	527 (4.1)	25 (1.9)	527 (5.4)	11 (1.6)	522 (11.0)	3 (0.7)	511 (17.0)
International Avg.	56 (0.5)	477 (0.9)	25 (0.5)	479 (1.5)	15 (0.4)	468 (1.9)	4 (0.2)	459 (3.6)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.  
 A dash (–) indicates comparable data not available. A tilde (~) indicates insufficient data to report achievement.  
 An "\*" indicates data are available for at least 70% but less than 85% of the students.

**Exhibit 5.11: Schools with Difficulties Filling Vacancies for Science Teachers (Continued)**

Country	No Vacancies		Vacancies Are Easy to Fill		Vacancies Are Somewhat Difficult to Fill		Vacancies Are Very Difficult to Fill	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
<b>Ninth Grade Participants</b>								
Botswana	47 (4.4)	401 (5.8)	21 (3.8)	415 (7.5)	22 (3.4)	401 (8.3)	10 (2.6)	396 (7.8)
Honduras	57 (4.6)	366 (5.9)	19 (3.9)	368 (6.0)	16 (3.6)	373 (12.3)	8 (2.4)	376 (12.8)
South Africa	47 (3.6)	333 (6.9)	8 (2.1)	361 (19.9)	28 (3.3)	342 (9.4)	17 (2.6)	299 (9.1)
<b>Benchmarking Participants</b>								
Alberta, Canada	59 (4.3)	546 (2.9)	33 (4.3)	549 (4.4)	8 (2.6)	539 (6.6)	0 (0.0)	~ ~
Ontario, Canada	71 (4.4)	521 (3.2)	20 (3.8)	523 (6.2)	8 (2.7)	520 (5.8)	0 (0.0)	~ ~
Quebec, Canada	32 (3.5)	533 (4.7)	42 (4.2)	519 (5.2)	20 (3.6)	504 (6.1)	6 (2.3)	513 (7.6)
Abu Dhabi, UAE	51 (4.6)	443 (5.4)	30 (4.3)	476 (12.0)	17 (3.3)	487 (10.5)	1 (0.9)	~ ~
Dubai, UAE	22 (0.3)	451 (3.9)	39 (0.4)	499 (4.1)	37 (0.5)	494 (4.9)	2 (0.0)	~ ~
Alabama, US	r 74 (6.2)	487 (9.1)	18 (5.0)	478 (16.5)	8 (4.0)	493 (39.3)	0 (0.0)	~ ~
California, US	r 58 (6.5)	491 (7.0)	27 (6.2)	528 (7.7)	9 (3.8)	476 (16.7)	6 (3.3)	494 (12.3)
Colorado, US	51 (6.5)	547 (8.8)	33 (5.6)	549 (9.1)	16 (4.5)	508 (21.5)	0 (0.0)	~ ~
Connecticut, US	78 (5.5)	538 (8.2)	13 (5.2)	520 (20.9)	4 (2.6)	531 (18.1)	5 (3.3)	494 (63.6)
Florida, US	34 (5.6)	538 (14.1)	52 (6.6)	529 (12.2)	6 (3.5)	529 (12.2)	8 (3.8)	486 (13.7)
Indiana, US	r 78 (4.9)	536 (5.9)	16 (5.2)	539 (10.6)	6 (3.6)	534 (27.5)	0 (0.0)	~ ~
Massachusetts, US	53 (6.6)	557 (8.8)	22 (5.5)	586 (11.1)	18 (6.1)	560 (15.3)	6 (3.8)	568 (39.8)
Minnesota, US	59 (7.0)	550 (8.1)	29 (6.8)	560 (8.7)	9 (4.7)	557 (13.4)	3 (2.7)	563 (6.8)
North Carolina, US	57 (5.6)	533 (11.5)	30 (5.2)	526 (10.8)	11 (3.0)	537 (28.7)	3 (2.4)	524 (4.2)

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011

### *Size of School Library*

Libraries, both within schools and local communities, provide a range of reading materials and other resources from which teachers can draw to expand their instructional approaches, and from which students can choose books for their own learning and enjoyment. Also, with growing technology use, libraries increasingly are becoming media centers offering Internet access to a wide range of materials, with the potential to improve achievement in all areas, including science.

Exhibit 5.12 presents principals' reports about the existence and size of school libraries for participants in the TIMSS 2011 fourth grade assessment. In considering these results, it is important to realize that, because of variation in policies across countries regarding school libraries and classroom libraries, some countries have well-resourced classroom libraries rather than a larger central library, so the lack of a school library does not necessarily mean that children do not have access to a variety of books. Also, primary schools tend to be smaller than middle and secondary schools, and may have small libraries as a result of their small enrollments.

On average, across the fourth grade countries, 32 percent of the students attended schools (for the most part primary schools) having well-resourced school libraries with more than 5,000 book titles. Another 38 percent of the students attended schools having libraries with between 501 and 5,000 book titles, and 17 percent attended schools having smaller library collections of 500 book titles or fewer. On average internationally, 13 percent of fourth grade students attended schools with no school library.

Average science achievement was positively related to size of school library, with fourth grade students attending schools with well-resourced school libraries having the highest achievement (505) and students with no school library the lowest achievement (472). In the sixth grade countries, there were few students in schools with libraries having more than 5,000 book titles, and high percentages of students (50% or greater) with no school library.

### *Schools with Computers Available for Instruction*

Recent research reviews suggest that computer use continues to grow in mathematics and science instruction, and that it can positively effect students' mathematics and science achievement. For example, a review of evaluation studies of computer use in US primary and secondary schools since 1990 found that computer tutorials in natural and social science classes have a strong record of effectiveness, and that simulation programs sometimes improve the effectiveness of science teaching, although the evidence is less definitive (Kulik, 2003).

Exhibit 5.13 shows principals' reports about the availability of computers for instruction for participants in the TIMSS fourth grade assessment. Internationally, 38 percent of the fourth grade students, on average, were in schools that had 1 computer for every 1–2 fourth grade students, 30 percent were in schools with 1 computer for every 3–5 fourth grade students, and 24 percent were in schools with 1 computer for 6 or more students. There was considerable variation from country to country, with the highest computer-to-student ratio in England (90% of students in schools with 1 computer for every 1–2 fourth grade students) and the lowest in Iran, Tunisia, and Yemen (7% or fewer students in such schools). On average, however, only 8 percent of the fourth grade students were in schools that did not have any computers available for instruction. The percentages of students in schools with no computers for instruction were higher for the sixth grade participants.

The relationship between computer availability and average science achievement is difficult to interpret because it is highly interrelated with socio-economic levels and instructional practices. In the primary grades, computer instruction can be used for remedial purposes as frequently (if not more frequently) because it can provide an increased variety of stimulating and challenging activities. However, the fourth grade students with access to computers for instruction had higher average science achievement than those students with no access to computers for instruction.

Exhibit 5.14 provides principals' reports about the availability of computers for instruction for participants in the TIMSS eighth grade assessment. Levels of computer availability are similar to the fourth grade (although a little more favorable), with 40 percent of the eighth grade students, on average, in schools that had 1 computer for every 1–2 eighth grade students, 28 percent in schools with 1 computer for every 3–5 eighth grade students, and 28 percent in schools with 1 computer for 6 or more students. Only 4 percent of the eighth grade students were in schools with no provision for computers for instruction. Eighth grade participants with 70 percent or more of students in schools with the highest computer-to-student ratio (1 computer for every 1–2 eighth grade students) included Australia, England, Georgia, Hungary, Macedonia, New Zealand, Norway, Slovenia, and, among benchmarking participants, Alberta, Colorado, and Indiana. Similar to the fourth grade, there was little relationship between computer-to-student ratio and science achievement, although average achievement was lower for the 4 percent of students in schools with no computers available for instruction.

## Exhibit 5.12: Size of School Library

Reported by Principals (Does not include classroom libraries)

Country	More than 5,000 Book Titles		501–5,000 Book Titles		500 Book Titles or Fewer		No School Library	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	42 (4.0)	414 (5.8)	50 (3.9)	417 (5.1)	8 (2.3)	421 (13.3)	0 (0.5)	~ ~
Australia	56 (3.6)	519 (4.0)	42 (3.7)	514 (5.2)	1 (0.5)	~ ~	1 (0.0)	~ ~
Austria	1 (0.1)	~ ~	45 (4.5)	534 (3.5)	27 (4.2)	517 (5.4)	27 (3.6)	541 (4.6)
Azerbaijan	29 (3.6)	450 (9.7)	44 (4.1)	442 (10.3)	28 (3.7)	422 (9.9)	0 (0.0)	~ ~
Bahrain	27 (4.8)	478 (7.4)	48 (5.5)	443 (5.6)	25 (4.1)	433 (10.4)	0 (0.0)	~ ~
Belgium (Flemish)	1 (0.0)	~ ~	13 (3.3)	507 (5.8)	26 (3.8)	513 (4.0)	60 (4.6)	508 (2.7)
Chile	16 (2.8)	519 (7.5)	58 (4.2)	478 (4.5)	22 (3.1)	471 (7.8)	4 (1.3)	466 (8.1)
Chinese Taipei	90 (2.8)	553 (2.3)	9 (2.7)	543 (6.2)	0 (0.0)	~ ~	1 (0.8)	~ ~
Croatia	39 (4.2)	518 (3.0)	53 (4.3)	515 (2.9)	8 (1.8)	504 (10.2)	0 (0.0)	~ ~
Czech Republic	6 (1.6)	533 (6.7)	55 (4.1)	536 (3.6)	23 (3.6)	540 (4.8)	17 (3.5)	533 (6.2)
Denmark	r 68 (3.6)	533 (3.3)	26 (3.7)	524 (6.5)	2 (1.5)	~ ~	4 (1.3)	529 (13.9)
England	13 (2.9)	521 (10.5)	63 (4.6)	536 (4.3)	15 (3.6)	516 (9.8)	8 (2.3)	503 (18.2)
Finland	4 (1.7)	583 (8.7)	47 (4.3)	569 (2.8)	27 (3.8)	571 (5.3)	21 (3.4)	568 (6.2)
Georgia	35 (3.2)	457 (4.7)	49 (3.6)	456 (7.3)	13 (2.4)	447 (8.3)	2 (1.3)	~ ~
Germany	2 (1.0)	~ ~	39 (3.4)	531 (4.5)	33 (3.6)	523 (5.0)	26 (3.3)	533 (4.7)
Hong Kong SAR	82 (3.2)	541 (4.3)	18 (3.2)	529 (6.1)	0 (0.0)	~ ~	0 (0.0)	~ ~
Hungary	52 (4.0)	543 (4.7)	41 (4.3)	528 (6.9)	3 (1.3)	518 (19.0)	4 (1.6)	523 (29.8)
Iran, Islamic Rep. of	3 (1.2)	507 (29.5)	40 (4.0)	479 (6.4)	37 (3.6)	447 (5.7)	20 (3.1)	413 (10.4)
Ireland	7 (2.1)	498 (9.0)	30 (4.0)	516 (6.8)	14 (2.8)	524 (10.3)	49 (4.2)	519 (4.8)
Italy	5 (1.4)	514 (15.3)	41 (3.9)	529 (4.1)	42 (3.8)	519 (4.9)	12 (2.6)	521 (7.4)
Japan	81 (3.1)	560 (2.2)	18 (3.2)	552 (4.3)	0 (0.0)	~ ~	1 (0.7)	~ ~
Kazakhstan	65 (3.9)	496 (6.5)	30 (3.9)	490 (10.0)	5 (1.9)	452 (20.8)	0 (0.0)	~ ~
Korea, Rep. of	92 (2.5)	587 (2.1)	8 (2.4)	578 (3.4)	0 (0.0)	~ ~	1 (0.0)	~ ~
Kuwait	3 (1.5)	342 (16.3)	37 (4.4)	356 (8.2)	59 (4.1)	347 (6.6)	1 (0.7)	~ ~
Lithuania	46 (3.9)	515 (3.8)	45 (4.0)	513 (4.4)	6 (1.7)	540 (10.3)	3 (0.8)	497 (10.8)
Malta	11 (0.1)	474 (4.5)	58 (0.1)	453 (1.9)	17 (0.1)	428 (4.7)	14 (0.1)	418 (4.4)
Morocco	0 (0.3)	~ ~	6 (2.2)	309 (20.6)	24 (3.0)	301 (10.1)	70 (3.3)	247 (5.8)
Netherlands	--	--	--	--	--	--	--	--
New Zealand	46 (3.8)	499 (4.7)	53 (3.7)	496 (4.2)	0 (0.0)	~ ~	1 (1.0)	~ ~
Northern Ireland	r 3 (1.5)	501 (17.0)	51 (4.6)	516 (4.9)	15 (3.9)	497 (13.7)	31 (4.0)	530 (5.5)
Norway	18 (4.0)	497 (4.8)	73 (4.8)	493 (3.2)	4 (2.3)	498 (5.1)	4 (2.0)	483 (9.2)
Oman	r 11 (2.2)	364 (9.9)	58 (3.7)	372 (5.0)	10 (2.1)	403 (17.9)	21 (2.6)	359 (7.8)
Poland	65 (3.6)	508 (3.4)	32 (3.6)	498 (5.1)	2 (1.0)	~ ~	1 (0.9)	~ ~
Portugal	5 (2.0)	512 (10.0)	47 (5.4)	514 (5.9)	24 (4.0)	536 (8.9)	25 (4.1)	524 (5.4)
Qatar	52 (3.4)	408 (7.9)	34 (3.3)	367 (7.9)	13 (2.2)	383 (7.8)	1 (1.0)	~ ~
Romania	45 (3.9)	521 (7.8)	45 (4.2)	489 (9.6)	6 (1.7)	503 (15.4)	4 (1.7)	497 (28.6)
Russian Federation	65 (3.4)	555 (3.8)	31 (3.4)	551 (6.1)	3 (1.8)	538 (25.4)	1 (0.0)	~ ~
Saudi Arabia	3 (1.5)	461 (18.9)	17 (3.0)	430 (14.9)	55 (4.2)	432 (8.4)	25 (3.6)	426 (9.8)
Serbia	66 (4.0)	523 (4.1)	22 (3.5)	505 (6.0)	8 (2.5)	480 (14.8)	4 (1.6)	496 (9.8)
Singapore	77 (0.0)	583 (3.9)	22 (0.0)	584 (7.6)	1 (0.0)	~ ~	0 (0.0)	~ ~
Slovak Republic	11 (2.0)	529 (9.8)	58 (3.9)	533 (5.2)	20 (3.2)	519 (7.7)	12 (2.6)	539 (6.7)
Slovenia	66 (2.9)	518 (2.6)	27 (3.6)	521 (4.2)	6 (2.7)	539 (13.2)	1 (0.6)	~ ~
Spain	19 (3.2)	515 (6.6)	69 (4.0)	504 (3.6)	8 (1.8)	504 (13.1)	3 (1.6)	508 (19.4)
Sweden	r 18 (3.7)	536 (5.3)	52 (5.0)	533 (4.4)	12 (3.4)	539 (6.9)	18 (3.8)	528 (7.9)
Thailand	18 (3.1)	517 (8.6)	37 (4.6)	468 (8.1)	42 (3.7)	447 (9.0)	3 (1.6)	552 (22.6)
Tunisia	0 (0.1)	~ ~	5 (2.2)	350 (12.2)	61 (3.8)	352 (7.3)	34 (3.3)	332 (9.9)
Turkey	1 (0.7)	~ ~	38 (3.2)	480 (5.5)	36 (3.3)	470 (5.2)	24 (2.7)	415 (12.2)
United Arab Emirates	r 27 (1.4)	467 (5.6)	47 (2.3)	417 (3.9)	23 (2.1)	403 (6.2)	3 (0.8)	445 (23.9)
United States	62 (3.1)	550 (2.6)	34 (2.9)	538 (4.2)	3 (1.2)	535 (15.5)	1 (0.8)	~ ~
Yemen	r 1 (0.7)	~ ~	3 (1.0)	286 (7.7)	19 (3.3)	227 (17.6)	77 (3.4)	207 (8.3)
International Avg.	32 (0.4)	505 (1.4)	38 (0.5)	486 (1.0)	17 (0.4)	469 (1.8)	13 (0.3)	472 (2.4)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.  
A dash (-) indicates comparable data are not available. A tilde (~) indicates insufficient data to report achievement.  
An "r" indicates data are available for at least 70% but less than 85% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 5.12: Size of School Library (Continued)**

Country	More than 5,000 Book Titles		501–5,000 Book Titles		500 Book Titles or Fewer		No School Library	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
<b>Sixth Grade Participants</b>								
Botswana	3 (1.2)	432 (58.6)	12 (2.7)	420 (32.0)	33 (4.1)	369 (9.5)	52 (4.5)	352 (7.1)
Honduras	0 (0.0)	~ ~	15 (3.5)	488 (16.6)	30 (4.2)	435 (11.8)	55 (4.2)	417 (6.9)
Yemen	1 (0.0)	~ ~	4 (1.4)	408 (10.3)	21 (3.3)	354 (12.5)	73 (3.5)	339 (8.7)
<b>Benchmarking Participants</b>								
Alberta, Canada	70 (4.0)	544 (2.9)	30 (4.0)	537 (5.9)	0 (0.0)	~ ~	0 (0.0)	~ ~
Ontario, Canada	51 (4.3)	529 (4.5)	45 (4.3)	526 (4.1)	2 (1.5)	~ ~	1 (1.0)	~ ~
Quebec, Canada	42 (4.2)	517 (3.8)	52 (4.0)	517 (3.7)	5 (1.9)	517 (5.2)	2 (1.1)	~ ~
Abu Dhabi, UAE	r 22 (3.6)	433 (13.5)	46 (4.8)	407 (8.1)	27 (3.8)	398 (8.9)	5 (1.7)	448 (23.7)
Dubai, UAE	r 51 (0.2)	497 (3.4)	39 (0.2)	437 (3.0)	10 (0.2)	404 (5.0)	0 (0.0)	~ ~
Florida, US	r 65 (6.9)	544 (5.5)	30 (6.1)	546 (10.4)	3 (2.3)	514 (21.7)	2 (0.1)	~ ~
North Carolina, US	76 (6.2)	540 (6.1)	24 (6.2)	542 (10.9)	0 (0.0)	~ ~	0 (0.0)	~ ~

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Does your school have a school library?**

1) Yes  
2) No

If Yes,

**A. Approximately how many books with different titles does your school library have (exclude magazines and periodicals)?**

1) 250 or fewer  
2) 251–500  
3) 501–2,000  
4) 2,001–5,000  
5) 5,001–10,000  
6) More than 10,000

**Exhibit 5.13: Schools with Computers Available for Instruction**

Reported by Principals

Country	1 Computer for 1–2 Students		1 Computer for 3–5 Students		1 Computer for 6 or More Students		No Computers Available	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	26 (3.7)	415 (9.3)	46 (4.3)	415 (5.7)	24 (3.7)	411 (6.7)	4 (1.8)	437 (14.0)
Australia	65 (3.7)	519 (3.6)	26 (3.2)	511 (6.2)	9 (2.4)	519 (5.6)	0 (0.1)	~ ~
Austria	11 (2.4)	551 (8.2)	19 (2.7)	535 (4.7)	66 (3.7)	529 (3.1)	4 (3.0)	495 (24.0)
Azerbaijan	19 (3.2)	436 (19.1)	37 (4.1)	427 (8.0)	29 (3.7)	459 (9.4)	15 (3.2)	426 (14.6)
Bahrain	r 42 (3.9)	459 (6.2)	43 (4.4)	445 (6.6)	15 (2.8)	434 (15.9)	0 (0.0)	~ ~
Belgium (Flemish)	41 (4.3)	511 (3.7)	34 (3.7)	513 (2.9)	25 (4.0)	504 (3.3)	0 (0.0)	~ ~
Chile	r 58 (3.7)	477 (4.3)	32 (3.6)	487 (5.8)	7 (2.2)	501 (11.4)	2 (1.1)	~ ~
Chinese Taipei	23 (2.7)	537 (4.7)	41 (3.7)	553 (3.6)	36 (3.6)	562 (3.3)	0 (0.0)	~ ~
Croatia	12 (2.4)	514 (4.6)	21 (3.3)	519 (4.0)	50 (4.3)	516 (3.0)	17 (3.1)	515 (4.7)
Czech Republic	66 (3.5)	533 (3.5)	26 (3.1)	542 (3.5)	5 (1.9)	544 (5.8)	3 (1.5)	545 (8.6)
Denmark	s 44 (4.7)	529 (4.7)	42 (4.4)	533 (4.1)	14 (3.3)	542 (7.8)	0 (0.0)	~ ~
England	r 90 (2.8)	528 (3.6)	10 (2.8)	533 (15.2)	0 (0.0)	~ ~	0 (0.0)	~ ~
Finland	55 (4.3)	572 (3.5)	28 (4.1)	566 (4.3)	15 (3.2)	572 (4.6)	2 (1.2)	~ ~
Georgia	64 (3.7)	447 (4.6)	25 (3.6)	464 (10.0)	9 (2.7)	486 (8.5)	2 (1.1)	~ ~
Germany	21 (2.5)	523 (6.7)	49 (3.6)	533 (3.8)	28 (3.4)	531 (4.3)	1 (0.9)	~ ~
Hong Kong SAR	56 (4.3)	526 (7.3)	43 (4.2)	548 (4.7)	1 (0.7)	~ ~	0 (0.0)	~ ~
Hungary	53 (3.9)	527 (5.0)	26 (3.4)	543 (8.4)	11 (2.8)	566 (7.4)	10 (2.7)	523 (14.3)
Iran, Islamic Rep. of	1 (0.5)	~ ~	2 (0.8)	~ ~	23 (3.3)	471 (8.2)	74 (3.4)	443 (4.8)
Ireland	35 (4.0)	515 (7.0)	27 (3.2)	521 (6.1)	38 (4.2)	517 (5.8)	0 (0.0)	~ ~
Italy	20 (3.0)	523 (6.7)	34 (3.4)	523 (5.5)	45 (3.6)	524 (4.6)	1 (0.0)	~ ~
Japan	48 (3.3)	553 (2.9)	44 (4.0)	562 (2.6)	8 (2.1)	568 (5.0)	0 (0.0)	~ ~
Kazakhstan	35 (3.9)	499 (9.8)	24 (3.6)	498 (10.1)	27 (4.0)	480 (9.2)	14 (2.7)	505 (14.1)
Korea, Rep. of	22 (3.5)	577 (3.6)	46 (4.0)	587 (2.6)	30 (3.7)	592 (3.3)	2 (1.1)	~ ~
Kuwait	40 (4.3)	356 (8.3)	50 (4.5)	344 (7.6)	9 (2.6)	340 (14.9)	1 (0.9)	~ ~
Lithuania	29 (3.2)	503 (5.7)	24 (3.9)	513 (5.8)	42 (3.9)	525 (4.4)	5 (1.8)	510 (7.3)
Malta	15 (0.1)	459 (3.8)	67 (0.1)	439 (2.6)	18 (0.1)	454 (3.6)	0 (0.0)	~ ~
Morocco	11 (2.3)	293 (23.3)	9 (2.2)	271 (10.3)	49 (4.0)	264 (5.6)	31 (3.4)	248 (9.5)
Netherlands	r 34 (4.4)	528 (3.8)	38 (5.4)	537 (3.9)	28 (4.9)	532 (5.1)	0 (0.0)	~ ~
New Zealand	70 (3.3)	494 (3.9)	22 (3.1)	510 (8.0)	7 (2.0)	497 (14.7)	1 (0.7)	~ ~
Northern Ireland	r 77 (4.3)	514 (4.0)	17 (3.8)	524 (5.9)	5 (2.3)	523 (15.9)	0 (0.0)	~ ~
Norway	58 (5.1)	492 (3.2)	26 (4.2)	492 (4.5)	16 (3.6)	503 (4.5)	1 (0.0)	~ ~
Oman	r 22 (2.3)	360 (7.7)	13 (1.9)	368 (12.7)	61 (2.8)	377 (4.7)	3 (0.8)	287 (16.0)
Poland	31 (3.0)	494 (4.7)	29 (3.7)	510 (4.4)	25 (3.4)	515 (5.0)	15 (2.6)	501 (7.4)
Portugal	14 (3.2)	541 (9.0)	21 (5.2)	509 (12.2)	58 (5.3)	525 (4.5)	7 (2.4)	510 (11.8)
Qatar	42 (3.5)	391 (8.2)	32 (3.7)	376 (11.6)	26 (1.3)	428 (8.6)	1 (0.6)	~ ~
Romania	42 (3.7)	494 (9.7)	34 (3.9)	507 (10.5)	19 (3.4)	520 (15.2)	5 (1.7)	523 (17.6)
Russian Federation	28 (3.0)	550 (7.1)	33 (4.0)	549 (4.8)	34 (3.4)	552 (5.6)	6 (2.1)	580 (14.6)
Saudi Arabia	16 (2.9)	436 (18.5)	20 (4.1)	429 (12.8)	28 (3.7)	425 (8.8)	36 (4.0)	429 (8.4)
Serbia	16 (2.6)	510 (7.8)	36 (3.6)	515 (5.8)	35 (4.4)	517 (5.5)	12 (2.6)	515 (8.3)
Singapore	51 (0.0)	584 (4.8)	47 (0.0)	583 (5.6)	3 (0.0)	586 (32.4)	0 (0.0)	~ ~
Slovak Republic	81 (2.5)	530 (4.5)	14 (2.1)	535 (9.4)	4 (1.4)	538 (10.0)	0 (0.0)	~ ~
Slovenia	65 (3.3)	521 (3.2)	30 (3.7)	521 (4.2)	5 (1.6)	513 (8.4)	0 (0.0)	~ ~
Spain	50 (3.9)	497 (4.6)	35 (4.1)	513 (4.3)	10 (2.5)	528 (7.7)	6 (2.0)	498 (9.8)
Sweden	r 29 (3.6)	540 (5.4)	37 (4.6)	526 (4.9)	35 (4.4)	531 (4.9)	0 (0.0)	~ ~
Thailand	37 (3.8)	483 (7.0)	32 (4.2)	458 (10.7)	23 (3.6)	485 (12.7)	8 (2.6)	435 (18.6)
Tunisia	7 (1.7)	364 (9.3)	23 (2.9)	316 (11.7)	51 (3.9)	356 (8.0)	18 (3.2)	342 (11.4)
Turkey	18 (2.6)	464 (6.9)	27 (3.0)	463 (10.3)	43 (3.2)	468 (6.5)	11 (2.2)	431 (21.7)
United Arab Emirates	r 32 (2.0)	414 (4.5)	40 (2.3)	409 (4.1)	27 (2.0)	451 (7.0)	1 (0.5)	~ ~
United States	r 65 (2.8)	551 (2.9)	26 (2.4)	539 (4.4)	8 (1.5)	537 (8.5)	1 (0.0)	~ ~
Yemen	r 6 (2.0)	179 (20.3)	7 (2.6)	241 (39.0)	15 (3.5)	234 (15.1)	72 (4.2)	213 (8.5)
International Avg.	38 (0.5)	486 (1.2)	30 (0.5)	487 (1.3)	24 (0.5)	491 (1.4)	8 (0.3)	450 (2.8)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

**Exhibit 5.13: Schools with Computers Available for Instruction (Continued)**

Country	1 Computer for 1–2 Students		1 Computer for 3–5 Students		1 Computer for 6 or More Students		No Computers Available	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
<b>Sixth Grade Participants</b>								
Botswana	13 (3.1)	378 (27.2)	15 (3.2)	431 (22.3)	41 (4.5)	354 (7.6)	31 (4.1)	356 (9.9)
Honduras	24 (3.9)	459 (13.8)	24 (4.0)	447 (6.6)	15 (2.7)	464 (7.3)	37 (4.0)	398 (11.1)
Yemen	r 9 (2.7)	340 (14.7)	6 (2.5)	390 (25.2)	12 (3.5)	359 (23.9)	73 (4.6)	339 (9.6)
<b>Benchmarking Participants</b>								
Alberta, Canada	91 (3.3)	541 (2.8)	8 (3.2)	543 (5.9)	1 (0.0)	~ ~	0 (0.0)	~ ~
Ontario, Canada	74 (3.7)	523 (3.6)	19 (3.6)	541 (7.1)	7 (1.6)	539 (10.7)	0 (0.0)	~ ~
Quebec, Canada	64 (3.6)	521 (3.5)	29 (3.6)	513 (3.4)	7 (2.5)	510 (10.8)	0 (0.0)	~ ~
Abu Dhabi, UAE	r 30 (3.7)	394 (9.7)	43 (3.9)	405 (7.9)	25 (3.9)	417 (13.6)	2 (1.2)	~ ~
Dubai, UAE	r 35 (0.4)	463 (3.5)	35 (0.5)	427 (4.9)	29 (0.3)	471 (3.5)	0 (0.0)	~ ~
Florida, US	r 55 (6.2)	548 (5.3)	36 (6.2)	547 (8.4)	8 (3.4)	507 (7.8)	0 (0.0)	~ ~
North Carolina, US	62 (7.1)	538 (6.0)	31 (7.0)	539 (8.7)	7 (4.1)	565 (20.2)	0 (0.0)	~ ~

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

The number of students per computer was calculated by dividing the number of students by the number of computers.

- 1) **What is the total enrollment of fourth grade students in your school as of the first day of the month TIMSS 2011 testing begins?**  
\_\_\_\_\_
- 2) **What is the total number of computers that can be used for instructional purposes by fourth grade students?**  
\_\_\_\_\_

**Exhibit 5.14: Schools with Computers Available for Instruction**

Reported by Principals

Country	1 Computer for 1–2 Students		1 Computer for 3–5 Students		1 Computer for 6 or More Students		No Computers Available	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	24 (3.4)	433 (7.1)	50 (4.2)	438 (5.1)	26 (3.2)	444 (7.5)	0 (0.0)	~ ~
Australia	89 (2.4)	521 (5.2)	9 (2.4)	525 (12.9)	2 (1.2)	~ ~	0 (0.0)	~ ~
Bahrain	32 (0.3)	456 (3.7)	35 (0.3)	456 (3.2)	26 (0.3)	446 (3.1)	7 (0.1)	414 (15.9)
Chile	49 (4.1)	464 (4.4)	38 (4.0)	461 (5.1)	11 (2.6)	463 (10.9)	2 (1.1)	~ ~
Chinese Taipei	6 (1.8)	572 (17.2)	18 (2.9)	553 (9.4)	76 (3.3)	567 (2.6)	1 (0.7)	~ ~
England	99 (0.9)	537 (5.2)	1 (0.9)	~ ~	0 (0.0)	~ ~	0 (0.0)	~ ~
Finland	47 (3.8)	557 (3.4)	44 (4.0)	547 (3.5)	7 (2.1)	546 (7.9)	2 (1.2)	~ ~
Georgia	70 (3.2)	414 (4.2)	25 (3.5)	437 (7.2)	4 (1.7)	428 (11.0)	1 (0.0)	~ ~
Ghana	42 (4.0)	299 (8.2)	13 (2.5)	343 (21.3)	31 (3.6)	323 (9.8)	15 (3.4)	265 (13.1)
Hong Kong SAR	54 (4.9)	527 (6.8)	37 (4.6)	542 (7.8)	9 (3.0)	532 (14.5)	0 (0.0)	~ ~
Hungary	71 (3.9)	518 (4.3)	25 (3.6)	543 (6.7)	2 (0.9)	~ ~	2 (1.3)	~ ~
Indonesia	r 1 (0.5)	~ ~	11 (2.6)	423 (8.6)	87 (2.7)	411 (4.8)	2 (1.3)	~ ~
Iran, Islamic Rep. of	1 (0.9)	~ ~	5 (2.0)	538 (14.8)	44 (3.1)	483 (6.1)	49 (3.2)	456 (4.7)
Israel	19 (3.2)	523 (11.2)	35 (4.3)	520 (6.5)	41 (4.0)	512 (8.9)	4 (1.9)	516 (12.8)
Italy	16 (2.8)	503 (6.9)	43 (4.2)	499 (4.9)	41 (3.9)	505 (4.4)	0 (0.4)	~ ~
Japan	31 (2.4)	562 (6.0)	48 (3.2)	558 (3.2)	22 (2.7)	552 (4.4)	0 (0.0)	~ ~
Jordan	31 (3.1)	442 (7.3)	41 (4.0)	454 (7.7)	26 (2.9)	451 (6.1)	2 (1.2)	~ ~
Kazakhstan	57 (3.8)	494 (6.0)	26 (3.7)	479 (9.9)	17 (3.0)	494 (9.2)	0 (0.0)	~ ~
Korea, Rep. of	6 (2.3)	549 (7.9)	26 (3.6)	558 (3.6)	68 (4.0)	562 (2.3)	0 (0.0)	~ ~
Lebanon	38 (4.1)	422 (8.9)	40 (4.3)	405 (9.1)	16 (3.0)	405 (13.2)	5 (2.0)	347 (14.1)
Lithuania	62 (3.8)	507 (3.5)	30 (3.8)	521 (4.1)	8 (2.7)	536 (11.9)	0 (0.0)	~ ~
Macedonia, Rep. of	r 72 (3.8)	417 (6.8)	16 (2.9)	397 (15.5)	9 (2.3)	391 (18.6)	3 (1.3)	360 (51.0)
Malaysia	2 (1.1)	~ ~	13 (2.7)	425 (17.4)	78 (3.1)	421 (6.6)	6 (1.9)	445 (16.2)
Morocco	6 (1.5)	404 (11.4)	10 (1.5)	393 (10.4)	70 (2.8)	373 (3.0)	13 (2.6)	372 (5.3)
New Zealand	r 88 (4.2)	510 (4.9)	8 (3.4)	537 (10.2)	4 (2.7)	545 (19.7)	0 (0.0)	~ ~
Norway	73 (4.2)	497 (3.2)	23 (3.9)	486 (5.4)	4 (1.9)	501 (18.2)	0 (0.0)	~ ~
Oman	47 (3.1)	427 (4.4)	34 (3.2)	415 (6.4)	15 (2.5)	419 (11.5)	4 (1.6)	429 (21.5)
Palestinian Nat'l Auth.	25 (3.2)	452 (7.7)	21 (2.9)	433 (5.8)	49 (3.7)	405 (5.0)	5 (1.4)	378 (13.8)
Qatar	r 44 (0.5)	435 (6.8)	48 (0.5)	409 (4.8)	7 (0.1)	410 (6.6)	1 (0.0)	~ ~
Romania	45 (3.8)	465 (7.0)	34 (4.0)	457 (6.0)	19 (3.4)	480 (7.8)	2 (1.2)	~ ~
Russian Federation	50 (3.3)	546 (5.1)	40 (3.6)	541 (4.8)	10 (2.3)	538 (7.0)	0 (0.0)	~ ~
Saudi Arabia	14 (2.5)	440 (10.8)	17 (3.3)	453 (8.6)	37 (3.8)	430 (6.4)	32 (3.7)	435 (6.0)
Singapore	68 (0.0)	593 (5.2)	28 (0.0)	585 (8.4)	4 (0.0)	600 (29.0)	0 (0.0)	~ ~
Slovenia	70 (4.1)	546 (2.9)	28 (4.1)	537 (5.3)	1 (1.1)	~ ~	0 (0.0)	~ ~
Sweden	r 54 (4.3)	512 (3.8)	38 (4.3)	510 (5.0)	8 (2.6)	509 (8.0)	0 (0.0)	~ ~
Syrian Arab Republic	8 (2.4)	415 (15.6)	24 (4.0)	436 (10.1)	68 (3.9)	424 (3.7)	1 (0.7)	~ ~
Thailand	28 (3.4)	437 (7.0)	37 (4.1)	451 (9.2)	35 (4.2)	463 (8.0)	0 (0.0)	~ ~
Tunisia	5 (1.5)	414 (5.6)	10 (2.3)	441 (12.4)	86 (2.5)	441 (2.9)	0 (0.0)	~ ~
Turkey	16 (1.9)	476 (10.6)	33 (2.9)	495 (8.3)	41 (2.6)	476 (5.2)	10 (1.9)	476 (10.3)
Ukraine	35 (4.0)	494 (7.1)	39 (4.4)	497 (6.0)	25 (3.3)	516 (5.9)	1 (1.0)	~ ~
United Arab Emirates	37 (2.1)	465 (4.2)	41 (2.3)	458 (4.2)	21 (2.4)	480 (6.2)	1 (0.4)	~ ~
United States	58 (2.1)	528 (4.0)	32 (2.1)	522 (4.9)	9 (1.2)	523 (11.1)	0 (0.0)	~ ~
International Avg.	40 (0.5)	481 (1.2)	28 (0.5)	480 (1.4)	28 (0.4)	474 (1.7)	4 (0.2)	408 (5.6)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

**Exhibit 5.14: Schools with Computers Available for Instruction (Continued)**

Country	1 Computer for 1–2 Students		1 Computer for 3–5 Students		1 Computer for 6 or More Students		No Computers Available	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
<b>Ninth Grade Participants</b>								
Botswana	8 (2.1)	415 (17.8)	11 (2.4)	419 (7.6)	76 (3.2)	401 (4.2)	5 (2.0)	416 (19.0)
Honduras	23 (3.2)	391 (13.0)	20 (4.0)	366 (9.3)	22 (3.4)	370 (5.8)	35 (4.4)	353 (5.8)
South Africa	15 (1.9)	364 (14.7)	9 (1.8)	411 (21.5)	30 (3.8)	331 (8.7)	46 (4.1)	309 (6.0)
<b>Benchmarking Participants</b>								
Alberta, Canada	90 (2.9)	547 (2.7)	10 (2.8)	551 (6.1)	1 (0.0)	~ ~	0 (0.0)	~ ~
Ontario, Canada	62 (3.9)	521 (2.9)	27 (4.1)	524 (6.5)	11 (2.8)	516 (7.2)	0 (0.0)	~ ~
Quebec, Canada	51 (4.4)	524 (3.6)	35 (4.4)	518 (5.9)	14 (3.0)	519 (10.7)	0 (0.0)	~ ~
Abu Dhabi, UAE	36 (3.5)	459 (7.5)	42 (4.5)	459 (7.2)	20 (4.1)	467 (11.1)	2 (1.1)	~ ~
Dubai, UAE	r 45 (0.5)	490 (4.8)	32 (0.4)	474 (3.9)	23 (0.5)	511 (4.3)	0 (0.0)	~ ~
Alabama, US	r 63 (6.9)	483 (10.5)	31 (6.8)	494 (13.5)	6 (3.7)	479 (17.8)	0 (0.0)	~ ~
California, US	r 26 (6.9)	495 (13.8)	43 (6.5)	503 (9.0)	31 (5.9)	494 (12.6)	0 (0.0)	~ ~
Colorado, US	72 (6.1)	540 (5.4)	24 (5.9)	546 (12.5)	4 (3.0)	536 (63.9)	0 (0.0)	~ ~
Connecticut, US	r 59 (7.1)	525 (10.0)	38 (7.1)	539 (12.7)	3 (2.5)	504 (5.8)	0 (0.0)	~ ~
Florida, US	51 (7.1)	521 (12.9)	37 (6.3)	533 (11.5)	12 (4.7)	546 (23.2)	0 (0.0)	~ ~
Indiana, US	r 81 (6.4)	532 (6.0)	19 (6.4)	547 (15.8)	0 (0.0)	~ ~	0 (0.0)	~ ~
Massachusetts, US	51 (7.2)	556 (9.5)	45 (6.7)	581 (7.7)	4 (3.0)	561 (95.9)	0 (0.0)	~ ~
Minnesota, US	62 (7.7)	549 (7.6)	36 (7.4)	563 (7.3)	2 (2.2)	~ ~	0 (0.0)	~ ~
North Carolina, US	51 (6.9)	537 (8.6)	38 (7.3)	523 (14.7)	11 (4.5)	547 (23.9)	0 (0.0)	~ ~

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

The number of students per computer was calculated by dividing the number of students by the number of computers.

- 1) **What is the total enrollment of eighth grade students in your school as of the first day of the month TIMSS 2011 testing begins?**  
\_\_\_\_\_
- 2) **What is the total number of computers that can be used for instructional purposes by eighth grade students?**  
\_\_\_\_\_

### *Schools with Science Laboratories*

Undertaking “hands-on” science investigations is an important component of science curricula in many countries. TIMSS 2011 collected information on the availability of science laboratories at the fourth and eighth grades, and the availability of instructional assistance when students are conducting experiments (at eighth grade only). Exhibit 5.15 presents results for principals’ reports of the availability of science laboratories among participants in the fourth grade assessment. Across fourth grade countries, 36 percent of students attended schools with a science laboratory, but among countries this percentage ranged from 0 percent (Ireland, Lithuania, and Northern Ireland) to 100 percent (Korea, Kuwait, and Singapore). On average across countries, students attending schools with a science laboratory had somewhat higher achievement (489) than students attending schools with no laboratory (483).

Exhibit 5.16 presents results for principals' reports of the availability of science laboratories and of assistance for teachers when students are conducting science experiments for participants in the eighth grade assessment. Across the eighth grade countries, a much higher percentage of students attended schools with science laboratories (80%) than at the fourth grade. In 29 of the 42 countries, more than 80 percent of students attended schools that had a science laboratory, and in only two countries (Lithuania and Ghana) was the percentage of students in schools with a laboratory less than 35 percent (13% and 2%, respectively). On average across countries, student science achievement in schools with laboratories was higher (485) than that of students at schools with no laboratories (451); this achievement difference also occurred within many countries. Across the eighth grade countries, 57 percent of students attended schools in which teachers had assistance when students were conducting science experiments, but among countries this percentage ranged from 9 percent (Chile and Italy) to 99 percent (Hong Kong SAR). On average across countries, the eighth grade students attending schools in which teachers had assistance had higher achievement (480) than students attending schools in which teachers did not have assistance (472).

**Exhibit 5.15: Schools Have a Science Laboratory**
*Reported by Principals*

Country	Yes		No	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Korea, Rep. of	100 (0.0)	587 (2.0)	0 (0.0)	~ ~
Kuwait	100 (0.0)	348 (4.7)	0 (0.0)	~ ~
Singapore	100 (0.0)	583 (3.4)	0 (0.0)	~ ~
Japan	99 (0.6)	559 (1.9)	1 (0.6)	~ ~
Chinese Taipei	89 (2.3)	551 (2.4)	11 (2.3)	562 (4.6)
Qatar	88 (2.1)	388 (4.8)	12 (2.1)	441 (13.1)
Bahrain	87 (3.0)	449 (3.9)	13 (3.0)	450 (10.6)
United Arab Emirates	84 (1.3)	417 (2.6)	16 (1.3)	469 (7.7)
Saudi Arabia	68 (4.0)	436 (7.1)	32 (4.0)	415 (10.1)
Turkey	66 (2.6)	478 (4.3)	34 (2.6)	432 (9.5)
Thailand	64 (3.8)	486 (6.1)	36 (3.8)	446 (10.1)
Armenia	60 (4.5)	415 (5.3)	40 (4.5)	418 (6.2)
Denmark	r 56 (3.6)	527 (3.9)	44 (3.6)	534 (4.3)
Iran, Islamic Rep. of	48 (3.7)	477 (6.1)	52 (3.7)	430 (5.3)
Romania	45 (4.1)	520 (9.0)	55 (4.1)	492 (8.5)
Chile	45 (3.5)	502 (4.3)	55 (3.5)	467 (4.3)
Italy	43 (3.4)	517 (4.5)	57 (3.4)	528 (3.9)
Kazakhstan	43 (4.4)	481 (8.7)	57 (4.4)	505 (6.6)
Hong Kong SAR	37 (4.0)	540 (5.6)	63 (4.0)	532 (5.8)
Czech Republic	36 (3.6)	537 (4.4)	64 (3.6)	536 (2.9)
Spain	34 (3.4)	510 (4.3)	66 (3.4)	504 (3.9)
Georgia	34 (3.9)	452 (6.6)	66 (3.9)	456 (5.0)
Oman	26 (2.1)	361 (6.3)	74 (2.1)	375 (5.8)
United States	25 (2.7)	549 (5.4)	75 (2.7)	545 (2.5)
Yemen	25 (3.6)	242 (11.8)	75 (3.6)	199 (8.4)
Sweden	24 (3.7)	527 (6.1)	76 (3.7)	534 (3.4)
Russian Federation	23 (2.9)	547 (7.2)	77 (2.9)	554 (3.4)
Slovak Republic	21 (3.1)	532 (6.9)	79 (3.1)	531 (4.3)
Slovenia	19 (2.7)	522 (4.7)	81 (2.7)	520 (3.2)
Portugal	18 (4.7)	519 (15.1)	82 (4.7)	522 (3.9)
Malta	18 (0.1)	477 (4.0)	82 (0.1)	440 (2.0)
Azerbaijan	17 (3.2)	443 (11.0)	83 (3.2)	437 (6.4)
Norway	17 (3.4)	496 (5.6)	83 (3.4)	493 (2.7)
Finland	16 (3.4)	566 (5.1)	84 (3.4)	571 (2.8)
Australia	13 (2.4)	535 (7.4)	87 (2.4)	514 (2.9)
Serbia	13 (2.9)	509 (11.1)	87 (2.9)	516 (3.4)
Hungary	13 (2.8)	551 (7.7)	87 (2.8)	533 (4.1)
Germany	13 (2.4)	519 (9.6)	87 (2.4)	531 (2.8)
Croatia	12 (2.9)	516 (5.7)	88 (2.9)	516 (2.4)
England	9 (2.1)	559 (10.6)	91 (2.1)	524 (3.5)
Poland	9 (2.4)	503 (11.2)	91 (2.4)	506 (2.7)
Austria	8 (2.5)	534 (9.6)	92 (2.5)	531 (2.9)
New Zealand	5 (1.9)	530 (13.9)	95 (1.9)	496 (2.6)
Tunisia	4 (1.4)	335 (14.9)	96 (1.4)	346 (5.3)
Morocco	3 (0.9)	324 (24.3)	97 (0.9)	261 (5.1)
Netherlands	r 3 (1.8)	535 (3.6)	97 (1.8)	532 (2.5)
Belgium (Flemish)	1 (0.0)	~ ~	99 (0.7)	510 (2.0)
Ireland	0 (0.0)	~ ~	100 (0.0)	517 (3.4)
Lithuania	0 (0.0)	~ ~	100 (0.0)	515 (2.5)
Northern Ireland	0 (0.0)	~ ~	100 (0.0)	517 (3.0)
International Avg.	36 (0.4)	489 (1.2)	64 (0.4)	483 (0.8)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.  
A tilde (~) indicates insufficient data to report achievement.  
An "r" indicates data are available for at least 70% but less than 85% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 5.15: Schools Have a Science Laboratory (Continued)**

Country	Yes		No	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement
<b>Sixth Grade Participants</b>				
Yemen	29 (3.7)	370 (11.1)	71 (3.7)	334 (8.7)
Honduras	12 (3.6)	475 (26.3)	88 (3.6)	426 (5.8)
Botswana	7 (2.1)	450 (40.2)	93 (2.1)	361 (5.0)
<b>Benchmarking Participants</b>				
Abu Dhabi, UAE	85 (2.6)	399 (4.8)	15 (2.6)	458 (15.6)
Dubai, UAE	78 (0.2)	450 (2.6)	22 (0.2)	500 (3.7)
Florida, US	49 (6.1)	537 (6.5)	51 (6.1)	550 (5.4)
North Carolina, US	17 (5.4)	553 (16.7)	83 (5.4)	538 (4.9)
Alberta, Canada	14 (3.1)	541 (4.8)	86 (3.1)	542 (2.9)
Quebec, Canada	14 (3.1)	530 (5.9)	86 (3.1)	515 (3.0)
Ontario, Canada	8 (2.3)	526 (12.6)	92 (2.3)	528 (3.2)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 5.16: School Resources For Conducting Science Experiments**

Reported by Principals

Country	Schools Have a Science Laboratory				Teachers Have Assistance Available When Students are Conducting Experiments			
	Yes		No		Yes		No	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Bahrain	100 (0.0)	452 (2.0)	0 (0.0)	~ ~	93 (0.1)	452 (2.1)	7 (0.1)	465 (4.8)
England	100 (0.0)	534 (5.2)	0 (0.0)	~ ~	75 (4.6)	532 (5.9)	25 (4.6)	546 (12.3)
Japan	100 (0.0)	558 (2.4)	0 (0.0)	~ ~	34 (4.1)	559 (4.1)	66 (4.1)	557 (3.3)
Korea, Rep. of	100 (0.0)	560 (2.0)	0 (0.0)	~ ~	63 (3.2)	562 (2.7)	37 (3.2)	557 (3.2)
Singapore	100 (0.0)	590 (4.4)	0 (0.0)	~ ~	89 (0.0)	590 (4.7)	11 (0.0)	591 (13.8)
New Zealand	100 (0.0)	514 (4.7)	0 (0.0)	~ ~	37 (4.8)	517 (7.4)	63 (4.8)	512 (6.6)
Australia	100 (0.1)	521 (5.0)	0 (0.1)	~ ~	66 (3.6)	525 (6.4)	34 (3.6)	514 (7.1)
Hong Kong SAR	99 (0.8)	533 (3.7)	1 (0.0)	~ ~	99 (1.0)	534 (3.7)	1 (1.0)	~ ~
Sweden	r 99 (0.8)	510 (3.0)	1 (0.8)	~ ~	r 11 (3.1)	505 (7.8)	89 (3.1)	511 (3.3)
Malaysia	99 (0.8)	426 (6.4)	1 (0.8)	~ ~	93 (2.0)	424 (6.5)	7 (2.0)	457 (21.5)
Qatar	99 (0.0)	416 (3.5)	1 (0.0)	~ ~	93 (0.4)	416 (3.7)	7 (0.4)	441 (11.1)
Chinese Taipei	99 (1.0)	564 (2.3)	1 (1.0)	~ ~	88 (2.7)	567 (2.5)	12 (2.7)	540 (10.2)
Oman	98 (1.0)	421 (3.2)	2 (1.0)	~ ~	93 (1.8)	423 (3.3)	7 (1.8)	377 (13.2)
United Arab Emirates	96 (1.2)	462 (2.3)	4 (1.2)	508 (16.5)	95 (0.8)	461 (2.3)	5 (0.8)	491 (8.2)
Thailand	94 (1.5)	451 (4.1)	6 (1.5)	455 (25.8)	23 (3.1)	444 (9.1)	77 (3.1)	453 (4.8)
Finland	91 (2.2)	552 (2.5)	9 (2.2)	555 (8.2)	10 (2.9)	550 (5.2)	90 (2.9)	552 (2.6)
Jordan	91 (2.5)	453 (4.4)	9 (2.5)	409 (16.7)	94 (1.4)	449 (4.2)	6 (1.4)	448 (13.4)
Norway	90 (2.9)	496 (3.0)	10 (2.9)	484 (6.4)	24 (4.1)	486 (5.6)	76 (4.1)	497 (3.0)
Ukraine	89 (2.8)	503 (3.5)	11 (2.8)	490 (8.5)	74 (3.5)	505 (3.4)	26 (3.5)	490 (8.4)
Saudi Arabia	89 (2.8)	438 (4.0)	11 (2.8)	425 (12.4)	93 (2.1)	438 (4.1)	7 (2.1)	415 (15.0)
Russian Federation	86 (2.7)	545 (3.9)	14 (2.7)	527 (8.6)	66 (3.2)	544 (3.7)	34 (3.2)	540 (6.7)
Israel	86 (2.7)	523 (4.8)	14 (2.7)	484 (11.1)	84 (2.4)	521 (4.7)	16 (2.4)	500 (7.9)
Tunisia	86 (2.3)	441 (2.7)	14 (2.3)	427 (5.9)	89 (2.2)	439 (2.8)	11 (2.2)	430 (5.0)
Turkey	83 (1.8)	489 (4.1)	17 (1.8)	454 (7.8)	12 (2.3)	489 (17.2)	88 (2.3)	482 (3.5)
Palestinian Nat'l Auth.	83 (3.1)	422 (3.7)	17 (3.1)	414 (12.3)	75 (3.1)	419 (3.8)	25 (3.1)	424 (8.7)
Kazakhstan	82 (3.0)	492 (4.8)	18 (3.0)	481 (11.1)	95 (1.2)	490 (4.3)	5 (1.2)	476 (13.5)
Lebanon	82 (3.3)	413 (5.6)	18 (3.3)	374 (15.8)	68 (3.8)	416 (5.6)	32 (3.8)	384 (10.7)
Morocco	82 (3.0)	377 (2.6)	18 (3.0)	373 (5.4)	60 (2.7)	378 (2.9)	40 (2.7)	373 (3.4)
United States	81 (2.0)	531 (3.0)	19 (2.0)	504 (8.5)	32 (2.5)	529 (6.3)	68 (2.5)	524 (2.9)
Iran, Islamic Rep. of	77 (3.2)	485 (4.2)	23 (3.2)	439 (7.1)	25 (3.2)	489 (8.6)	75 (3.2)	470 (4.5)
Syrian Arab Republic	75 (3.1)	431 (4.9)	25 (3.1)	412 (7.6)	76 (3.4)	432 (4.6)	24 (3.4)	406 (8.5)
Armenia	75 (4.0)	440 (4.1)	25 (4.0)	427 (6.3)	77 (3.7)	440 (3.8)	23 (3.7)	425 (7.6)
Italy	74 (3.2)	503 (2.8)	26 (3.2)	494 (6.4)	9 (1.6)	494 (9.6)	91 (1.6)	501 (2.7)
Indonesia	71 (4.0)	419 (4.8)	29 (4.0)	371 (7.9)	19 (3.1)	427 (10.0)	81 (3.1)	401 (4.9)
Romania	66 (4.1)	472 (3.8)	34 (4.1)	449 (6.8)	26 (3.3)	485 (6.5)	74 (3.3)	458 (4.5)
Chile	59 (3.8)	479 (4.6)	41 (3.8)	439 (3.7)	9 (2.4)	482 (17.1)	91 (2.4)	461 (2.9)
Slovenia	48 (3.6)	545 (4.6)	52 (3.6)	542 (3.3)	76 (3.2)	546 (2.7)	24 (3.2)	537 (7.3)
Georgia	47 (3.3)	423 (5.1)	53 (3.3)	419 (4.1)	19 (3.1)	440 (7.9)	81 (3.1)	417 (3.5)
Macedonia, Rep. of	37 (3.7)	436 (9.8)	63 (3.7)	392 (6.8)	74 (3.4)	412 (7.0)	26 (3.4)	393 (10.3)
Hungary	36 (4.3)	536 (4.9)	64 (4.3)	515 (4.7)	11 (2.6)	517 (7.6)	89 (2.6)	523 (3.6)
Lithuania	13 (3.3)	532 (6.2)	87 (3.3)	511 (3.0)	19 (3.4)	523 (7.2)	81 (3.4)	511 (3.0)
Ghana	2 (1.1)	~ ~	98 (1.1)	304 (5.3)	26 (4.2)	317 (13.6)	74 (4.2)	301 (5.9)
International Avg.	80 (0.4)	485 (0.7)	20 (0.4)	451 (1.9)	57 (0.5)	480 (1.1)	43 (0.5)	472 (1.3)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 5.16: School Resources For Conducting Science Experiments (Continued)**

Country	Schools Have a Science Laboratory				Teachers Have Assistance Available When Students are Conducting Experiments			
	Yes		No		Yes		No	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
<b>Ninth Grade Participants</b>								
Botswana	91 (2.7)	401 (3.6)	9 (2.7)	431 (13.8)	48 (4.3)	410 (5.2)	52 (4.3)	399 (4.8)
Honduras	53 (3.9)	384 (6.2)	47 (3.9)	349 (4.2)	52 (4.4)	384 (6.5)	48 (4.4)	350 (5.5)
South Africa	44 (2.9)	377 (7.5)	56 (2.9)	295 (4.1)	52 (4.3)	325 (6.1)	48 (4.3)	340 (7.7)
<b>Benchmarking Participants</b>								
Quebec, Canada	99 (0.8)	520 (2.6)	1 (0.8)	~ ~	93 (1.9)	519 (2.9)	7 (1.9)	532 (8.5)
Minnesota, US	98 (2.0)	554 (5.6)	2 (2.0)	~ ~	33 (7.3)	541 (12.9)	67 (7.3)	560 (5.3)
Dubai, UAE	97 (0.0)	485 (2.8)	3 (0.0)	502 (5.0)	93 (0.1)	483 (2.9)	7 (0.1)	512 (4.2)
Abu Dhabi, UAE	94 (2.9)	458 (4.2)	6 (2.9)	508 (35.0)	96 (1.5)	458 (4.2)	4 (1.5)	476 (15.5)
Indiana, US	r 93 (4.1)	534 (5.8)	7 (4.1)	537 (8.3)	r 19 (6.0)	512 (7.8)	81 (6.0)	540 (6.6)
Florida, US	88 (4.9)	528 (8.6)	12 (4.9)	530 (22.9)	28 (7.0)	527 (19.3)	72 (7.0)	529 (8.4)
Alberta, Canada	85 (3.0)	547 (2.4)	15 (3.0)	538 (6.7)	23 (3.5)	548 (6.0)	77 (3.5)	546 (2.6)
Connecticut, US	84 (5.1)	536 (6.6)	16 (5.1)	509 (19.0)	21 (4.5)	545 (12.9)	79 (4.5)	528 (8.1)
Massachusetts, US	83 (5.6)	577 (6.3)	17 (5.6)	531 (24.0)	33 (7.0)	559 (10.0)	67 (7.0)	573 (6.5)
Colorado, US	82 (5.6)	549 (6.4)	18 (5.6)	509 (22.0)	22 (6.2)	534 (15.1)	78 (6.2)	545 (4.8)
Alabama, US	r 71 (8.8)	494 (7.8)	29 (8.8)	466 (11.5)	r 26 (7.0)	487 (13.3)	74 (7.0)	484 (8.1)
North Carolina, US	71 (7.2)	533 (7.3)	29 (7.2)	530 (18.4)	12 (4.8)	554 (14.4)	88 (4.8)	529 (7.7)
California, US	r 68 (6.1)	503 (5.2)	32 (6.1)	488 (14.3)	r 27 (6.5)	506 (11.4)	73 (6.5)	494 (6.5)
Ontario, Canada	52 (3.6)	525 (4.0)	48 (3.6)	518 (3.1)	13 (2.8)	522 (7.3)	87 (2.8)	521 (2.8)

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011



# Chapter 6

## School Climate

Students with the highest science achievement typically attend schools that emphasize academic success, as indicated by rigorous curricular goals, effective teachers, students that desire to do well, and parental support. In contrast, schools with discipline and safety problems are not conducive to high achievement. Students that attended schools with disorderly environments and reported more frequent bullying had much lower achievement than their counterparts in safe and orderly schools.

The school's educational values are reflected by the teachers, school leadership, the students themselves, and their parents. A school with a positive atmosphere toward high achievement and a rigorous academic program can overcome resource shortages and encourage students toward excellent performance. By contrast, the environment in a school with disciplinary problems is not conducive to higher student achievement. When students are fearful and worried about their safety, for example, it is difficult to focus on academics. Chapter 6 presents the TIMSS 2011 results about positive and negative aspects of the atmosphere in schools around the world.

## Schools Emphasize Academic Success

Studies of academic optimism show that a positive school atmosphere emphasizing academic achievement can even overcome socioeconomic disadvantages (McGuigan & Hoy, 2006). There are several dimensions of academic optimism, including the communication of a school's academic emphasis through clear and rigorous academic goals. The effect on achievement is greatest when there is a collective influence, including a school administration and teachers that support and trust in students' capability to achieve. In addition to making it clear that academic success is important, principals and teachers must emphasize that it can be achieved. Parents' support for their children's learning also contributes to a school's collective efficacy and the belief that the school's academic goals can be implemented.

### *School Emphasis on Academic Success*

The TIMSS 2011 School Emphasis on Academic Success scale characterizes five aspects of academic optimism:

- ◆ Teachers' understanding of the school's curricular goals;
- ◆ Teachers' degree of success in implementing the school's curriculum;
- ◆ Teachers' expectations for student achievement;
- ◆ Parental support for student achievement; and
- ◆ Students' desire to do well in school.

Information was collected from both students' principals and teachers, with the respective responses used to create scales.

Exhibit 6.1 shows the principals' reports on the School Emphasis on Academic Success scale for the TIMSS 2011 fourth grade assessment. As might be anticipated, principals had very positive attitudes about the emphasis on

academics in their schools, so the three regions of the scale have been described as **Very High**, **High**, and **Medium**. Students were scored according to their principals' characterization of their school in terms of the five aspects. Students in schools with **Very High Emphasis** on academic success had principals characterizing three of the five aspects as "very high" and the other two as "high," on average. Students in **Medium Emphasis** schools had principals characterizing three of the five aspects as "medium" and the other two as "high," on average. All other students attended schools with a **High Emphasis** on academic success.

On average, across the fourth grade countries, 8 percent of the students attended schools where the principal reported a **Very High Emphasis** on academic success, 58 percent attended schools with a **High Emphasis**, and 34 percent attended a school with a **Medium Emphasis**. However, there was considerable variation across countries, with as few as 28 percent of students, and as many as 99 percent of students, attending schools with a very high or high emphasis on academic success. On average across fourth grade countries, there was a distinct direct correspondence between average science achievement and principals' reports, with higher emphasis on academic success related to higher average science achievement. The results were similar for most of the sixth grade countries and benchmarking participants.

Exhibit 6.2 shows the principals' reports on the School Emphasis on Academic Success scale for the TIMSS 2011 eighth grade assessment. Although similar to the fourth grade results, principals of the eighth grade schools reported slightly less emphasis on academic success, with 7 percent of the students attending a school where the principal reported a **Very High Emphasis** on academic success, 53 percent a school with a **High Emphasis**, and 41 percent a school with a **Medium Emphasis** (compared to 8%, 58%, and 34%, respectively, at the fourth grade). Similar to the fourth grade, there was considerable variation across countries, from as little 19 percent to as much as 93 percent of students attending schools with a very high or high emphasis on academic success. At the eighth grade, there was also a somewhat greater difference in average science achievement (44 points) between students attending **Very High Emphasis** schools (504) and students attending **Medium Emphasis** schools (460); this difference was 37 points at the fourth grade (508 vs. 471 for **Very High Emphasis** and **Medium Emphasis** schools, respectively).

Exhibits 6.3 and 6.4 show the teachers' reports on the School Emphasis on Academic Success scale for the fourth and eighth grade assessments,

**Exhibit 6.1: School Emphasis on Academic Success - Principal Reports**

Reported by Principals

Students were scored according to their principals' responses characterizing five aspects on the *School Emphasis on Academic Success* scale. Students in schools where their principals reported a **Very High Emphasis** on academic success had a score on the scale of at least 13.1, which corresponds to their principals characterizing three of the five aspects as "very high" and the other two as "high," on average. Students in schools with a **Medium Emphasis** on academic success had a score no higher than 8.9, which corresponds to their principals characterizing three of the five aspects as "medium" and the other two as "high," on average. All other students attended schools with a **High Emphasis** on academic success.

Country	Very High Emphasis		High Emphasis		Medium Emphasis		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Northern Ireland	33 (4.2)	532 (4.2)	60 (4.3)	511 (3.9)	7 (2.5)	495 (12.1)	12.0 (0.19)
Qatar	31 (2.9)	418 (12.1)	54 (3.2)	393 (6.2)	15 (2.4)	349 (12.7)	11.6 (0.14)
Ireland	28 (4.0)	532 (5.1)	67 (3.9)	512 (4.6)	4 (1.7)	493 (7.8)	11.9 (0.17)
United States	22 (2.5)	566 (4.5)	60 (2.7)	546 (3.3)	18 (2.1)	520 (5.0)	11.2 (0.13)
New Zealand	22 (3.0)	517 (4.4)	67 (3.3)	497 (3.4)	11 (2.1)	459 (11.2)	11.5 (0.14)
Korea, Rep. of	22 (3.5)	597 (3.4)	58 (4.3)	586 (2.5)	20 (3.4)	576 (3.1)	11.1 (0.19)
United Arab Emirates	21 (1.6)	461 (5.9)	61 (2.0)	422 (3.6)	18 (1.7)	390 (7.1)	11.2 (0.09)
Chinese Taipei	17 (3.0)	551 (6.0)	71 (3.7)	553 (2.7)	12 (2.5)	543 (4.6)	11.3 (0.15)
Australia	16 (3.0)	544 (7.3)	64 (3.8)	519 (3.4)	21 (3.0)	487 (5.1)	10.9 (0.14)
Malta	13 (0.1)	462 (4.0)	69 (0.1)	455 (2.2)	18 (0.1)	402 (3.4)	11.1 (0.00)
Bahrain	11 (2.5)	498 (9.3)	68 (3.7)	447 (4.9)	21 (2.8)	430 (9.1)	10.6 (0.16)
England	10 (2.9)	539 (7.0)	72 (4.7)	531 (4.3)	17 (3.8)	508 (8.5)	10.8 (0.18)
Iran, Islamic Rep. of	9 (2.0)	464 (14.9)	70 (3.4)	459 (5.1)	21 (2.7)	428 (7.0)	10.6 (0.12)
Saudi Arabia	9 (2.7)	480 (20.9)	59 (4.1)	439 (4.6)	32 (3.4)	397 (10.9)	10.2 (0.18)
Croatia	9 (2.5)	525 (5.4)	70 (3.8)	518 (2.4)	21 (3.4)	507 (4.7)	10.7 (0.14)
Sweden	9 (2.7)	556 (9.0)	59 (4.8)	533 (3.4)	32 (4.9)	527 (5.4)	10.3 (0.17)
Kuwait	9 (2.0)	355 (16.7)	65 (3.8)	355 (6.3)	27 (3.8)	329 (9.3)	10.4 (0.17)
Oman	9 (1.8)	368 (10.8)	73 (3.0)	377 (5.7)	18 (2.2)	348 (7.8)	10.6 (0.10)
Austria	8 (2.1)	534 (9.0)	75 (4.4)	535 (2.6)	17 (3.9)	515 (8.2)	10.4 (0.14)
Singapore	8 (0.0)	611 (12.9)	62 (0.0)	589 (4.6)	31 (0.0)	565 (6.6)	10.2 (0.00)
Finland	6 (1.9)	585 (3.3)	71 (4.2)	572 (2.9)	24 (4.2)	561 (4.5)	10.4 (0.16)
Lithuania	6 (2.0)	529 (11.9)	65 (3.6)	521 (3.0)	29 (3.4)	499 (5.5)	10.0 (0.13)
Kazakhstan	5 (1.9)	483 (29.5)	65 (4.4)	497 (7.1)	30 (4.1)	491 (9.9)	10.2 (0.12)
Chile	5 (1.9)	533 (15.9)	30 (3.3)	498 (6.1)	65 (3.8)	471 (4.0)	8.8 (0.19)
Denmark	r 5 (1.3)	537 (4.7)	65 (3.6)	530 (3.9)	30 (3.3)	530 (4.8)	10.1 (0.11)
Portugal	4 (2.0)	540 (8.5)	64 (5.0)	526 (5.6)	31 (4.5)	511 (6.4)	10.0 (0.13)
Azerbaijan	4 (1.7)	465 (17.3)	44 (3.8)	443 (10.6)	53 (3.8)	431 (6.3)	9.2 (0.15)
Romania	4 (1.6)	558 (22.5)	55 (4.1)	520 (7.0)	41 (4.1)	480 (10.0)	9.5 (0.15)
Poland	3 (1.6)	551 (17.0)	70 (3.5)	507 (2.9)	26 (3.7)	495 (4.7)	9.8 (0.15)
Morocco	3 (1.0)	349 (20.6)	25 (3.1)	292 (12.5)	72 (3.0)	252 (5.9)	8.0 (0.14)
Yemen	2 (1.2)	~ ~	35 (4.2)	225 (10.4)	62 (4.5)	201 (9.7)	8.7 (0.18)
Tunisia	2 (1.3)	~ ~	37 (4.3)	361 (6.6)	60 (4.2)	334 (6.8)	8.8 (0.16)
Spain	2 (1.3)	~ ~	58 (4.1)	513 (3.2)	40 (3.9)	493 (5.1)	9.6 (0.12)
Turkey	2 (1.0)	~ ~	33 (3.3)	484 (7.7)	65 (3.1)	449 (5.6)	8.6 (0.14)
Thailand	2 (1.1)	~ ~	52 (4.8)	478 (7.1)	46 (4.8)	461 (9.2)	9.5 (0.14)
Serbia	2 (1.2)	~ ~	52 (4.0)	520 (3.8)	46 (4.0)	507 (4.6)	9.4 (0.13)
Slovenia	2 (0.8)	~ ~	63 (2.9)	520 (3.0)	35 (3.1)	520 (4.0)	9.6 (0.10)
Russian Federation	2 (0.9)	~ ~	50 (4.4)	559 (4.4)	48 (4.3)	546 (4.2)	9.2 (0.11)
Hong Kong SAR	1 (0.9)	~ ~	60 (4.5)	536 (3.8)	38 (4.6)	534 (7.5)	9.7 (0.16)
Japan	1 (1.0)	~ ~	48 (4.5)	565 (2.5)	51 (4.5)	552 (2.8)	9.0 (0.16)
Italy	1 (0.8)	~ ~	52 (3.7)	523 (3.7)	46 (3.7)	525 (4.2)	9.4 (0.10)
Hungary	1 (0.9)	~ ~	49 (3.9)	556 (4.4)	50 (3.9)	515 (5.6)	9.0 (0.13)
Czech Republic	1 (0.9)	~ ~	45 (3.9)	538 (4.0)	54 (4.0)	535 (3.2)	8.9 (0.13)
Armenia	1 (0.8)	~ ~	56 (4.3)	422 (4.6)	43 (4.3)	409 (5.9)	9.6 (0.12)
Norway	1 (0.1)	~ ~	64 (4.7)	497 (3.1)	34 (4.7)	486 (3.3)	9.8 (0.13)
Germany	1 (0.8)	~ ~	66 (3.4)	539 (2.6)	33 (3.3)	508 (5.3)	9.9 (0.11)
Netherlands	r 1 (1.0)	~ ~	50 (6.0)	536 (3.4)	49 (6.0)	528 (3.3)	9.3 (0.18)
Georgia	1 (0.9)	~ ~	46 (3.9)	460 (6.2)	53 (3.6)	450 (5.3)	9.1 (0.11)
Slovak Republic	1 (0.7)	~ ~	41 (3.4)	545 (4.5)	58 (3.4)	521 (5.6)	8.8 (0.10)
Belgium (Flemish)	1 (0.0)	~ ~	70 (3.7)	513 (2.1)	30 (3.7)	500 (4.3)	9.9 (0.11)
International Avg.	8 (0.3)	508 (2.3)	58 (0.5)	492 (0.7)	34 (0.5)	471 (1.0)	

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

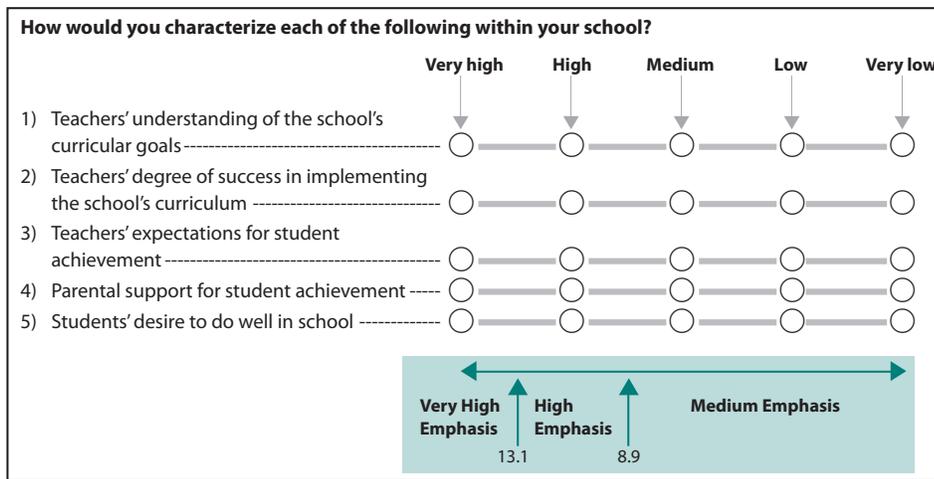
A tilde (~) indicates insufficient data to report achievement.

An "r" indicates data are available for at least 70% but less than 85% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011

**Exhibit 6.1: School Emphasis on Academic Success - Principal Reports (Continued)**

Country	Very High Emphasis		High Emphasis		Medium Emphasis		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Sixth Grade Participants</b>							
Honduras	10 (2.5)	415 (16.3)	61 (4.5)	431 (9.4)	29 (4.1)	439 (6.9)	10.2 (0.17)
Botswana	5 (1.8)	498 (34.3)	29 (3.8)	397 (12.3)	66 (4.1)	344 (5.4)	8.8 (0.18)
Yemen	2 (1.2)	~ ~	33 (4.2)	372 (10.8)	65 (4.2)	331 (8.9)	8.7 (0.17)
<b>Benchmarking Participants</b>							
Dubai, UAE	35 (0.3)	494 (3.3)	49 (0.5)	459 (3.1)	16 (0.4)	380 (7.0)	11.8 (0.01)
Alberta, Canada	31 (4.4)	551 (3.6)	58 (4.9)	541 (3.3)	12 (2.8)	524 (10.6)	11.8 (0.17)
Florida, US	27 (5.0)	582 (7.3)	58 (5.3)	530 (4.9)	15 (4.4)	528 (9.1)	11.5 (0.27)
Abu Dhabi, UAE	17 (3.4)	431 (11.1)	68 (3.8)	408 (5.7)	15 (3.0)	379 (15.6)	11.0 (0.17)
Ontario, Canada	12 (2.9)	546 (7.0)	65 (4.3)	532 (3.6)	23 (4.1)	508 (4.6)	10.6 (0.20)
North Carolina, US	7 (4.2)	589 (7.6)	76 (7.1)	542 (5.7)	17 (5.6)	514 (8.3)	10.8 (0.27)
Quebec, Canada	5 (1.6)	549 (10.2)	75 (3.6)	518 (3.0)	21 (3.4)	503 (5.2)	10.4 (0.12)



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

## Exhibit 6.2: School Emphasis on Academic Success - Principal Reports

Reported by Principals

Students were scored according to their principals' responses characterizing five aspects on the *School Emphasis on Academic Success* scale. Students in schools where their principals reported **Very High Emphasis** on academic success had a score on the scale of at least 13.3, which corresponds to their principals characterizing three of the five aspects as "very high" and the other two as "high," on average. Students in schools with a **Medium Emphasis** on academic success had a score no higher than 9.2, which corresponds to their principals characterizing three of the five aspects as "medium" and the other two as "high," on average. All other students attended schools with a **High Emphasis** on academic success.

Country	Very High Emphasis		High Emphasis		Medium Emphasis		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Qatar	27 (0.3)	461 (7.0)	57 (0.3)	404 (5.2)	16 (0.1)	388 (4.7)	11.5 (0.02)
England	26 (3.5)	553 (11.3)	56 (4.7)	534 (7.7)	19 (3.4)	506 (14.1)	11.6 (0.18)
Australia	20 (2.7)	567 (12.6)	48 (3.8)	522 (5.6)	32 (3.1)	495 (8.0)	10.8 (0.16)
New Zealand	19 (3.8)	546 (5.1)	61 (4.9)	509 (6.8)	20 (3.3)	496 (7.0)	11.1 (0.15)
United Arab Emirates	17 (1.6)	505 (6.8)	63 (2.0)	463 (3.1)	20 (1.8)	433 (4.9)	11.1 (0.09)
Korea, Rep. of	16 (3.2)	577 (5.4)	56 (4.3)	560 (2.7)	28 (3.6)	550 (2.8)	10.7 (0.19)
United States	15 (2.0)	546 (7.4)	61 (2.7)	531 (3.8)	24 (2.1)	500 (5.6)	10.9 (0.09)
Chinese Taipei	12 (2.8)	598 (10.8)	81 (3.3)	560 (2.9)	7 (1.7)	543 (7.2)	11.4 (0.11)
Iran, Islamic Rep. of	12 (2.5)	517 (12.1)	62 (3.6)	478 (5.8)	27 (2.6)	447 (5.6)	10.7 (0.13)
Singapore	11 (0.0)	638 (13.7)	60 (0.0)	594 (4.8)	29 (0.0)	560 (9.0)	10.8 (0.00)
Israel	9 (2.4)	517 (14.1)	75 (3.6)	527 (4.9)	17 (3.0)	477 (12.5)	11.0 (0.13)
Indonesia	8 (2.2)	430 (17.7)	60 (4.8)	407 (6.8)	32 (4.4)	398 (6.1)	10.4 (0.16)
Oman	7 (1.4)	453 (11.0)	67 (2.8)	429 (4.3)	25 (2.6)	383 (5.7)	10.5 (0.10)
Saudi Arabia	7 (2.3)	466 (11.6)	48 (4.5)	439 (5.6)	45 (4.1)	428 (6.4)	9.9 (0.16)
Ghana	6 (1.7)	366 (13.7)	53 (4.6)	314 (8.7)	41 (4.3)	286 (7.5)	10.0 (0.13)
Malaysia	6 (1.9)	463 (28.5)	65 (3.1)	442 (7.8)	29 (2.7)	384 (9.1)	10.4 (0.12)
Kazakhstan	5 (1.8)	522 (23.1)	60 (4.2)	483 (6.4)	35 (4.1)	497 (6.8)	10.2 (0.13)
Jordan	5 (1.6)	479 (9.7)	56 (3.5)	459 (5.5)	39 (3.6)	431 (6.1)	10.0 (0.14)
Chile	5 (1.8)	505 (11.8)	27 (3.3)	489 (5.5)	68 (3.3)	449 (3.4)	8.7 (0.17)
Sweden	5 (2.1)	518 (9.9)	62 (4.6)	517 (4.0)	34 (4.4)	499 (5.0)	10.3 (0.15)
Romania	4 (1.6)	514 (13.0)	55 (4.6)	476 (5.6)	41 (4.6)	446 (5.3)	9.8 (0.16)
Finland	4 (1.8)	571 (8.8)	71 (4.1)	555 (2.9)	25 (3.9)	541 (4.0)	10.4 (0.13)
Syrian Arab Republic	4 (1.7)	402 (18.8)	39 (3.7)	439 (5.2)	57 (3.9)	420 (5.6)	9.3 (0.19)
Bahrain	4 (0.1)	552 (6.3)	57 (0.3)	468 (2.5)	40 (0.3)	420 (3.3)	10.3 (0.01)
Macedonia, Rep. of	3 (1.1)	426 (23.8)	64 (3.6)	422 (6.4)	33 (3.7)	383 (11.8)	10.2 (0.15)
Morocco	3 (0.9)	442 (22.7)	26 (2.7)	394 (5.0)	71 (2.7)	367 (2.7)	8.7 (0.12)
Hong Kong SAR	3 (1.6)	590 (31.2)	51 (4.1)	552 (5.1)	47 (4.3)	512 (6.6)	9.8 (0.15)
Palestinian Nat'l Auth.	3 (1.4)	410 (9.7)	52 (4.1)	423 (5.1)	46 (4.2)	418 (6.3)	9.7 (0.14)
Thailand	3 (1.4)	475 (15.5)	47 (3.9)	458 (7.2)	50 (4.1)	443 (5.7)	9.7 (0.15)
Lebanon	2 (1.2)	~ ~	59 (4.1)	431 (7.0)	39 (3.9)	371 (7.2)	9.8 (0.16)
Slovenia	2 (1.1)	~ ~	62 (3.4)	546 (3.3)	35 (3.5)	538 (4.8)	9.8 (0.12)
Turkey	2 (0.9)	~ ~	33 (3.1)	519 (7.9)	65 (3.0)	463 (4.0)	8.9 (0.11)
Norway	2 (1.1)	~ ~	63 (4.6)	499 (3.5)	35 (4.5)	485 (3.2)	10.1 (0.13)
Lithuania	2 (1.1)	~ ~	56 (3.9)	522 (3.8)	42 (3.9)	503 (4.5)	9.7 (0.12)
Japan	2 (1.1)	~ ~	52 (4.4)	566 (3.3)	47 (4.3)	548 (3.2)	9.7 (0.14)
Hungary	1 (1.0)	~ ~	48 (4.2)	538 (3.6)	51 (4.1)	507 (5.2)	9.3 (0.15)
Tunisia	1 (0.4)	~ ~	18 (3.1)	452 (8.3)	82 (3.0)	436 (2.6)	8.0 (0.14)
Italy	0 (0.0)	~ ~	47 (3.6)	506 (3.7)	53 (3.6)	497 (4.2)	9.4 (0.13)
Armenia	0 (0.0)	~ ~	41 (4.2)	450 (6.2)	59 (4.2)	428 (4.4)	9.3 (0.10)
Georgia	0 (0.0)	~ ~	30 (3.3)	431 (7.0)	70 (3.3)	416 (3.8)	8.7 (0.11)
Russian Federation	0 (0.0)	~ ~	28 (3.0)	561 (6.9)	72 (3.0)	535 (3.4)	8.8 (0.08)
Ukraine	0 (0.0)	~ ~	31 (3.5)	520 (5.2)	69 (3.5)	493 (4.2)	9.0 (0.10)
International Avg.	7 (0.3)	504 (2.8)	53 (0.6)	486 (0.9)	41 (0.5)	460 (1.0)	

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

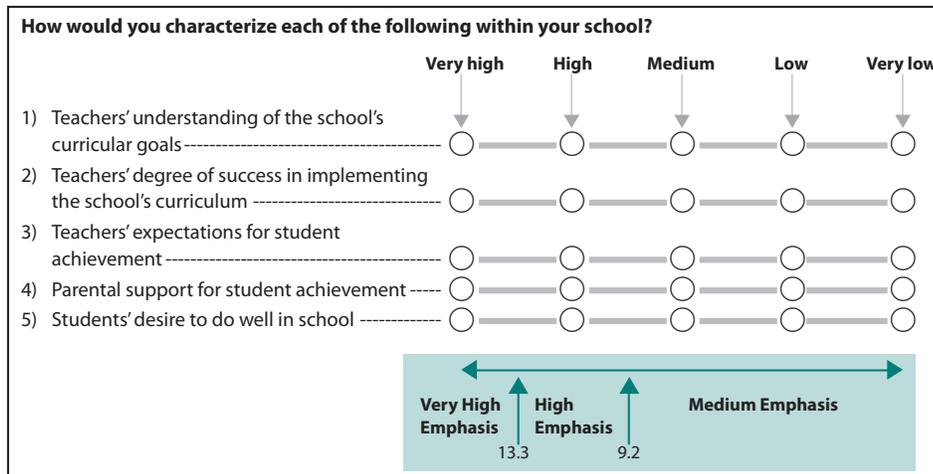
A tilde (~) indicates insufficient data to report achievement.

An "r" indicates data are available for at least 70% but less than 85% of the students.

**Exhibit 6.2: School Emphasis on Academic Success - Principal Reports (Continued)**

Country	Very High Emphasis		High Emphasis		Medium Emphasis		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Ninth Grade Participants</b>							
South Africa	4 (1.0)	470 (57.6)	31 (3.1)	359 (11.1)	66 (3.0)	310 (4.7)	8.9 (0.12)
Honduras	2 (1.0)	~ ~	52 (4.6)	370 (6.7)	47 (4.7)	364 (6.1)	9.4 (0.18)
Botswana	1 (0.8)	~ ~	20 (3.2)	429 (9.0)	79 (3.2)	395 (4.1)	8.2 (0.13)
<b>Benchmarking Participants</b>							
Dubai, UAE	28 (0.4)	528 (4.6)	59 (0.4)	480 (3.5)	13 (0.3)	417 (6.3)	11.8 (0.02)
Massachusetts, US	27 (6.1)	586 (11.1)	51 (6.7)	560 (10.8)	22 (5.8)	550 (14.8)	11.4 (0.34)
Connecticut, US	22 (5.6)	560 (15.9)	54 (6.9)	545 (10.2)	24 (5.7)	485 (13.8)	11.2 (0.29)
Alberta, Canada	19 (3.1)	562 (5.0)	68 (4.0)	543 (2.8)	13 (2.7)	536 (5.6)	11.5 (0.15)
Colorado, US	18 (4.6)	568 (9.5)	52 (7.2)	544 (8.1)	30 (5.7)	520 (14.4)	10.9 (0.26)
California, US	14 (3.0)	546 (12.8)	63 (5.9)	499 (7.8)	23 (4.9)	468 (10.6)	10.8 (0.21)
Indiana, US	13 (5.6)	547 (14.7)	68 (7.0)	535 (7.1)	18 (5.5)	534 (9.0)	11.1 (0.32)
Abu Dhabi, UAE	13 (3.4)	501 (18.3)	64 (4.4)	463 (5.2)	22 (3.9)	433 (6.7)	10.9 (0.18)
Ontario, Canada	13 (3.1)	525 (6.6)	62 (4.4)	527 (2.7)	25 (3.6)	507 (7.0)	10.7 (0.17)
Minnesota, US	12 (5.1)	546 (41.5)	68 (6.0)	557 (5.1)	20 (5.4)	548 (13.1)	11.1 (0.24)
Alabama, US	11 (2.8)	530 (26.3)	56 (9.0)	489 (8.1)	33 (9.0)	465 (11.5)	10.6 (0.27)
Florida, US	10 (4.9)	522 (40.8)	66 (8.2)	536 (10.2)	24 (6.9)	511 (13.8)	10.6 (0.31)
North Carolina, US	9 (4.2)	552 (10.5)	46 (7.4)	545 (9.6)	45 (6.6)	514 (11.1)	10.1 (0.25)
Quebec, Canada	7 (1.8)	561 (9.6)	62 (4.1)	525 (3.2)	31 (3.7)	501 (5.2)	10.4 (0.13)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



### Exhibit 6.3: School Emphasis on Academic Success - Teacher Reports

Reported by Teachers

Students were scored according to their teachers' responses characterizing five aspects on the *School Emphasis on Academic Success* scale. Students in schools where their teachers reported a **Very High Emphasis** on academic success had a score on the scale of at least 13.1, which corresponds to their teachers characterizing three of the five aspects as "very high" and the other two as "high," on average. Students in schools with a **Medium Emphasis** on academic success had a score no higher than 8.8, which corresponds to their teachers characterizing three of the five aspects as "medium" and the other two as "high," on average. All other students attended schools with a **High Emphasis** on academic success.

Country	Very High Emphasis		High Emphasis		Medium Emphasis		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Northern Ireland	r 28 (4.2)	527 (6.6)	66 (4.3)	514 (3.8)	6 (1.9)	496 (9.8)	11.8 (0.18)
Ireland	22 (3.4)	537 (5.0)	70 (3.5)	514 (4.5)	8 (1.8)	481 (8.9)	11.5 (0.15)
Croatia	21 (3.0)	515 (3.8)	69 (3.6)	516 (2.5)	10 (2.2)	520 (5.6)	11.4 (0.12)
England	17 (2.9)	554 (8.0)	67 (4.4)	529 (4.1)	16 (3.4)	504 (7.6)	11.1 (0.14)
United States	r 17 (2.1)	563 (4.3)	68 (2.7)	547 (2.5)	15 (1.8)	514 (5.3)	11.0 (0.11)
Korea, Rep. of	17 (3.4)	600 (6.1)	65 (3.7)	587 (2.1)	18 (3.4)	574 (3.7)	10.9 (0.19)
United Arab Emirates	17 (2.2)	461 (6.8)	66 (2.8)	429 (3.6)	17 (1.8)	402 (6.8)	11.0 (0.10)
Qatar	16 (3.9)	405 (20.8)	57 (5.2)	401 (7.5)	27 (4.1)	373 (10.7)	10.6 (0.19)
Australia	r 16 (2.9)	548 (11.3)	64 (4.4)	520 (4.1)	20 (3.1)	494 (5.4)	10.8 (0.16)
New Zealand	14 (2.1)	522 (7.1)	69 (2.9)	497 (2.8)	17 (2.5)	478 (6.4)	10.9 (0.12)
Malta	14 (0.1)	467 (3.5)	69 (0.1)	448 (2.1)	17 (0.1)	423 (3.3)	10.7 (0.00)
Kazakhstan	12 (2.3)	479 (13.4)	68 (3.4)	495 (6.5)	20 (2.9)	506 (11.9)	10.7 (0.13)
Chinese Taipei	11 (2.7)	562 (6.4)	73 (3.1)	554 (2.5)	17 (2.7)	538 (6.2)	10.6 (0.15)
Saudi Arabia	10 (2.2)	466 (12.1)	56 (4.3)	437 (6.0)	35 (4.0)	406 (10.9)	10.1 (0.16)
Austria	10 (2.1)	542 (4.6)	72 (2.8)	534 (3.4)	19 (2.5)	517 (6.1)	10.5 (0.12)
Oman	9 (1.8)	390 (13.4)	59 (3.3)	390 (4.8)	32 (2.9)	351 (6.5)	10.1 (0.11)
Iran, Islamic Rep. of	9 (1.8)	473 (14.5)	68 (3.5)	460 (5.4)	23 (3.0)	422 (7.9)	10.5 (0.13)
Bahrain	9 (2.6)	499 (17.5)	57 (4.3)	454 (4.6)	34 (3.9)	429 (6.9)	10.3 (0.16)
Romania	9 (2.3)	497 (20.9)	61 (3.7)	521 (6.3)	30 (3.3)	472 (11.7)	10.2 (0.16)
Azerbaijan	8 (2.4)	459 (19.6)	43 (3.7)	444 (7.5)	49 (4.2)	429 (8.1)	9.6 (0.18)
Poland	7 (2.0)	501 (7.4)	76 (3.2)	507 (2.9)	17 (2.8)	496 (4.3)	10.3 (0.12)
Spain	7 (2.1)	515 (10.2)	54 (4.4)	517 (3.2)	39 (4.1)	488 (4.2)	9.7 (0.16)
Denmark	7 (1.9)	544 (8.2)	64 (3.5)	536 (3.0)	29 (2.9)	514 (6.1)	10.1 (0.11)
Chile	6 (2.0)	540 (5.7)	43 (3.7)	492 (4.6)	51 (4.0)	464 (4.7)	9.2 (0.16)
Yemen	6 (2.4)	188 (26.0)	46 (4.6)	205 (9.3)	48 (4.7)	215 (10.9)	9.4 (0.22)
Hong Kong SAR	6 (2.1)	536 (10.1)	63 (4.6)	538 (5.0)	31 (4.4)	529 (8.7)	9.8 (0.18)
Kuwait	5 (1.9)	378 (20.9)	66 (3.5)	348 (6.1)	28 (3.4)	337 (8.4)	10.2 (0.15)
Serbia	5 (1.9)	553 (13.7)	69 (3.6)	520 (3.5)	25 (3.3)	495 (6.8)	10.1 (0.13)
Finland	5 (1.7)	577 (8.6)	63 (3.2)	575 (2.6)	33 (3.4)	561 (4.4)	9.9 (0.12)
Portugal	4 (1.7)	577 (16.8)	56 (4.7)	531 (3.7)	40 (4.6)	503 (5.6)	9.9 (0.18)
Sweden	r 4 (1.7)	570 (10.3)	63 (4.8)	541 (3.0)	33 (4.6)	519 (5.0)	9.9 (0.17)
Singapore	4 (1.1)	619 (19.2)	62 (2.7)	589 (5.0)	34 (2.5)	569 (5.8)	9.8 (0.09)
Georgia	4 (1.4)	476 (16.9)	61 (3.6)	461 (4.5)	36 (3.6)	442 (6.7)	9.8 (0.12)
Turkey	4 (1.1)	525 (12.0)	39 (3.3)	481 (8.4)	57 (3.3)	445 (5.0)	8.8 (0.14)
Thailand	3 (1.4)	444 (11.9)	55 (4.2)	485 (7.2)	42 (4.3)	460 (9.5)	9.5 (0.16)
Tunisia	3 (1.2)	413 (16.7)	38 (3.3)	365 (7.9)	59 (3.2)	330 (7.4)	8.9 (0.14)
Armenia	3 (1.2)	427 (22.7)	57 (3.2)	421 (4.9)	40 (3.2)	409 (5.4)	9.6 (0.12)
Lithuania	3 (0.9)	512 (13.8)	74 (3.2)	517 (3.2)	23 (3.2)	506 (5.6)	10.2 (0.09)
Belgium (Flemish)	2 (1.1)	~ ~	67 (3.4)	514 (2.2)	31 (3.3)	498 (4.1)	9.8 (0.10)
Slovenia	2 (1.1)	~ ~	66 (3.7)	524 (3.3)	32 (3.5)	513 (4.0)	9.7 (0.10)
Norway	2 (1.2)	~ ~	73 (4.3)	496 (2.5)	25 (4.4)	486 (4.5)	9.9 (0.16)
Czech Republic	2 (0.9)	~ ~	44 (4.2)	539 (3.6)	54 (4.2)	534 (3.8)	9.0 (0.14)
Japan	1 (1.1)	~ ~	56 (3.9)	561 (2.1)	42 (3.9)	555 (3.1)	9.4 (0.14)
Slovak Republic	1 (0.7)	~ ~	49 (3.4)	537 (3.3)	50 (3.3)	524 (6.8)	9.1 (0.13)
Italy	1 (0.4)	~ ~	55 (3.9)	531 (3.6)	44 (3.9)	518 (4.5)	9.3 (0.13)
Morocco	1 (0.5)	~ ~	25 (2.5)	279 (11.3)	74 (2.6)	257 (5.8)	7.9 (0.10)
Russian Federation	1 (0.0)	~ ~	52 (4.0)	554 (3.5)	47 (4.1)	550 (5.2)	9.3 (0.12)
Hungary	0 (0.3)	~ ~	56 (3.7)	552 (4.3)	44 (3.7)	511 (6.0)	9.3 (0.12)
Germany	0 (0.0)	~ ~	59 (3.5)	541 (2.8)	41 (3.5)	510 (4.2)	9.3 (0.11)
Netherlands	r 0 (0.0)	~ ~	40 (4.2)	537 (4.0)	60 (4.2)	526 (3.0)	9.0 (0.13)
International Avg.	8 (0.3)	499 (2.2)	60 (0.5)	492 (0.7)	33 (0.5)	472 (1.0)	

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

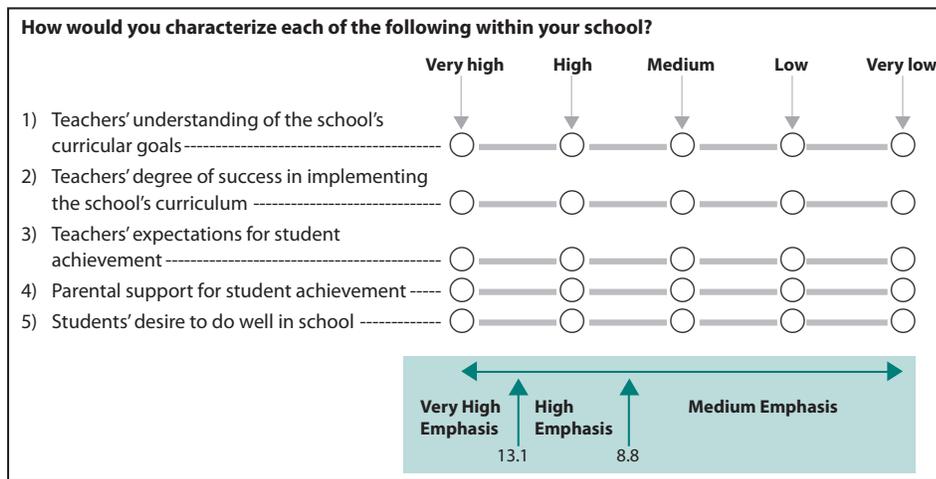
An "r" indicates data are available for at least 70% but less than 85% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011

**Exhibit 6.3: School Emphasis on Academic Success - Teacher Reports (Continued)**

Country	Very High Emphasis		High Emphasis		Medium Emphasis		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Sixth Grade Participants</b>							
Honduras	12 (3.0)	473 (18.2)	52 (4.4)	435 (7.5)	37 (4.4)	414 (9.5)	10.2 (0.21)
Botswana	7 (2.3)	449 (33.1)	33 (3.8)	399 (11.6)	60 (3.9)	344 (6.5)	9.0 (0.18)
Yemen	5 (2.2)	305 (34.0)	42 (4.2)	345 (10.4)	53 (4.0)	349 (9.7)	9.2 (0.18)
<b>Benchmarking Participants</b>							
Florida, US	r 20 (4.5)	556 (8.2)	55 (4.5)	547 (5.8)	25 (3.3)	530 (7.0)	10.6 (0.24)
Alberta, Canada	r 19 (4.2)	542 (5.6)	68 (3.9)	547 (3.4)	13 (2.9)	509 (9.2)	11.2 (0.18)
Dubai, UAE	r 19 (3.9)	498 (10.8)	65 (3.9)	462 (6.2)	16 (1.4)	443 (8.9)	11.1 (0.13)
Abu Dhabi, UAE	16 (3.8)	456 (15.8)	65 (4.4)	407 (7.4)	18 (3.4)	400 (9.6)	11.0 (0.21)
Ontario, Canada	10 (2.1)	541 (7.8)	63 (3.8)	529 (3.3)	27 (3.5)	518 (6.1)	10.3 (0.16)
North Carolina, US	8 (3.2)	574 (14.2)	65 (4.6)	541 (6.0)	26 (4.5)	517 (5.4)	10.3 (0.27)
Quebec, Canada	5 (1.8)	530 (11.6)	66 (4.3)	518 (3.2)	29 (4.3)	510 (4.1)	10.2 (0.15)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



## Exhibit 6.4: School Emphasis on Academic Success - Teacher Reports

Reported by Teachers

Students were scored according to their teachers' responses characterizing five aspects on the *School Emphasis on Academic Success* scale. Students in schools where their teachers reported **Very High Emphasis** on academic success had a score on the scale of at least 13.6, which corresponds to their teachers characterizing three of the five aspects as "very high" and the other two as "high," on average. Students in schools with a **Medium Emphasis** on academic success had a score no higher than 9.5, which corresponds to their teachers characterizing three of the five aspects as "medium" and the other two as "high," on average. All other students attended schools with a **High Emphasis** on academic success.

Country	Very High Emphasis		High Emphasis		Medium Emphasis		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Qatar	16 (1.7)	431 (14.9)	58 (3.6)	432 (7.8)	26 (3.6)	380 (11.1)	11.3 (0.14)
England	16 (2.5)	554 (14.5)	60 (3.6)	533 (5.9)	24 (3.2)	514 (12.0)	11.1 (0.15)
United States	r 10 (1.6)	563 (10.2)	54 (2.5)	536 (3.3)	36 (2.1)	503 (4.5)	10.5 (0.09)
Australia	s 10 (2.2)	570 (11.1)	51 (3.5)	535 (8.7)	39 (3.6)	501 (6.9)	10.4 (0.17)
Ghana	10 (2.4)	356 (18.0)	61 (3.7)	308 (7.7)	29 (3.5)	286 (7.9)	10.7 (0.16)
United Arab Emirates	9 (1.6)	490 (10.4)	66 (2.4)	465 (3.4)	25 (2.2)	440 (4.5)	11.0 (0.10)
Indonesia	9 (2.5)	387 (23.2)	56 (3.9)	408 (5.0)	35 (3.8)	405 (6.6)	10.7 (0.15)
Saudi Arabia	9 (2.5)	468 (8.6)	52 (4.0)	443 (4.4)	39 (4.0)	420 (6.2)	10.4 (0.16)
Bahrain	9 (2.3)	548 (6.1)	47 (3.6)	460 (4.9)	44 (2.8)	428 (4.4)	10.1 (0.12)
Chinese Taipei	8 (2.2)	582 (9.3)	66 (3.7)	567 (3.2)	26 (3.4)	551 (5.2)	10.8 (0.13)
New Zealand	8 (2.2)	518 (10.8)	62 (3.8)	518 (6.1)	30 (3.4)	494 (7.1)	10.6 (0.13)
Romania	7 (1.2)	496 (8.9)	55 (2.4)	471 (3.8)	37 (2.5)	449 (5.0)	10.4 (0.11)
Oman	7 (1.8)	454 (14.0)	53 (3.5)	440 (4.5)	40 (3.1)	388 (5.6)	10.1 (0.13)
Malaysia	7 (1.9)	460 (29.1)	64 (3.8)	439 (7.2)	30 (3.7)	389 (9.8)	10.6 (0.15)
Korea, Rep. of	5 (1.7)	569 (6.0)	56 (4.2)	564 (2.7)	39 (3.9)	554 (3.3)	10.3 (0.13)
Israel	5 (1.6)	549 (9.0)	60 (3.5)	528 (5.0)	35 (3.7)	492 (7.5)	10.5 (0.15)
Sweden	r 5 (2.1)	543 (10.5)	53 (3.7)	516 (3.9)	42 (3.4)	500 (3.7)	10.2 (0.13)
Lebanon	5 (1.4)	455 (13.8)	50 (3.4)	429 (7.0)	45 (3.4)	374 (6.0)	10.1 (0.14)
Kazakhstan	5 (0.8)	497 (11.2)	67 (2.7)	484 (5.0)	28 (2.7)	505 (6.0)	10.7 (0.09)
Macedonia, Rep. of	4 (1.0)	449 (14.1)	54 (2.1)	419 (5.6)	41 (2.2)	393 (7.6)	10.3 (0.10)
Hong Kong SAR	4 (1.9)	559 (21.3)	50 (4.5)	553 (5.2)	46 (4.5)	514 (6.7)	9.8 (0.20)
Syrian Arab Republic	4 (1.3)	429 (11.8)	46 (3.4)	436 (5.5)	50 (3.5)	417 (6.0)	9.8 (0.15)
Jordan	4 (1.7)	463 (15.0)	54 (4.2)	458 (5.4)	42 (4.0)	436 (6.6)	10.2 (0.14)
Japan	3 (1.5)	584 (23.1)	43 (4.2)	569 (3.3)	54 (4.1)	547 (2.9)	9.6 (0.16)
Iran, Islamic Rep. of	3 (1.2)	567 (22.4)	52 (3.5)	488 (5.0)	45 (3.5)	453 (4.7)	10.0 (0.12)
Chile	3 (1.2)	508 (21.4)	28 (3.7)	474 (6.8)	69 (3.8)	454 (3.0)	9.0 (0.17)
Singapore	3 (0.9)	624 (37.9)	54 (2.3)	616 (5.9)	43 (2.2)	554 (7.6)	10.1 (0.09)
Thailand	3 (1.4)	450 (24.2)	53 (4.1)	458 (7.2)	45 (4.2)	443 (5.5)	9.9 (0.15)
Norway	2 (1.2)	~ ~	64 (4.6)	499 (2.8)	34 (4.4)	483 (4.6)	10.4 (0.11)
Palestinian Nat'l Auth.	2 (1.2)	~ ~	52 (4.0)	423 (4.6)	46 (4.0)	417 (6.1)	10.0 (0.13)
Tunisia	2 (1.2)	~ ~	24 (3.5)	438 (5.3)	74 (3.8)	436 (2.8)	8.8 (0.14)
Lithuania	2 (0.5)	~ ~	57 (2.2)	522 (3.0)	41 (2.2)	503 (3.7)	10.1 (0.07)
Turkey	2 (0.9)	~ ~	33 (3.1)	510 (6.4)	65 (3.1)	466 (3.7)	9.1 (0.12)
Finland	2 (0.6)	~ ~	52 (2.6)	557 (3.0)	46 (2.6)	546 (3.0)	10.0 (0.09)
Morocco	1 (0.5)	~ ~	19 (2.3)	397 (4.9)	80 (2.4)	370 (2.6)	8.4 (0.09)
Russian Federation	1 (0.5)	~ ~	31 (2.0)	563 (3.6)	68 (2.2)	533 (3.7)	9.2 (0.09)
Slovenia	1 (0.6)	~ ~	44 (2.1)	544 (3.1)	54 (2.2)	541 (3.1)	9.5 (0.08)
Georgia	1 (0.5)	~ ~	31 (2.5)	437 (4.0)	68 (2.5)	412 (3.3)	9.0 (0.09)
Armenia	1 (0.4)	~ ~	34 (2.7)	448 (4.7)	65 (2.8)	433 (3.7)	9.2 (0.10)
Hungary	1 (0.2)	~ ~	42 (2.4)	541 (3.3)	58 (2.4)	509 (4.2)	9.3 (0.08)
Ukraine	0 (0.1)	~ ~	37 (3.0)	515 (4.9)	63 (3.0)	493 (4.1)	9.4 (0.08)
Italy	0 (0.0)	~ ~	36 (3.9)	509 (4.4)	64 (3.9)	498 (4.0)	9.2 (0.12)
International Avg.	5 (0.2)	504 (3.2)	50 (0.5)	487 (0.8)	46 (0.5)	463 (0.9)	

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

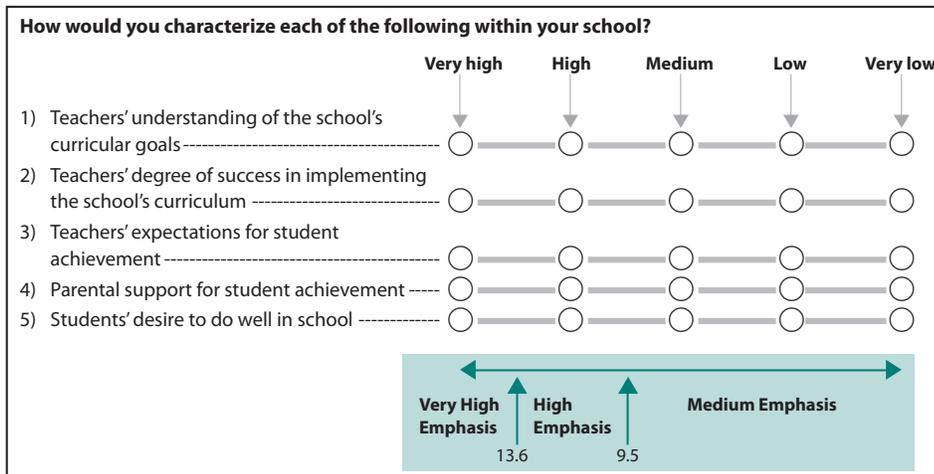
An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

An "x" indicates data are available for less than 50% of students.

**Exhibit 6.4: School Emphasis on Academic Success - Teacher Reports (Continued)**

Country	Very High Emphasis		High Emphasis		Medium Emphasis		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Ninth Grade Participants</b>							
Honduras	5 (2.1)	390 (19.6)	44 (4.8)	367 (5.9)	51 (4.9)	369 (7.0)	10.0 (0.20)
South Africa	5 (1.6)	329 (25.3)	31 (2.9)	366 (9.0)	64 (3.1)	312 (5.2)	9.4 (0.14)
Botswana	1 (0.9)	~ ~	27 (3.3)	422 (7.4)	72 (3.3)	395 (4.0)	8.8 (0.15)
<b>Benchmarking Participants</b>							
Alabama, US	r 15 (4.9)	506 (14.2)	43 (8.1)	487 (8.1)	42 (6.5)	470 (9.5)	10.6 (0.32)
Dubai, UAE	r 14 (4.2)	508 (10.6)	68 (4.3)	488 (4.9)	18 (1.9)	423 (10.6)	11.4 (0.20)
Alberta, Canada	13 (2.5)	565 (7.3)	68 (3.8)	544 (2.8)	18 (3.1)	540 (4.3)	11.4 (0.14)
Connecticut, US	r 13 (3.5)	590 (10.0)	45 (6.4)	541 (9.7)	42 (6.3)	509 (13.6)	10.5 (0.25)
Colorado, US	13 (4.6)	560 (13.5)	55 (6.4)	555 (7.4)	33 (5.3)	510 (11.0)	10.8 (0.26)
Massachusetts, US	r 11 (4.7)	603 (15.5)	70 (6.5)	561 (7.5)	18 (5.0)	547 (14.4)	11.3 (0.25)
Abu Dhabi, UAE	9 (2.6)	498 (15.8)	58 (4.6)	461 (5.7)	33 (4.6)	448 (7.4)	10.8 (0.17)
Ontario, Canada	9 (2.6)	532 (8.4)	68 (3.9)	526 (3.4)	23 (3.5)	504 (4.5)	11.0 (0.15)
California, US	s 9 (3.6)	509 (26.6)	53 (5.2)	514 (7.0)	39 (5.4)	478 (9.0)	10.5 (0.26)
North Carolina, US	s 7 (4.2)	576 (11.4)	76 (6.2)	529 (11.0)	17 (5.3)	492 (18.5)	10.8 (0.29)
Minnesota, US	r 7 (4.4)	582 (26.0)	69 (6.6)	554 (8.2)	24 (5.7)	544 (9.3)	10.6 (0.22)
Quebec, Canada	5 (2.2)	561 (11.6)	42 (4.2)	534 (4.3)	53 (3.6)	506 (4.2)	9.8 (0.15)
Indiana, US	r 4 (2.1)	580 (8.3)	62 (6.8)	536 (6.7)	34 (7.0)	527 (6.6)	10.4 (0.22)
Florida, US	x x	x x	x x	x x	x x	x x	x x

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



respectively. The teachers' reports were similar to those of the principals for both assessments. On average across countries, with each reported decrease in academic emphasis, the students had progressively lower average science achievement. Similar to the results from principals' reports, the eighth grade students had science teachers who reported slightly less emphasis on academic success than did the fourth grade students' teachers, but the achievement gap between students in **Very High Emphasis** and **Medium Emphasis** schools was greater at the eighth grade (41 points) than at the fourth grade (27 points).

### *Principals Spend Time on Leadership Activities*

The effectiveness of school leadership has become a central issue in education, and principals worldwide are held increasingly accountable for their students' achievement outcomes. However, the effects of principal leadership are often indirect and difficult to measure. A meta-analysis of multinational studies conducted between 1986 and 1996 found that “defining and communicating the school’s mission” had the largest direct effect on student achievement (Witziers, Bosker, & Kruger, 2003), whereas a different meta-analysis of 27 studies conducted between 1978 and 2006 found strong effects for promoting teacher learning and development, and establishing goals (Robinson, Lloyd, & Rowe, 2008).

TIMSS 2011 used research conducted in the Netherlands (ten Bruggencate, Luyten, Scheerens, & Slegers, 2012) to develop questions about principals' leadership styles. In both the fourth and eighth grade assessments, principals were presented a list of nine leadership activities and asked to indicate on which activities they spent “a lot of time.”

Exhibit 6.5 presents principals' reports from the fourth grade assessment about the various activities on which they spend “a lot of time.” The pattern of varying reports from country to country can be observed among the fourth grade countries, sixth grade countries, and benchmarking participants. The first four activities about which principals were asked focused on school educational goals. On average across fourth grade countries, more than half of the students were in schools where promoting educational goals and developing educational goals occupied “a lot” of the principal's time (59% and 60%, respectively). Also, more than half of the fourth grade students had principals who spent “a lot of time” monitoring whether teachers implemented educational goals and monitoring students' progress to ensure goals are reached (53% and 57%, respectively). Principals also were asked about maintaining school discipline.

Over two-thirds of students (68%) were in schools in which the principal spent “a lot of time” keeping an orderly atmosphere in the school and 44 percent had principals that spent “a lot of time” addressing disruptive student behavior. Exhibit 6.5 also shows that three other leadership activities were reported less frequently as occupying “a lot” of principals’ time: advising teachers, initiating projects or improvements, and participating in professional development for principals.

Exhibit 6.6 summarizes principals’ reports from the eighth grade assessment about time spent on leadership activities. As at the fourth grade, reports vary considerably from country to country; however, summary results indicate that about two-thirds of the eighth grade students were in schools where the principal reported spending “a lot of time” promoting and developing the school’s educational goals and monitoring whether those goals were implemented by teachers and achieved by students. Three-fourths of the eighth grade students were in schools where the principal devoted “a lot of time” to keeping an orderly atmosphere and more than half had principals that spent “a lot of time” addressing disruptive student behavior. Similar to the fourth grade, the last three areas—advising teachers, initiating projects or improvements, and participating in professional development for principals—less frequently occupy “a lot” of the principal’s time.

**Exhibit 6.5: Principals Spend Time on Leadership Activities**
*Reported by Principals*

Country	Percent of Students Whose Principals Spend "A Lot of Time"								
	Promoting the School's Educational Vision or Goals	Developing the School's Curricular and Educational Goals	Monitoring Teachers' Implementation of the School's Educational Goals in Their Teaching	Monitoring Students' Learning Progress to Ensure that the School's Educational Goals Are Reached	Keeping an Orderly Atmosphere in the School	Addressing Disruptive Student Behavior	Advising Teachers Who Have Questions or Problems with Their Teaching	Initiating Educational Projects or Improvements	Participating in Professional Development Activities Specifically for School Principals
Armenia	80 (3.4)	75 (4.0)	60 (4.3)	62 (3.8)	66 (4.3)	32 (4.2)	23 (3.7)	23 (3.4)	31 (4.0)
Australia	60 (4.1)	73 (3.8)	52 (4.6)	68 (3.8)	63 (3.6)	35 (3.8)	27 (3.4)	53 (4.4)	33 (3.7)
Austria	41 (3.9)	13 (3.0)	24 (3.4)	27 (3.2)	73 (4.3)	41 (4.6)	39 (4.5)	22 (3.6)	44 (3.9)
Azerbaijan	50 (4.4)	55 (4.3)	33 (4.0)	40 (4.8)	79 (3.7)	38 (4.4)	29 (3.3)	27 (3.9)	38 (4.0)
Bahrain	70 (4.6)	77 (4.2)	85 (2.9)	85 (3.1)	87 (3.0)	52 (4.8)	72 (4.4)	71 (4.6)	46 (5.8)
Belgium (Flemish)	35 (3.8)	30 (3.7)	24 (3.8)	22 (3.2)	36 (4.4)	31 (3.7)	28 (4.0)	29 (4.4)	34 (4.3)
Chile	59 (4.0)	75 (3.8)	55 (4.3)	63 (4.5)	74 (3.7)	62 (3.4)	39 (4.5)	45 (4.1)	37 (3.9)
Chinese Taipei	72 (3.6)	69 (3.8)	59 (3.9)	54 (3.6)	49 (4.4)	15 (3.0)	44 (4.2)	53 (4.2)	57 (4.4)
Croatia	64 (3.9)	69 (3.9)	39 (4.2)	41 (3.8)	84 (2.9)	50 (4.0)	43 (4.3)	32 (4.0)	70 (3.7)
Czech Republic	69 (3.9)	64 (4.0)	54 (4.3)	66 (3.8)	95 (1.7)	58 (4.2)	40 (4.5)	61 (3.7)	42 (4.1)
Denmark	r 28 (3.9)	r 24 (3.6)	r 6 (2.0)	r 9 (1.9)	r 62 (4.0)	r 26 (2.9)	r 24 (3.5)	r 24 (3.3)	r 17 (2.9)
England	61 (4.0)	62 (5.0)	56 (4.4)	76 (4.5)	53 (4.8)	25 (4.0)	17 (3.3)	37 (4.6)	17 (3.7)
Finland	36 (3.8)	34 (4.4)	18 (3.0)	12 (2.1)	33 (4.6)	26 (4.1)	16 (2.9)	28 (4.1)	23 (3.6)
Georgia	42 (4.8)	36 (4.5)	39 (4.0)	55 (3.7)	72 (3.9)	51 (4.2)	19 (3.5)	20 (3.3)	27 (3.5)
Germany	49 (3.4)	47 (3.3)	15 (2.6)	18 (2.6)	56 (3.6)	49 (3.5)	28 (3.2)	24 (3.2)	17 (2.6)
Hong Kong SAR	52 (4.5)	68 (4.3)	58 (4.4)	62 (4.0)	60 (4.1)	11 (2.6)	16 (3.4)	42 (4.8)	31 (4.3)
Hungary	80 (3.6)	72 (4.0)	59 (4.0)	62 (4.2)	79 (3.2)	59 (4.0)	34 (4.0)	41 (4.4)	35 (4.2)
Iran, Islamic Rep. of	77 (3.1)	88 (2.7)	79 (3.9)	86 (2.5)	89 (2.0)	82 (2.7)	61 (3.6)	44 (3.9)	67 (3.3)
Ireland	40 (4.5)	60 (4.5)	19 (3.2)	34 (4.4)	64 (3.9)	29 (4.0)	10 (2.4)	31 (3.8)	16 (2.8)
Italy	83 (3.6)	62 (3.8)	43 (3.9)	47 (4.2)	49 (3.7)	31 (3.3)	48 (3.7)	61 (3.7)	35 (3.3)
Japan	40 (4.0)	28 (3.8)	47 (4.1)	31 (4.2)	41 (4.0)	15 (3.0)	27 (3.6)	26 (3.9)	17 (3.1)
Kazakhstan	73 (3.0)	77 (3.5)	74 (3.9)	66 (3.9)	69 (3.5)	44 (3.9)	47 (3.6)	58 (4.4)	54 (4.4)
Korea, Rep. of	88 (2.5)	82 (3.5)	81 (3.7)	75 (4.0)	88 (2.9)	77 (3.6)	72 (3.8)	75 (4.0)	80 (2.9)
Kuwait	68 (4.0)	58 (4.1)	82 (3.2)	85 (3.0)	84 (3.2)	73 (3.5)	73 (3.7)	72 (3.6)	67 (4.2)
Lithuania	74 (3.7)	90 (2.4)	60 (3.6)	68 (4.0)	62 (4.5)	42 (3.8)	48 (4.3)	41 (4.3)	44 (3.9)
Malta	58 (0.1)	67 (0.1)	32 (0.1)	40 (0.1)	71 (0.1)	39 (0.1)	39 (0.1)	44 (0.1)	26 (0.1)
Morocco	64 (3.4)	58 (3.6)	63 (3.9)	59 (4.0)	91 (2.1)	66 (3.0)	56 (3.7)	43 (3.8)	42 (3.9)
Netherlands	r 33 (5.2)	r 49 (5.5)	r 48 (4.6)	r 44 (5.9)	r 14 (4.1)	r 15 (4.4)	r 31 (5.5)	r 43 (5.1)	r 23 (5.1)
New Zealand	65 (3.5)	70 (4.0)	45 (3.8)	71 (3.5)	47 (3.6)	21 (3.1)	24 (3.5)	41 (3.6)	18 (3.0)
Northern Ireland	47 (4.5)	73 (3.9)	r 35 (4.6)	61 (4.2)	54 (5.2)	13 (2.9)	r 7 (2.1)	r 35 (4.5)	r 23 (4.5)
Norway	27 (4.4)	19 (3.7)	17 (3.3)	17 (3.2)	56 (4.6)	31 (4.4)	16 (3.5)	23 (4.1)	24 (4.3)
Oman	40 (3.2)	r 18 (2.4)	75 (3.4)	80 (3.1)	82 (2.5)	45 (3.5)	51 (3.5)	36 (3.4)	24 (2.5)
Poland	56 (3.9)	49 (4.2)	59 (4.0)	75 (3.3)	76 (3.8)	40 (3.9)	29 (3.9)	51 (4.1)	54 (4.2)
Portugal	63 (4.4)	50 (5.4)	35 (4.7)	41 (4.9)	49 (4.9)	38 (5.3)	8 (2.6)	28 (5.4)	6 (1.8)
Qatar	70 (2.5)	81 (2.3)	81 (2.4)	81 (2.5)	85 (2.5)	64 (2.7)	69 (2.9)	61 (3.4)	54 (3.2)
Romania	84 (3.2)	84 (3.2)	81 (3.5)	84 (3.0)	87 (2.5)	73 (3.6)	57 (4.3)	63 (3.8)	69 (4.2)
Russian Federation	80 (2.8)	81 (2.6)	81 (2.6)	74 (2.9)	87 (2.1)	64 (3.1)	34 (3.1)	52 (3.6)	64 (4.0)
Saudi Arabia	48 (4.4)	61 (4.1)	77 (3.3)	76 (3.5)	78 (3.5)	57 (3.7)	52 (3.9)	45 (4.4)	40 (4.3)
Serbia	63 (3.3)	72 (3.9)	47 (4.8)	42 (4.6)	64 (3.7)	48 (4.0)	41 (4.1)	47 (4.2)	31 (3.7)
Singapore	76 (0.0)	80 (0.0)	66 (0.0)	77 (0.0)	66 (0.0)	32 (0.0)	33 (0.0)	58 (0.0)	47 (0.0)
Slovak Republic	56 (3.6)	69 (3.6)	45 (3.9)	42 (3.9)	60 (3.7)	55 (3.3)	34 (3.6)	46 (3.7)	46 (3.8)
Slovenia	68 (3.1)	62 (4.1)	61 (3.5)	69 (4.0)	92 (2.2)	59 (3.8)	53 (4.0)	62 (3.9)	73 (3.4)
Spain	58 (4.1)	62 (3.8)	40 (4.4)	47 (4.4)	68 (3.8)	39 (4.2)	19 (3.7)	47 (4.1)	33 (3.6)
Sweden	52 (4.4)	40 (4.8)	17 (3.2)	28 (4.2)	24 (3.7)	19 (3.6)	27 (4.0)	28 (4.1)	16 (3.6)
Thailand	68 (3.9)	74 (3.9)	76 (3.3)	77 (3.6)	94 (2.0)	51 (3.9)	74 (3.4)	68 (4.4)	69 (3.9)
Tunisia	49 (4.4)	52 (4.6)	54 (4.4)	61 (4.9)	86 (2.9)	61 (3.8)	49 (4.0)	26 (3.6)	18 (2.8)
Turkey	63 (3.2)	56 (3.7)	62 (3.6)	54 (3.6)	86 (2.4)	79 (2.8)	55 (3.7)	45 (3.4)	46 (3.2)
United Arab Emirates	69 (2.1)	77 (2.2)	82 (1.8)	85 (1.4)	82 (1.8)	55 (2.1)	62 (2.0)	65 (2.0)	47 (1.9)
United States	72 (2.8)	68 (2.3)	71 (2.4)	76 (2.1)	69 (3.0)	42 (2.8)	42 (2.6)	46 (2.9)	34 (2.7)
Yemen	48 (4.6)	47 (4.2)	71 (4.3)	64 (4.3)	84 (3.2)	64 (4.7)	52 (4.7)	18 (3.5)	28 (4.0)
International Avg.	59 (0.5)	60 (0.5)	53 (0.5)	57 (0.5)	68 (0.5)	44 (0.5)	39 (0.5)	43 (0.6)	39 (0.5)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent. An "r" indicates data are available for at least 70% but less than 85% of the students.

**Exhibit 6.5: Principals Spend Time on Leadership Activities (Continued)**

Country	Percent of Students Whose Principals Spend "A Lot of Time"								
	Promoting the School's Educational Vision or Goals	Developing the School's Curricular and Educational Goals	Monitoring Teachers' Implementation of the School's Educational Goals in Their Teaching	Monitoring Students' Learning Progress to Ensure that the School's Educational Goals Are Reached	Keeping an Orderly Atmosphere in the School	Addressing Disruptive Student Behavior	Advising Teachers Who Have Questions or Problems with Their Teaching	Initiating Educational Projects or Improvements	Participating in Professional Development Activities Specifically for School Principals
<b>Sixth Grade Participants</b>									
Botswana	68 (3.7)	67 (3.9)	83 (2.8)	82 (3.0)	87 (2.5)	62 (4.6)	57 (3.6)	45 (4.2)	52 (4.7)
Honduras	58 (4.5)	63 (4.7)	51 (5.1)	65 (4.4)	90 (2.5)	72 (4.8)	56 (4.6)	63 (4.7)	51 (4.9)
Yemen	49 (4.6)	53 (4.3)	75 (3.9)	66 (4.2)	84 (2.9)	64 (4.6)	56 (4.3)	19 (3.8)	32 (4.3)
<b>Benchmarking Participants</b>									
Alberta, Canada	63 (4.3)	60 (4.7)	44 (4.6)	45 (4.8)	67 (4.1)	30 (4.4)	23 (4.1)	38 (4.4)	30 (4.0)
Ontario, Canada	65 (4.2)	76 (4.0)	53 (4.4)	61 (4.4)	75 (3.8)	52 (4.6)	32 (4.2)	43 (4.3)	44 (4.0)
Quebec, Canada	44 (4.7)	41 (4.3)	18 (3.4)	36 (3.8)	47 (4.3)	47 (4.7)	29 (4.0)	31 (4.0)	19 (3.2)
Abu Dhabi, UAE	78 (3.9)	79 (3.6)	83 (3.3)	87 (2.7)	82 (3.0)	51 (4.4)	66 (4.1)	64 (4.4)	59 (3.7)
Dubai, UAE	72 (0.4)	82 (0.4)	79 (0.4)	80 (0.4)	80 (0.2)	58 (0.5)	55 (0.5)	71 (0.4)	43 (0.3)
Florida, US	r 82 (4.1)	r 79 (5.5)	r 79 (5.0)	r 88 (2.8)	r 77 (6.1)	r 39 (6.5)	r 36 (6.0)	r 38 (5.9)	r 43 (6.3)
North Carolina, US	81 (5.9)	76 (6.8)	88 (4.7)	84 (5.9)	72 (7.2)	29 (7.5)	33 (6.7)	30 (7.9)	41 (7.8)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

## Exhibit 6.6: Principals Spend Time on Leadership Activities

Reported by Principals

Country	Percent of Students Whose Principals Spend "A Lot of Time"								
	Promoting the School's Educational Vision or Goals	Developing the School's Curricular and Educational Goals	Monitoring Teachers' Implementation of the School's Educational Goals in Their Teaching	Monitoring Students' Learning Progress to Ensure that the School's Educational Goals Are Reached	Keeping an Orderly Atmosphere in the School	Addressing Disruptive Student Behavior	Advising Teachers Who Have Questions or Problems with Their Teaching	Initiating Educational Projects or Improvements	Participating in Professional Development Activities Specifically for School Principals
Armenia	79 (3.5)	75 (3.4)	66 (3.8)	59 (3.9)	69 (4.4)	31 (4.3)	26 (3.6)	23 (3.3)	32 (4.0)
Australia	64 (3.3)	63 (4.1)	34 (3.5)	53 (3.9)	55 (3.5)	35 (3.8)	19 (3.0)	52 (4.1)	30 (3.9)
Bahrain	60 (0.3)	71 (0.3)	78 (0.3)	81 (0.3)	88 (0.2)	70 (0.3)	67 (0.3)	61 (0.3)	46 (0.3)
Chile	65 (4.1)	78 (3.2)	54 (4.4)	58 (4.8)	78 (3.0)	66 (3.7)	37 (4.1)	46 (4.2)	38 (4.2)
Chinese Taipei	62 (3.8)	54 (3.8)	47 (4.0)	54 (4.0)	75 (3.5)	22 (3.6)	25 (3.7)	29 (3.6)	31 (4.2)
England	64 (4.6)	67 (4.4)	55 (4.5)	75 (3.8)	51 (4.6)	29 (4.0)	20 (3.1)	33 (4.7)	9 (2.7)
Finland	34 (4.4)	25 (3.9)	22 (3.8)	28 (4.0)	44 (4.3)	37 (4.1)	17 (3.1)	21 (3.9)	16 (3.2)
Georgia	76 (3.7)	71 (4.3)	72 (3.1)	75 (3.4)	84 (2.9)	68 (4.2)	50 (4.2)	38 (3.9)	52 (3.7)
Ghana	67 (3.9)	48 (4.5)	86 (3.0)	88 (2.8)	89 (2.8)	57 (3.8)	50 (4.4)	25 (3.7)	36 (4.1)
Hong Kong SAR	41 (4.9)	47 (5.1)	48 (4.9)	41 (5.3)	54 (4.9)	11 (2.9)	21 (3.9)	21 (4.4)	24 (4.2)
Hungary	78 (3.7)	71 (3.7)	57 (4.4)	63 (4.0)	78 (3.6)	58 (4.4)	40 (4.1)	39 (4.0)	44 (4.1)
Indonesia	85 (2.8)	85 (3.8)	80 (3.8)	85 (3.4)	95 (2.3)	87 (2.8)	76 (3.5)	38 (4.8)	75 (3.8)
Iran, Islamic Rep. of	84 (2.2)	91 (1.9)	81 (3.0)	92 (2.0)	93 (1.6)	80 (2.9)	48 (3.5)	48 (3.8)	61 (3.7)
Israel	80 (3.4)	71 (3.7)	62 (4.0)	75 (3.6)	85 (3.1)	76 (3.5)	64 (4.1)	67 (4.0)	64 (4.2)
Italy	79 (2.9)	61 (4.0)	40 (4.0)	56 (4.2)	64 (4.0)	49 (4.2)	39 (3.5)	61 (3.7)	29 (3.3)
Japan	31 (3.9)	21 (3.7)	32 (4.0)	19 (3.0)	48 (3.9)	21 (3.2)	18 (3.4)	21 (3.7)	11 (2.7)
Jordan	62 (3.9)	67 (3.8)	88 (2.7)	82 (3.3)	95 (2.0)	84 (2.8)	72 (3.6)	42 (3.6)	41 (3.9)
Kazakhstan	72 (3.8)	79 (3.0)	66 (4.1)	71 (3.7)	64 (4.2)	41 (4.0)	46 (4.1)	58 (4.0)	47 (4.3)
Korea, Rep. of	88 (3.1)	78 (3.7)	77 (3.2)	73 (3.5)	89 (2.5)	70 (3.1)	61 (3.7)	64 (3.7)	75 (3.1)
Lebanon	75 (3.7)	67 (3.8)	76 (4.1)	84 (3.0)	85 (3.2)	73 (3.9)	76 (3.7)	42 (3.9)	45 (4.2)
Lithuania	74 (3.8)	82 (3.4)	42 (4.2)	61 (4.3)	71 (3.9)	41 (4.1)	38 (4.2)	47 (4.5)	42 (4.2)
Macedonia, Rep. of	50 (4.0)	57 (3.7)	46 (3.9)	53 (4.2)	59 (3.7)	42 (3.9)	37 (3.7)	45 (3.7)	43 (3.7)
Malaysia	71 (3.7)	76 (2.9)	74 (3.5)	79 (2.7)	87 (2.4)	75 (3.4)	55 (4.1)	36 (3.5)	42 (3.8)
Morocco	61 (3.3)	48 (2.6)	58 (3.0)	59 (3.7)	92 (1.8)	75 (3.3)	51 (3.0)	55 (3.6)	39 (3.2)
New Zealand	57 (5.1)	59 (5.2)	30 (4.4)	42 (5.6)	54 (5.1)	31 (5.3)	16 (3.3)	37 (3.7)	20 (4.5)
Norway	29 (3.8)	20 (3.6)	20 (3.1)	22 (3.2)	54 (3.7)	45 (4.7)	20 (3.6)	15 (3.1)	16 (3.6)
Oman	52 (3.4)	21 (2.3)	79 (2.5)	77 (2.5)	86 (2.2)	47 (3.3)	56 (3.3)	28 (2.9)	28 (3.4)
Palestinian Nat'l Auth.	60 (4.1)	58 (3.8)	90 (1.5)	92 (2.0)	89 (2.5)	75 (3.3)	58 (3.9)	32 (3.8)	37 (3.8)
Qatar	72 (0.8)	78 (0.5)	79 (1.0)	83 (1.1)	82 (1.1)	69 (1.0)	66 (1.0)	57 (0.9)	54 (0.9)
Romania	87 (2.8)	86 (3.2)	85 (2.9)	84 (3.6)	92 (2.6)	69 (4.1)	55 (4.4)	65 (4.0)	71 (4.2)
Russian Federation	80 (2.7)	82 (2.6)	68 (3.4)	69 (2.8)	78 (2.7)	51 (3.6)	27 (2.8)	54 (3.7)	61 (3.5)
Saudi Arabia	53 (4.3)	59 (3.8)	81 (3.2)	72 (3.2)	88 (2.7)	70 (3.5)	56 (4.5)	37 (3.6)	34 (3.7)
Singapore	68 (0.0)	66 (0.0)	63 (0.0)	72 (0.0)	56 (0.0)	27 (0.0)	21 (0.0)	42 (0.0)	26 (0.0)
Slovenia	58 (3.6)	56 (4.2)	60 (3.9)	62 (3.6)	83 (3.1)	50 (3.9)	48 (4.5)	48 (3.9)	72 (3.5)
Sweden	r 45 (4.8)	r 44 (4.7)	r 20 (3.8)	r 35 (4.3)	r 45 (4.7)	r 29 (3.9)	r 21 (3.6)	r 22 (4.1)	r 24 (3.7)
Syrian Arab Republic	49 (4.3)	49 (4.5)	75 (3.7)	75 (3.6)	86 (3.0)	74 (3.6)	57 (4.5)	23 (3.4)	22 (3.5)
Thailand	72 (3.9)	78 (3.7)	69 (4.1)	68 (4.0)	85 (2.7)	51 (4.0)	61 (4.3)	57 (4.1)	76 (3.4)
Tunisia	39 (3.9)	39 (3.7)	51 (3.8)	59 (3.5)	89 (2.4)	75 (2.9)	44 (4.0)	21 (3.0)	14 (2.6)
Turkey	69 (2.7)	63 (2.9)	65 (3.2)	60 (3.6)	85 (2.4)	81 (2.7)	52 (3.5)	42 (3.1)	48 (3.4)
Ukraine	59 (4.3)	60 (4.0)	84 (3.6)	57 (4.4)	56 (4.1)	36 (4.0)	30 (3.9)	43 (4.2)	22 (3.4)
United Arab Emirates	67 (1.9)	76 (2.0)	83 (1.8)	81 (1.8)	80 (1.8)	56 (2.2)	57 (2.4)	59 (2.1)	48 (2.4)
United States	65 (2.6)	64 (2.2)	64 (2.2)	65 (2.3)	75 (2.2)	46 (2.5)	38 (2.2)	44 (2.5)	36 (2.6)
International Avg.	64 (0.6)	62 (0.5)	62 (0.5)	65 (0.5)	75 (0.5)	54 (0.5)	44 (0.6)	41 (0.6)	40 (0.5)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent. An "r" indicates data are available for at least 70% but less than 85% of the students.

**Exhibit 6.6: Principals Spend Time on Leadership Activities (Continued)**

Country	Percent of Students Whose Principals Spend "A Lot of Time"								
	Promoting the School's Educational Vision or Goals	Developing the School's Curricular and Educational Goals	Monitoring Teachers' Implementation of the School's Educational Goals in Their Teaching	Monitoring Students' Learning Progress to Ensure that the School's Educational Goals Are Reached	Keeping an Orderly Atmosphere in the School	Addressing Disruptive Student Behavior	Advising Teachers Who Have Questions or Problems with Their Teaching	Initiating Educational Projects or Improvements	Participating in Professional Development Activities Specifically for School Principals
<b>Ninth Grade Participants</b>									
Botswana	64 (4.1)	48 (4.4)	56 (4.2)	70 (4.0)	86 (3.2)	71 (4.1)	28 (3.9)	26 (3.7)	33 (4.2)
Honduras	49 (5.2)	53 (4.8)	43 (4.4)	46 (4.6)	86 (3.0)	66 (4.0)	48 (4.5)	35 (4.4)	39 (4.5)
South Africa	60 (3.8)	62 (3.4)	61 (4.0)	69 (3.9)	90 (2.6)	77 (3.5)	51 (3.6)	31 (3.4)	57 (3.9)
<b>Benchmarking Participants</b>									
Alberta, Canada	50 (4.0)	54 (4.0)	33 (3.8)	45 (4.5)	65 (4.4)	40 (4.3)	25 (3.4)	37 (4.9)	27 (4.0)
Ontario, Canada	61 (4.4)	69 (4.0)	49 (4.1)	45 (4.5)	78 (3.6)	44 (4.4)	34 (4.0)	32 (4.0)	38 (3.5)
Quebec, Canada	33 (3.9)	40 (4.0)	22 (2.8)	41 (3.9)	59 (4.3)	66 (4.5)	32 (4.0)	27 (3.5)	12 (2.9)
Abu Dhabi, UAE	70 (3.6)	74 (3.8)	79 (3.5)	78 (4.0)	84 (3.1)	55 (4.3)	62 (4.6)	65 (4.7)	59 (4.0)
Dubai, UAE	68 (0.4)	78 (0.4)	86 (0.2)	80 (0.4)	68 (0.4)	43 (0.5)	40 (0.4)	55 (0.5)	35 (0.5)
Alabama, US	r 53 (9.3)	r 50 (9.1)	r 65 (8.4)	r 73 (6.5)	r 78 (6.2)	r 57 (8.5)	r 25 (6.1)	r 24 (7.6)	r 29 (6.5)
California, US	r 71 (6.0)	r 71 (6.5)	r 76 (6.6)	r 73 (6.7)	r 78 (6.1)	r 52 (7.4)	r 43 (7.5)	r 49 (7.1)	r 45 (6.7)
Colorado, US	72 (7.2)	71 (5.1)	65 (7.1)	59 (6.3)	52 (7.2)	29 (7.7)	41 (6.9)	46 (6.8)	32 (6.9)
Connecticut, US	r 66 (7.7)	65 (6.2)	76 (6.2)	82 (4.8)	77 (5.2)	52 (6.6)	41 (6.6)	47 (8.2)	21 (5.7)
Florida, US	68 (7.0)	67 (7.5)	77 (6.5)	84 (5.6)	85 (5.4)	39 (7.3)	38 (7.6)	52 (7.9)	62 (8.0)
Indiana, US	r 60 (8.6)	r 59 (7.9)	r 61 (8.0)	r 64 (6.9)	r 71 (7.0)	r 33 (7.7)	r 28 (7.1)	r 45 (7.8)	r 22 (5.8)
Massachusetts, US	63 (6.6)	70 (6.5)	68 (7.6)	r 57 (6.5)	52 (7.3)	23 (6.2)	37 (7.5)	40 (7.6)	22 (5.7)
Minnesota, US	66 (7.7)	61 (7.1)	53 (7.8)	57 (7.3)	76 (7.0)	46 (6.0)	25 (6.2)	48 (7.7)	25 (6.1)
North Carolina, US	63 (7.3)	54 (7.9)	60 (7.0)	60 (6.8)	82 (5.6)	46 (7.0)	38 (5.6)	30 (7.0)	39 (6.7)

## Schools with Discipline and Safety Problems

The sense of security that comes from attending a school with few behavior problems and having little or no concern about student or teacher safety promotes a stable learning environment. There is increasing research showing that a safe school environment is important for students' academic achievement. On the other hand, a general lack of discipline, especially if students and teachers are afraid for their safety, does not facilitate learning. Unfortunately, community and school violence are becoming an increasing problem, especially among urban youth.

### *Safe and Orderly School*

There is growing evidence that students' perceived school safety adversely affects academic performance, even for primary school children (Milam, Furr-Holden, & Leaf, 2010). It seems that safety at school can no longer be taken for granted, even at the fourth grade. TIMSS 2011 developed the Safe and Orderly School scale to provide information on the extent to which school safety might be related to science achievement. In both the fourth and eighth grade assessments, students' teachers were asked about the degree to which they agreed or disagreed with five statements:

- ◆ This school is located in a safe neighborhood;
- ◆ I feel safe at this school;
- ◆ This school's security policies and practices are sufficient;
- ◆ The students behave in an orderly manner; and
- ◆ The students are respectful of the teachers.

Exhibit 6.7 presents the results for the Safe and Orderly School scale for the fourth grade assessment. Students were scored according to their teachers' degree of agreement with the five statements. Students in **Safe and Orderly** schools had teachers that "agreed a lot" with three of the five qualities and "agreed a little" with the other two, on average. Students in **Not Safe and Orderly** schools had teachers that "disagreed a little" with three of the five statements and "agreed a little" with the other two, on average. All other students attended **Somewhat Safe and Orderly** schools. There was substantial variation across countries, but on average across the fourth grade countries, the majority of students (53%) were attending **Safe and Orderly** schools. Almost all of the remaining students (43%) were in schools judged to be **Somewhat Safe and Orderly**. Only a small percentage of students (4%, on average) were in schools

judged **Not Safe and Orderly**. On average across the fourth grade countries, the safer the school as reported by their teachers, the higher the students' average science achievement, with a 44-point difference between the average achievement of students at **Safe and Orderly** schools and that of students at **Not Safe and Orderly** schools (493 vs. 449).

Exhibit 6.8 presents the corresponding Safe and Orderly School scale results for the eighth grade assessment. Students were assigned to one of the three school orderliness categories using the same criteria as at the fourth grade, and with broadly similar results. Although almost all eighth grade students, on average internationally, were in **Safe and Orderly** or **Somewhat Safe and Orderly** schools, the eighth grade science teachers were noticeably less positive in their reports. On average across the eighth grade countries, 45 percent of students (compared to 53% at fourth grade) were attending schools judged by their teachers to be **Safe and Orderly**, 50 percent of students (compared to 43%) were in schools judged to be **Somewhat Safe and Orderly**, and 6 percent of students (compared to 4%) were in schools judged **Not Safe and Orderly**. Similar to the fourth grade, on average across the eighth grade countries, the safer the school as reported by their teachers, the higher the students' average science achievement; however, the 31-point difference between the achievement of students in **Safe and Orderly** schools (488) and that of students in **Not Safe and Orderly** Schools (457) was less than at fourth grade.

### *School Discipline and Safety*

Previous TIMSS assessments have asked principals for their perceptions about the degree to which a series of discipline, disorderly, and bullying behaviors are problems in their schools, and found that having fewer problems was related to higher average achievement. Exhibit 6.9 presents the TIMSS 2011 results for the fourth grade School Discipline and Safety scale. The scale was based on principals' responses about the extent to which ten different discipline and safety problems existed at their school (see the second page of the exhibit for a complete list of problems). Countries are ordered by the percentage of students whose principals reported few student discipline and school safety problems. Principals in schools with **Hardly Any Problems** with discipline or safety reported "not a problem" for five of the ten problems and only "minor problem" for the other five, on average. Principals in schools with **Moderate Problems** reported "moderate problem" for five of the ten issues and "minor problem" for the other five, on average. All other students attended schools with **Minor Problems**.

## Exhibit 6.7: Safe and Orderly School

Reported by Teachers

Students were scored according to their teachers' degree of agreement with five statements on the *Safe and Orderly School* scale. Students in **Safe and Orderly** schools had a score on the scale of at least 10.2, which corresponds to their teachers "agreeing a lot" with three of the five qualities of a safe and orderly school and "agreeing a little" with the other two, on average. Students in **Not Safe and Orderly** schools had a score no higher than 6.3, which corresponds to their teachers "disagreeing a little" with three of the five qualities and "agreeing a little" with the other two, on average. All other students attended **Somewhat Safe and Orderly** schools.

Country	Safe and Orderly		Somewhat Safe and Orderly		Not Safe and Orderly		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Northern Ireland	r 85 (2.7)	521 (3.5)	15 (2.6)	493 (7.2)	0 (0.4)	~ ~	11.5 (0.13)
Azerbaijan	85 (2.9)	437 (6.3)	14 (2.8)	444 (15.7)	1 (0.7)	~ ~	11.5 (0.13)
Georgia	82 (2.5)	456 (4.0)	17 (2.4)	454 (9.3)	1 (0.7)	~ ~	11.3 (0.12)
Ireland	78 (3.3)	527 (3.6)	20 (3.3)	482 (7.0)	2 (1.0)	~ ~	11.3 (0.15)
Australia	r 75 (3.5)	528 (3.5)	21 (3.2)	497 (7.8)	4 (1.4)	462 (15.4)	11.0 (0.17)
United Arab Emirates	74 (2.0)	434 (3.5)	25 (2.0)	421 (4.6)	0 (0.3)	~ ~	10.8 (0.08)
Croatia	73 (3.1)	514 (2.4)	26 (3.0)	520 (3.9)	1 (0.7)	~ ~	10.8 (0.12)
Thailand	72 (3.9)	477 (5.0)	26 (3.8)	478 (11.5)	3 (1.8)	338 (24.3)	11.0 (0.18)
Armenia	72 (2.7)	418 (4.3)	26 (2.6)	411 (7.3)	2 (1.1)	~ ~	10.9 (0.13)
New Zealand	70 (2.3)	512 (2.6)	29 (2.3)	466 (4.5)	1 (0.6)	~ ~	11.0 (0.10)
England	68 (4.0)	541 (3.8)	30 (3.9)	504 (7.0)	2 (1.2)	~ ~	10.8 (0.16)
Kazakhstan	67 (4.0)	498 (6.6)	33 (4.0)	489 (10.1)	1 (0.4)	~ ~	10.7 (0.15)
United States	r 65 (2.1)	556 (2.3)	30 (1.9)	530 (4.2)	5 (0.9)	497 (7.7)	10.5 (0.10)
Singapore	64 (2.1)	594 (4.1)	33 (2.1)	564 (5.3)	3 (0.5)	576 (17.5)	10.3 (0.09)
Qatar	62 (4.9)	398 (6.5)	34 (3.4)	392 (9.2)	4 (3.0)	362 (32.3)	10.3 (0.20)
Norway	62 (4.7)	500 (2.7)	38 (4.7)	485 (3.7)	0 (0.0)	~ ~	10.6 (0.15)
Denmark	61 (3.5)	533 (3.0)	38 (3.5)	531 (4.4)	1 (0.9)	~ ~	10.3 (0.11)
Iran, Islamic Rep. of	60 (3.5)	462 (4.4)	39 (3.4)	441 (6.6)	1 (0.8)	~ ~	10.3 (0.15)
Kuwait	60 (3.7)	352 (6.4)	38 (3.4)	337 (7.4)	3 (1.4)	353 (41.1)	10.1 (0.15)
Austria	58 (3.5)	538 (3.2)	39 (3.7)	525 (4.0)	2 (1.5)	~ ~	10.1 (0.13)
Netherlands	r 56 (4.6)	533 (2.9)	43 (4.6)	527 (4.0)	1 (0.8)	~ ~	10.2 (0.18)
Malta	56 (0.1)	456 (2.2)	43 (0.1)	437 (2.6)	2 (0.0)	~ ~	10.5 (0.00)
Poland	55 (3.4)	503 (3.3)	44 (3.4)	508 (3.8)	1 (0.6)	~ ~	10.0 (0.12)
Yemen	55 (4.2)	204 (7.8)	41 (4.1)	210 (13.1)	5 (1.8)	251 (23.2)	10.1 (0.18)
Bahrain	53 (5.4)	463 (5.0)	43 (5.3)	431 (7.1)	4 (1.9)	477 (10.0)	10.1 (0.19)
Hungary	52 (3.7)	543 (4.6)	44 (3.5)	526 (5.6)	4 (1.4)	491 (18.1)	9.8 (0.13)
Spain	51 (3.8)	518 (3.5)	45 (3.9)	495 (4.5)	5 (1.8)	472 (11.4)	9.7 (0.16)
Saudi Arabia	50 (4.6)	432 (7.0)	46 (4.5)	427 (9.5)	4 (1.8)	429 (29.2)	9.9 (0.17)
Russian Federation	49 (4.1)	554 (5.4)	49 (3.9)	551 (4.7)	2 (1.3)	~ ~	9.8 (0.17)
Hong Kong SAR	49 (5.0)	539 (3.8)	47 (4.9)	536 (6.4)	4 (1.8)	467 (60.0)	9.9 (0.17)
Oman	47 (2.5)	393 (6.2)	49 (2.6)	364 (4.7)	4 (1.4)	353 (21.1)	9.9 (0.10)
Lithuania	47 (3.2)	519 (3.4)	52 (3.1)	510 (3.4)	2 (0.9)	~ ~	9.7 (0.12)
Portugal	46 (5.1)	530 (8.0)	50 (4.9)	516 (4.5)	4 (1.3)	493 (14.4)	9.6 (0.20)
Belgium (Flemish)	46 (3.0)	516 (2.5)	52 (2.9)	504 (2.7)	1 (0.8)	~ ~	9.7 (0.11)
Germany	43 (3.7)	538 (3.7)	54 (3.7)	523 (3.5)	3 (1.3)	503 (10.8)	9.6 (0.12)
Slovak Republic	42 (3.3)	533 (5.9)	57 (3.3)	531 (5.2)	1 (0.7)	~ ~	9.4 (0.08)
Chile	41 (3.7)	503 (4.3)	46 (3.7)	469 (4.4)	13 (3.1)	449 (13.2)	9.2 (0.19)
Czech Republic	41 (3.9)	538 (4.3)	57 (3.8)	536 (3.3)	2 (0.9)	~ ~	9.4 (0.12)
Serbia	40 (4.2)	515 (4.7)	55 (4.1)	519 (3.8)	5 (1.6)	480 (17.5)	9.4 (0.16)
Romania	40 (3.6)	501 (10.1)	55 (3.7)	509 (7.3)	5 (1.6)	466 (22.0)	9.5 (0.14)
Sweden	r 39 (4.4)	551 (3.6)	57 (4.4)	529 (3.9)	4 (1.3)	465 (4.8)	9.5 (0.16)
Tunisia	38 (4.3)	359 (9.0)	52 (3.9)	340 (5.9)	9 (2.6)	322 (21.2)	9.3 (0.19)
Finland	38 (3.6)	581 (4.0)	57 (4.0)	566 (2.7)	6 (1.7)	548 (6.6)	9.4 (0.13)
Chinese Taipei	37 (4.1)	557 (3.7)	59 (4.1)	550 (2.5)	4 (1.5)	526 (15.7)	9.3 (0.15)
Turkey	37 (3.3)	487 (4.9)	45 (3.1)	455 (6.3)	18 (2.7)	432 (14.0)	8.9 (0.17)
Morocco	34 (3.4)	294 (6.8)	52 (3.9)	251 (8.1)	13 (2.4)	236 (10.8)	8.8 (0.14)
Slovenia	27 (3.1)	518 (4.0)	67 (3.2)	523 (3.5)	6 (1.6)	502 (9.1)	8.9 (0.11)
Korea, Rep. of	25 (3.7)	593 (5.0)	68 (3.7)	586 (2.1)	7 (2.1)	574 (5.4)	8.8 (0.18)
Italy	15 (2.2)	524 (7.3)	79 (2.9)	528 (2.9)	7 (2.0)	493 (16.8)	8.5 (0.11)
Japan	5 (1.8)	569 (10.5)	80 (3.4)	559 (2.1)	16 (2.8)	551 (4.3)	7.8 (0.10)
International Avg.	53 (0.5)	493 (0.7)	43 (0.5)	480 (0.9)	4 (0.2)	449 (4.0)	

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students.



## Exhibit 6.8: Safe and Orderly School

Reported by Teachers

Students were scored according to their teachers' degree of agreement with five statements on the *Safe and Orderly School* scale. Students in **Safe and Orderly** schools had a score on the scale of at least 10.7, which corresponds to their teachers "agreeing a lot" with three of the five qualities of a safe and orderly school and "agreeing a little" with the other two, on average. Students in **Not Safe and Orderly** schools had a score no higher than 6.8, which corresponds to their teachers "disagreeing a little" with three of the five qualities and "agreeing a little" with the other two, on average. All other students attended **Somewhat Safe and Orderly** schools.

Country	Safe and Orderly		Somewhat Safe and Orderly		Not Safe and Orderly		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Georgia	73 (2.4)	422 (3.4)	25 (2.5)	416 (4.5)	2 (0.8)	~ ~	11.2 (0.10)
Norway	66 (4.2)	495 (3.1)	34 (4.2)	491 (4.5)	0 (0.0)	~ ~	11.1 (0.13)
Armenia	64 (2.9)	440 (3.7)	34 (2.9)	436 (4.6)	1 (0.6)	~ ~	10.9 (0.11)
United Arab Emirates	64 (2.4)	469 (3.1)	34 (2.2)	448 (4.1)	2 (0.7)	~ ~	10.7 (0.09)
Qatar	63 (3.9)	430 (7.6)	35 (3.9)	398 (9.2)	2 (0.0)	~ ~	10.9 (0.13)
Kazakhstan	63 (2.7)	495 (5.0)	36 (2.6)	483 (5.9)	1 (0.8)	~ ~	11.0 (0.11)
Ukraine	63 (3.0)	507 (4.4)	37 (3.0)	491 (4.7)	0 (0.0)	~ ~	10.7 (0.09)
Singapore	61 (2.8)	603 (5.7)	35 (2.8)	572 (8.2)	5 (0.9)	558 (21.0)	10.6 (0.10)
Syrian Arab Republic	60 (3.5)	428 (4.8)	37 (3.4)	424 (6.4)	3 (1.4)	425 (25.8)	10.7 (0.12)
Macedonia, Rep. of	59 (2.5)	416 (6.9)	38 (2.6)	400 (6.7)	3 (0.8)	407 (17.0)	10.6 (0.10)
Thailand	57 (4.3)	445 (6.2)	40 (4.5)	458 (5.9)	3 (1.4)	472 (3.8)	10.5 (0.15)
Romania	57 (2.3)	471 (4.1)	40 (2.3)	457 (4.4)	3 (0.9)	440 (10.8)	10.6 (0.10)
Iran, Islamic Rep. of	55 (3.0)	485 (5.2)	41 (3.1)	465 (5.7)	4 (1.2)	433 (14.4)	10.5 (0.11)
Australia	53 (3.8)	542 (8.4)	38 (3.2)	510 (7.1)	9 (2.8)	488 (13.8)	10.4 (0.21)
New Zealand	53 (3.7)	528 (4.5)	42 (4.0)	491 (9.1)	6 (1.8)	498 (11.7)	10.3 (0.13)
Israel	50 (3.9)	530 (5.3)	45 (4.0)	509 (6.4)	5 (1.5)	455 (13.0)	10.2 (0.16)
Lebanon	49 (3.2)	426 (5.7)	46 (3.4)	393 (7.7)	5 (1.7)	338 (10.9)	10.2 (0.13)
United States	49 (2.1)	545 (4.2)	44 (2.1)	511 (4.1)	7 (1.3)	493 (8.8)	10.2 (0.10)
Hong Kong SAR	49 (4.1)	550 (6.1)	48 (4.2)	524 (6.2)	2 (0.7)	~ ~	10.3 (0.17)
Saudi Arabia	49 (4.0)	443 (4.9)	48 (4.2)	433 (5.4)	3 (1.7)	391 (16.2)	10.2 (0.14)
England	46 (3.0)	544 (7.3)	46 (3.0)	522 (7.1)	8 (1.6)	516 (15.1)	10.2 (0.13)
Russian Federation	45 (2.6)	552 (3.4)	52 (2.4)	535 (3.8)	3 (0.8)	530 (9.5)	10.1 (0.09)
Oman	44 (2.9)	432 (5.0)	52 (3.0)	415 (5.4)	3 (1.1)	350 (9.7)	10.0 (0.10)
Hungary	44 (2.4)	533 (2.8)	51 (2.5)	515 (4.0)	5 (1.2)	510 (12.4)	9.8 (0.09)
Indonesia	43 (4.3)	400 (8.1)	55 (4.4)	410 (5.2)	2 (1.0)	~ ~	10.2 (0.15)
Malaysia	43 (3.8)	437 (9.1)	52 (3.6)	417 (9.0)	5 (1.5)	421 (22.1)	9.9 (0.15)
Bahrain	42 (2.6)	490 (4.5)	56 (2.6)	428 (3.2)	2 (0.1)	~ ~	10.0 (0.08)
Turkey	38 (3.3)	501 (7.6)	50 (3.4)	479 (4.6)	12 (2.1)	440 (8.6)	9.4 (0.14)
Palestinian Nat'l Auth.	37 (3.9)	423 (5.4)	57 (4.0)	422 (5.1)	5 (1.9)	370 (19.0)	9.7 (0.14)
Lithuania	37 (2.2)	518 (3.0)	61 (2.2)	512 (3.2)	3 (0.6)	515 (10.4)	9.7 (0.07)
Jordan	36 (4.0)	466 (6.5)	53 (3.9)	446 (6.1)	11 (2.1)	406 (17.6)	9.4 (0.16)
Ghana	34 (3.8)	335 (9.0)	57 (4.1)	295 (7.6)	9 (2.4)	267 (16.7)	9.5 (0.16)
Morocco	31 (2.5)	392 (4.0)	54 (2.6)	371 (2.8)	15 (1.7)	367 (5.3)	9.2 (0.12)
Chile	30 (3.0)	490 (4.8)	52 (4.1)	456 (4.0)	18 (3.7)	428 (6.1)	9.2 (0.19)
Sweden	29 (3.2)	525 (4.5)	67 (3.1)	507 (3.4)	4 (1.1)	470 (11.0)	9.5 (0.13)
Finland	26 (2.7)	562 (3.9)	68 (2.6)	550 (2.5)	6 (1.2)	535 (7.8)	9.2 (0.09)
Chinese Taipei	25 (3.0)	581 (6.2)	68 (3.8)	559 (3.2)	8 (2.2)	548 (8.6)	9.2 (0.12)
Tunisia	22 (3.3)	447 (7.2)	59 (4.1)	437 (3.1)	18 (3.3)	435 (6.6)	8.7 (0.16)
Slovenia	20 (1.9)	546 (3.6)	72 (2.1)	542 (2.9)	8 (1.3)	540 (5.0)	9.0 (0.08)
Italy	17 (2.9)	512 (5.0)	75 (3.1)	502 (3.3)	8 (2.1)	475 (12.9)	8.9 (0.13)
Korea, Rep. of	13 (2.6)	568 (5.4)	75 (3.4)	558 (2.2)	11 (2.6)	565 (6.3)	8.4 (0.13)
Japan	10 (2.4)	583 (7.4)	73 (3.4)	557 (3.0)	17 (3.1)	548 (4.6)	8.3 (0.12)
International Avg.	45 (0.5)	488 (0.9)	50 (0.5)	470 (0.8)	6 (0.3)	457 (2.3)	

Centerpoint of scale set at 10.

(.) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

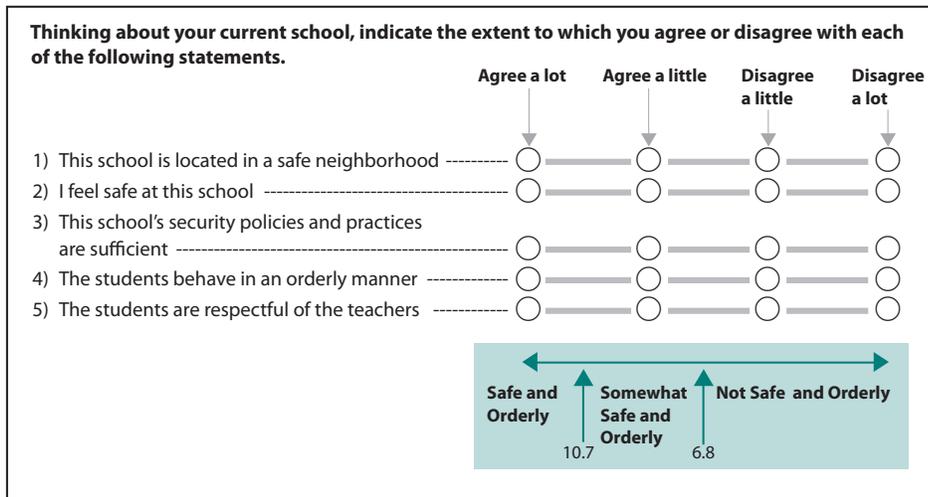
An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

An "x" indicates data are available for less than 50% of students.

**Exhibit 6.8: Safe and Orderly School (Continued)**

Country	Safe and Orderly		Somewhat Safe and Orderly		Not Safe and Orderly		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Ninth Grade Participants</b>							
Honduras	48 (5.0)	367 (6.1)	43 (5.1)	373 (7.6)	8 (2.1)	362 (9.0)	9.9 (0.21)
South Africa	23 (3.2)	349 (12.7)	51 (3.6)	325 (6.3)	26 (2.7)	320 (8.0)	8.6 (0.18)
Botswana	11 (2.7)	427 (14.4)	62 (3.8)	407 (4.0)	27 (3.5)	388 (7.0)	7.9 (0.15)
<b>Benchmarking Participants</b>							
Dubai, UAE	r 75 (1.6)	495 (3.6)	24 (1.6)	431 (6.1)	1 (0.0)	~ ~	11.1 (0.08)
Alberta, Canada	r 75 (3.6)	548 (2.9)	23 (3.3)	541 (3.9)	2 (1.0)	~ ~	11.3 (0.15)
Minnesota, US	r 69 (5.7)	556 (4.1)	30 (5.9)	547 (17.5)	1 (1.0)	~ ~	11.5 (0.25)
Colorado, US	r 66 (5.6)	551 (5.5)	26 (5.0)	520 (12.9)	7 (2.5)	527 (33.1)	10.8 (0.26)
Indiana, US	r 62 (5.6)	543 (5.4)	34 (5.2)	522 (7.1)	3 (2.1)	521 (40.3)	10.9 (0.23)
Massachusetts, US	r 61 (7.1)	575 (7.4)	35 (7.3)	550 (12.1)	4 (3.0)	490 (42.2)	10.9 (0.31)
North Carolina, US	s 58 (7.7)	544 (13.3)	32 (7.1)	510 (9.3)	10 (4.7)	475 (21.8)	10.6 (0.37)
Abu Dhabi, UAE	r 57 (4.4)	464 (6.3)	40 (4.4)	456 (6.7)	3 (1.5)	442 (8.7)	10.4 (0.17)
Ontario, Canada	r 54 (4.2)	529 (3.0)	41 (4.2)	514 (4.6)	5 (1.7)	500 (4.9)	10.6 (0.18)
Connecticut, US	r 50 (7.2)	565 (7.9)	44 (7.1)	508 (12.8)	5 (3.0)	445 (28.6)	10.5 (0.26)
Quebec, Canada	r 44 (3.7)	532 (3.6)	54 (3.6)	511 (4.4)	2 (1.1)	~ ~	10.0 (0.12)
Alabama, US	r 41 (8.4)	502 (13.0)	49 (8.3)	478 (7.3)	10 (3.9)	432 (16.7)	9.7 (0.27)
California, US	s 34 (4.8)	534 (12.1)	58 (4.3)	482 (7.7)	8 (2.8)	480 (17.9)	9.8 (0.25)
Florida, US	x x	x x	x x	x x	x x	x x	x x

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



## Exhibit 6.9: School Discipline and Safety

Reported by Principals

Students were scored according to their principals' responses concerning ten potential school problems on the *School Discipline and Safety* scale. Students in schools with **Hardly Any Problems** had a score on the scale of at least 9.7, which corresponds to their principals reporting "not a problem" for five of the ten discipline and safety issues and "minor problem" for the other five, on average. Students in schools with **Moderate Problems** had a score no higher than 7.6, which corresponds to their principals reporting "moderate problem" for five of the ten issues and "minor problem" for the other five, on average. All other students attended schools with **Minor Problems**.

Country	Hardly Any Problems		Minor Problems		Moderate Problems		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Kazakhstan	91 (2.2)	498 (5.6)	9 (2.4)	463 (17.7)	1 (0.6)	~ ~	11.1 (0.10)
Armenia	87 (2.7)	414 (4.0)	8 (2.3)	422 (13.9)	4 (1.7)	445 (20.7)	11.1 (0.12)
Northern Ireland	85 (3.7)	520 (3.4)	15 (3.7)	502 (7.3)	0 (0.0)	~ ~	11.0 (0.13)
Netherlands	85 (3.6)	536 (2.7)	15 (3.6)	516 (6.5)	0 (0.0)	~ ~	11.3 (0.16)
Hong Kong SAR	84 (2.9)	540 (3.0)	15 (2.8)	505 (19.5)	1 (0.0)	~ ~	11.2 (0.12)
Ireland	83 (3.1)	521 (3.5)	16 (3.0)	499 (11.2)	1 (1.0)	~ ~	11.1 (0.13)
Georgia	81 (2.8)	454 (4.7)	13 (2.4)	454 (9.5)	6 (1.4)	470 (10.8)	10.7 (0.15)
Spain	80 (3.3)	510 (2.9)	12 (2.8)	486 (8.7)	8 (2.3)	498 (13.8)	10.7 (0.17)
Chinese Taipei	77 (3.3)	552 (2.7)	23 (3.3)	551 (4.4)	0 (0.0)	~ ~	11.4 (0.13)
England	77 (4.1)	537 (3.5)	20 (4.2)	500 (10.0)	3 (1.6)	486 (7.3)	10.6 (0.11)
Korea, Rep. of	76 (3.6)	588 (2.3)	18 (3.4)	580 (3.6)	6 (2.0)	582 (7.0)	10.9 (0.15)
Lithuania	75 (3.5)	518 (2.8)	25 (3.5)	505 (5.3)	0 (0.0)	~ ~	10.5 (0.11)
Iran, Islamic Rep. of	74 (3.9)	458 (5.0)	25 (3.9)	440 (8.7)	0 (0.0)	~ ~	10.7 (0.11)
Japan	72 (3.2)	559 (2.1)	24 (3.3)	558 (4.2)	4 (1.6)	557 (8.2)	10.5 (0.12)
New Zealand	69 (3.4)	512 (3.1)	28 (3.2)	469 (6.0)	3 (1.3)	428 (14.4)	10.7 (0.12)
Czech Republic	68 (3.6)	539 (2.9)	29 (3.5)	529 (5.1)	2 (1.0)	~ ~	10.2 (0.11)
Belgium (Flemish)	67 (4.4)	512 (2.3)	32 (4.3)	504 (4.4)	1 (0.0)	~ ~	10.4 (0.13)
Singapore	67 (0.0)	584 (4.1)	33 (0.0)	581 (6.5)	0 (0.0)	~ ~	10.7 (0.00)
Croatia	66 (4.0)	517 (2.6)	31 (4.0)	512 (3.6)	2 (1.2)	~ ~	10.4 (0.12)
Portugal	66 (5.4)	527 (4.3)	30 (5.5)	512 (8.6)	5 (1.7)	519 (20.6)	10.3 (0.17)
Russian Federation	65 (3.9)	555 (4.4)	35 (3.8)	549 (5.1)	0 (0.5)	~ ~	10.1 (0.09)
United States	64 (2.7)	555 (3.0)	34 (2.6)	532 (3.6)	2 (0.7)	~ ~	10.3 (0.09)
Australia	64 (3.9)	523 (4.1)	34 (3.8)	510 (5.0)	2 (1.0)	~ ~	10.4 (0.12)
Finland	64 (4.5)	574 (2.9)	34 (4.4)	565 (3.8)	2 (1.2)	~ ~	10.2 (0.12)
Romania	64 (4.1)	519 (6.1)	23 (3.4)	501 (12.0)	13 (2.9)	446 (23.8)	10.2 (0.17)
Malta	64 (0.1)	457 (2.3)	30 (0.1)	429 (2.7)	6 (0.1)	419 (7.2)	10.1 (0.00)
Bahrain	63 (4.2)	453 (5.3)	25 (4.1)	437 (9.7)	12 (4.7)	452 (7.3)	10.1 (0.30)
Qatar	63 (3.2)	414 (5.9)	23 (2.6)	366 (11.8)	14 (2.3)	347 (14.8)	9.9 (0.14)
Azerbaijan	62 (4.2)	438 (7.2)	8 (2.3)	431 (12.8)	30 (3.9)	440 (10.6)	9.5 (0.26)
United Arab Emirates	61 (2.3)	438 (3.1)	24 (2.0)	402 (5.1)	15 (1.7)	411 (7.7)	9.9 (0.11)
Denmark	60 (4.0)	534 (3.3)	40 (4.0)	525 (5.1)	1 (0.0)	~ ~	10.0 (0.09)
Norway	58 (4.4)	494 (3.1)	39 (4.2)	492 (3.3)	3 (1.6)	483 (10.2)	9.9 (0.13)
Thailand	58 (4.6)	484 (5.5)	36 (4.4)	457 (10.7)	6 (2.3)	444 (24.5)	10.1 (0.16)
Slovak Republic	57 (3.6)	537 (3.5)	35 (3.4)	529 (7.4)	9 (2.0)	503 (18.4)	9.9 (0.12)
Italy	56 (3.9)	525 (4.0)	25 (3.8)	526 (6.1)	19 (2.9)	520 (6.6)	9.5 (0.14)
Serbia	55 (4.7)	513 (4.7)	30 (4.2)	524 (5.3)	15 (3.2)	506 (7.3)	9.7 (0.18)
Slovenia	53 (3.7)	519 (3.9)	42 (3.6)	523 (4.2)	4 (1.4)	503 (8.3)	10.0 (0.12)
Poland	51 (3.9)	505 (3.4)	46 (4.2)	505 (3.6)	3 (1.4)	518 (14.9)	9.7 (0.09)
Hungary	50 (4.2)	550 (5.0)	45 (4.2)	528 (5.8)	5 (1.5)	456 (21.6)	9.7 (0.13)
Sweden	49 (4.7)	547 (3.1)	45 (4.7)	522 (4.8)	6 (1.2)	504 (11.0)	9.7 (0.13)
Austria	46 (4.3)	538 (3.7)	42 (4.1)	529 (4.4)	12 (3.3)	515 (8.0)	9.4 (0.14)
Saudi Arabia	45 (3.9)	439 (6.1)	25 (3.8)	409 (15.0)	30 (3.8)	433 (10.2)	9.1 (0.18)
Germany	41 (3.3)	541 (3.4)	53 (3.5)	526 (4.0)	6 (1.5)	475 (10.7)	9.5 (0.08)
Chile	39 (3.4)	498 (5.1)	43 (4.1)	477 (4.5)	18 (2.9)	459 (6.4)	9.2 (0.14)
Turkey	38 (2.9)	486 (6.7)	35 (3.4)	458 (6.9)	26 (3.4)	436 (10.5)	8.9 (0.14)
Oman	28 (2.9)	378 (6.4)	37 (3.1)	366 (5.8)	35 (3.0)	372 (8.9)	8.4 (0.15)
Tunisia	26 (3.3)	345 (9.3)	27 (3.2)	343 (10.1)	46 (4.0)	348 (8.2)	8.0 (0.19)
Kuwait	24 (3.5)	358 (9.6)	48 (4.2)	351 (7.5)	29 (3.6)	334 (9.6)	8.4 (0.15)
Morocco	14 (2.4)	271 (12.0)	24 (3.1)	244 (8.6)	62 (3.9)	271 (6.3)	7.2 (0.15)
Yemen	13 (2.8)	226 (14.4)	33 (4.1)	217 (12.0)	54 (4.0)	201 (11.4)	7.5 (0.16)
International Avg.	61 (0.5)	492 (0.7)	29 (0.5)	477 (1.2)	11 (0.3)	448 (2.2)	

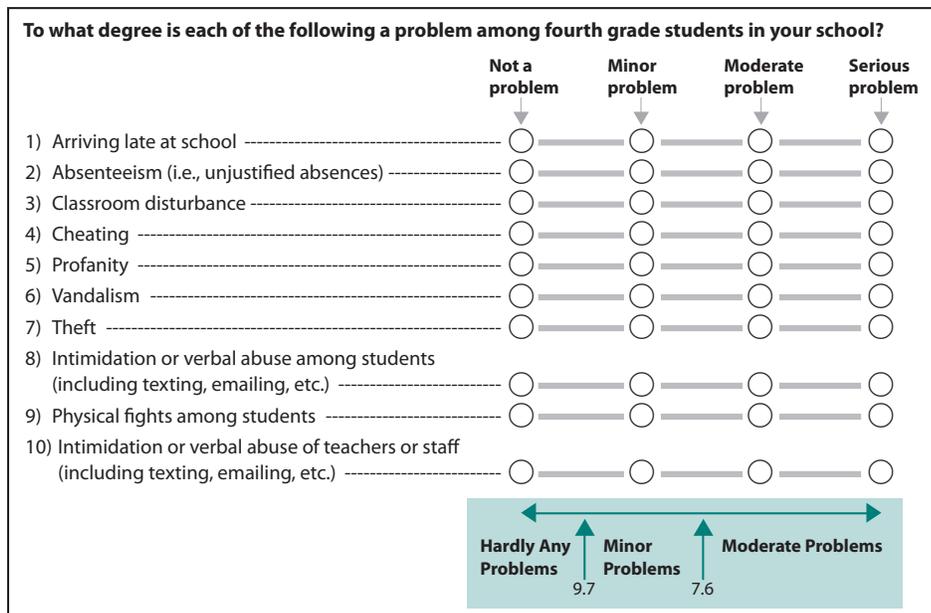
SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Centerpoint of scale set at 10.  
 (.) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.  
 A tilde (~) indicates insufficient data to report achievement.  
 An "r" indicates data are available for at least 70% but less than 85% of the students.

**Exhibit 6.9: School Discipline and Safety (Continued)**

Country	Hardly Any Problems		Minor Problems		Moderate Problems		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Sixth Grade Participants</b>							
Honduras	44 (4.5)	441 (10.5)	37 (4.9)	428 (10.9)	19 (3.3)	417 (9.2)	9.1 (0.17)
Botswana	27 (3.9)	403 (16.3)	58 (4.2)	363 (6.8)	14 (2.9)	315 (12.9)	9.0 (0.12)
Yemen	13 (3.0)	377 (17.2)	34 (4.3)	341 (9.6)	53 (4.0)	336 (10.6)	7.5 (0.15)
<b>Benchmarking Participants</b>							
Dubai, UAE	74 (0.4)	474 (2.3)	17 (0.4)	411 (7.4)	10 (0.1)	437 (4.2)	10.6 (0.01)
Alberta, Canada	68 (4.3)	546 (3.1)	32 (4.3)	535 (4.2)	0 (0.0)	~ ~	10.5 (0.13)
Ontario, Canada	66 (4.5)	531 (3.4)	33 (4.6)	524 (4.8)	1 (0.9)	~ ~	10.4 (0.13)
Abu Dhabi, UAE	63 (4.2)	421 (6.0)	25 (4.0)	384 (9.8)	12 (2.8)	384 (12.1)	9.9 (0.18)
Florida, US	60 (6.5)	553 (6.6)	40 (6.5)	530 (4.7)	0 (0.0)	~ ~	10.3 (0.21)
North Carolina, US	59 (7.5)	550 (5.5)	41 (7.5)	527 (10.0)	0 (0.0)	~ ~	10.1 (0.23)
Quebec, Canada	56 (4.3)	521 (3.1)	40 (4.1)	511 (4.1)	4 (1.9)	496 (12.6)	9.9 (0.12)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



## Exhibit 6.10: School Discipline and Safety

Reported by Principals

Students were scored according to their principals' responses concerning eleven potential school problems on the *School Discipline and Safety* scale. Students in schools with **Hardly Any Problems** had a score on the scale of at least 10.7, which corresponds to their principals reporting "not a problem" for six of the eleven discipline and safety issues and "minor problem" for the other five, on average. Students in schools with **Moderate Problems** had a score no higher than 8.0, which corresponds to their principals reporting "moderate problem" for six of the eleven issues and "minor problem" for the other five, on average. All other students attended schools with **Minor Problems**.

Country	Hardly Any Problems		Minor Problems		Moderate Problems		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Kazakhstan	81 (3.5)	488 (5.2)	19 (3.5)	497 (8.6)	0 (0.0)	~ ~	11.8 (0.11)
Iran, Islamic Rep. of	66 (3.3)	481 (5.6)	33 (3.3)	462 (4.8)	1 (0.6)	~ ~	11.4 (0.11)
Armenia	66 (4.0)	440 (4.0)	29 (3.9)	429 (7.8)	6 (1.9)	439 (15.2)	11.0 (0.13)
Chinese Taipei	64 (4.1)	565 (3.4)	35 (4.2)	562 (4.8)	1 (0.8)	~ ~	11.4 (0.15)
Georgia	61 (3.2)	417 (3.9)	35 (3.3)	425 (5.5)	3 (1.4)	437 (20.9)	10.8 (0.10)
Ukraine	59 (4.5)	505 (5.2)	33 (4.3)	497 (4.8)	7 (2.4)	487 (12.5)	10.7 (0.16)
Qatar	52 (0.6)	424 (5.9)	36 (0.3)	412 (3.5)	12 (0.4)	399 (7.5)	10.6 (0.04)
Singapore	51 (0.0)	604 (5.2)	49 (0.0)	574 (6.6)	0 (0.0)	~ ~	10.9 (0.00)
Hong Kong SAR	51 (4.6)	558 (5.7)	49 (4.7)	510 (6.4)	1 (0.0)	~ ~	10.9 (0.15)
Russian Federation	50 (3.4)	552 (4.6)	50 (3.5)	533 (4.8)	0 (0.4)	~ ~	10.5 (0.07)
Romania	50 (3.9)	468 (5.0)	41 (3.7)	467 (6.5)	9 (2.6)	434 (13.3)	10.5 (0.17)
Indonesia	47 (4.0)	413 (6.0)	39 (4.7)	401 (8.3)	14 (3.1)	392 (11.1)	10.3 (0.13)
United Arab Emirates	47 (2.0)	477 (3.4)	36 (2.4)	450 (5.0)	17 (1.4)	458 (5.4)	10.2 (0.08)
Lebanon	47 (4.4)	422 (7.8)	39 (4.4)	395 (9.2)	14 (2.9)	380 (11.3)	10.2 (0.20)
Saudi Arabia	46 (4.6)	435 (4.6)	26 (3.8)	444 (8.7)	29 (3.9)	436 (7.6)	9.7 (0.22)
Japan	45 (4.1)	567 (4.0)	35 (4.1)	555 (3.4)	20 (3.3)	542 (3.8)	10.0 (0.18)
Oman	43 (3.3)	445 (4.3)	33 (3.2)	394 (6.9)	25 (2.9)	410 (7.9)	9.8 (0.19)
England	41 (4.6)	558 (8.7)	58 (4.7)	518 (8.0)	1 (0.0)	~ ~	10.6 (0.14)
Macedonia, Rep. of	38 (3.9)	416 (8.4)	49 (4.0)	413 (7.7)	13 (2.1)	377 (18.8)	10.0 (0.15)
Korea, Rep. of	38 (3.7)	564 (2.7)	50 (4.2)	560 (2.7)	13 (3.0)	548 (5.4)	10.1 (0.17)
Bahrain	37 (0.3)	457 (3.1)	49 (0.3)	449 (2.8)	14 (0.2)	452 (6.4)	10.0 (0.01)
Thailand	34 (4.1)	452 (8.4)	61 (4.3)	449 (5.8)	5 (1.8)	463 (21.1)	10.1 (0.13)
Australia	33 (3.8)	548 (9.1)	62 (3.9)	511 (5.7)	5 (1.5)	484 (22.0)	10.1 (0.10)
Ghana	33 (4.3)	335 (10.0)	62 (4.2)	294 (7.3)	6 (1.9)	266 (13.7)	10.0 (0.13)
Slovenia	32 (3.5)	537 (4.1)	61 (4.0)	549 (2.9)	7 (2.3)	520 (7.9)	9.9 (0.11)
Norway	32 (4.7)	501 (4.6)	64 (4.7)	492 (3.2)	4 (1.7)	473 (7.2)	10.1 (0.13)
United States	30 (2.3)	536 (4.6)	66 (2.3)	523 (3.7)	4 (0.8)	485 (21.0)	10.1 (0.07)
Italy	30 (3.3)	512 (4.3)	48 (3.3)	501 (4.8)	23 (2.7)	488 (5.2)	9.4 (0.13)
Chile	29 (3.9)	488 (7.3)	54 (4.5)	458 (3.6)	16 (3.4)	433 (4.6)	9.6 (0.15)
Palestinian Nat'l Auth.	27 (3.7)	427 (6.4)	44 (3.7)	419 (6.4)	29 (3.4)	416 (7.6)	9.1 (0.20)
Finland	27 (4.1)	564 (4.6)	70 (4.1)	548 (2.6)	3 (1.5)	542 (9.9)	9.9 (0.11)
Turkey	26 (3.1)	513 (8.7)	49 (3.4)	475 (4.5)	25 (2.7)	466 (7.2)	9.2 (0.14)
Lithuania	26 (3.5)	502 (6.9)	72 (3.7)	519 (2.8)	2 (1.1)	~ ~	10.1 (0.11)
Israel	26 (3.9)	531 (7.3)	58 (4.2)	523 (5.3)	16 (2.6)	478 (14.3)	9.4 (0.16)
Malaysia	25 (3.8)	459 (11.4)	72 (4.0)	420 (7.2)	3 (1.2)	319 (18.0)	9.9 (0.10)
New Zealand	23 (3.5)	528 (8.8)	74 (3.9)	510 (5.5)	3 (1.7)	494 (29.4)	9.7 (0.09)
Jordan	22 (3.0)	460 (9.0)	51 (4.0)	449 (5.6)	27 (3.6)	439 (7.8)	9.1 (0.14)
Hungary	22 (3.5)	538 (6.3)	68 (3.9)	524 (3.7)	10 (2.5)	475 (12.7)	9.6 (0.11)
Sweden	18 (4.1)	530 (6.4)	80 (4.4)	507 (3.3)	3 (1.5)	479 (13.8)	9.5 (0.10)
Morocco	13 (2.0)	393 (7.0)	38 (3.6)	365 (4.5)	49 (3.4)	380 (3.5)	8.2 (0.13)
Syrian Arab Republic	11 (2.5)	437 (14.4)	21 (3.8)	437 (8.1)	68 (4.1)	421 (4.4)	7.4 (0.19)
Tunisia	9 (1.8)	437 (5.7)	44 (3.9)	436 (3.4)	47 (3.9)	442 (3.7)	8.1 (0.12)
International Avg.	38 (0.5)	488 (1.0)	49 (0.6)	473 (0.9)	13 (0.4)	446 (2.2)	

Centerpoint of scale set at 10.

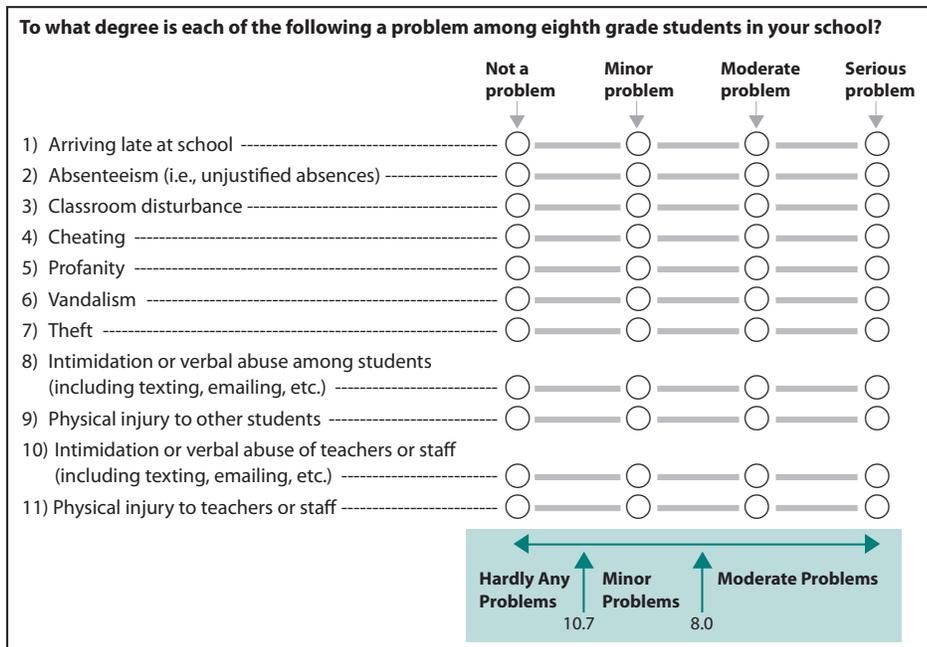
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students.

**Exhibit 6.10: School Discipline and Safety (Continued)**

Country	Hardly Any Problems		Minor Problems		Moderate Problems		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Ninth Grade Participants</b>							
Honduras	35 (4.2)	380 (8.9)	51 (4.8)	363 (4.6)	14 (3.2)	355 (8.2)	9.8 (0.15)
South Africa	8 (2.1)	338 (28.1)	63 (3.6)	336 (6.1)	29 (3.3)	317 (7.2)	8.8 (0.10)
Botswana	5 (1.8)	416 (18.7)	70 (3.7)	408 (4.4)	25 (3.6)	389 (7.9)	8.8 (0.09)
<b>Benchmarking Participants</b>							
Dubai, UAE	62 (0.4)	493 (3.5)	25 (0.4)	478 (4.7)	13 (0.1)	457 (4.3)	10.9 (0.01)
Massachusetts, US	49 (7.2)	590 (7.8)	41 (7.0)	543 (8.9)	9 (4.4)	529 (20.7)	10.6 (0.20)
Abu Dhabi, UAE	41 (3.9)	480 (6.1)	43 (4.5)	448 (9.5)	16 (3.2)	453 (9.1)	10.1 (0.18)
Minnesota, US	37 (6.3)	560 (12.8)	59 (6.9)	549 (4.3)	4 (3.5)	569 (19.3)	10.2 (0.22)
Ontario, Canada	36 (4.3)	527 (3.5)	58 (4.3)	521 (3.5)	6 (2.2)	496 (12.3)	10.2 (0.14)
Alberta, Canada	32 (3.9)	558 (4.6)	68 (3.9)	540 (2.7)	0 (0.0)	~ ~	10.3 (0.12)
Quebec, Canada	31 (3.7)	534 (4.0)	63 (4.2)	514 (4.1)	6 (2.0)	516 (11.3)	10.0 (0.11)
Florida, US	27 (7.4)	526 (20.6)	69 (7.7)	531 (8.7)	4 (2.5)	504 (25.7)	9.8 (0.22)
Indiana, US	r 27 (7.1)	554 (9.0)	71 (7.5)	532 (6.6)	2 (0.1)	~ ~	10.2 (0.18)
Colorado, US	25 (6.3)	560 (7.3)	72 (7.0)	535 (7.2)	3 (0.2)	528 (6.2)	9.8 (0.18)
Connecticut, US	r 24 (4.7)	572 (11.4)	76 (4.7)	522 (7.5)	0 (0.0)	~ ~	10.1 (0.11)
Alabama, US	r 23 (7.5)	507 (12.8)	72 (7.4)	483 (9.2)	5 (2.9)	429 (20.6)	9.9 (0.23)
North Carolina, US	17 (5.2)	537 (16.1)	82 (5.4)	530 (8.7)	1 (0.1)	~ ~	9.7 (0.19)
California, US	r 14 (6.1)	513 (12.4)	77 (6.2)	505 (6.2)	8 (2.6)	412 (15.9)	9.6 (0.20)



On average across fourth grade countries, more than half of the students (61%) attended schools in which principals reported **Hardly Any Problems** with discipline and safety and 29 percent attended schools in which principals reported **Minor Problems**. Only 11 percent attended schools in which principals reported **Moderate Problems**. Students whose principals reported **Moderate Problems** had substantially lower science achievement, by 44 points on average, than students whose principals reported **Hardly Any Problems** (448 vs. 492). The results for the sixth grade countries and benchmarking participants followed a similar pattern.

Exhibit 6.10 presents the results for the School Discipline and Safety scale for the TIMSS 2011 eighth grade assessment. This scale is based on eleven discipline and school safety problems, ten of which comprised the fourth grade scale plus one additional problem more suited to older students—“Physical injury to teachers or staff” (see the second page of the exhibit for a complete list of the problems). Compared to the fourth grade, fewer eighth grade students attend schools in which principals reported **Hardly Any Problems** (38% vs. 61%) and more attended schools in which principals reported **Minor Problems** (49% vs. 29%). There were similar percentages of students in schools with **Moderate Problems** at the fourth and eighth grades (11% and 13%). Further examination of the principals’ reports of each of the discipline and safety problems indicates that the increase in the percentage of students attending schools with **Moderate Problems** and **Minor Problems** is largely because eight of these problems (classroom disturbance, cheating, profanity, vandalism, theft, intimidation or verbal abuse among students, students fighting, and intimidation or verbal abuse of teachers) often were “not a problem” at the fourth grade schools but were more often a “minor problem” at the eighth grade schools. Similar to fourth grade, the eighth grade students whose principals reported **Moderate Problems** in their schools had substantially lower science achievement, by 40 points on average, than those students whose principals reported **Hardly Any Problems**. The results for the ninth grade countries and benchmarking participants followed a similar pattern.

### *Students Bullied at School*

Bullying typically involves aggression or negative behavior intended to harm or bother less physically or psychologically powerful persons, although a New Zealand review of the literature found a range of definitions and terminology

relating bullying to violence and abuse (Carroll-Lind, 2009). There is growing evidence that bullying in schools is on the rise, especially with the emergence of cyber-bullying, and that bullying does have a negative impact on students' educational achievement. To provide data about bullying in the participating countries, TIMSS 2011 created the Students Bullied at School scale, based on how often students experienced six bullying behaviors:

- ◆ I was made fun of or called names;
- ◆ I was left out of games or activities by other students;
- ◆ Someone spread lies about me;
- ◆ Something was stolen from me;
- ◆ I was hit or hurt by other student(s); and
- ◆ I was made to do things I didn't want to do by other students.

Exhibit 6.11 provides the results for the Students Bullied at School scale for the TIMSS 2011 fourth grade assessment. Students were scored according to their responses to how often they experienced six bullying behaviors (detailed on the second page of the exhibit). Students bullied **Almost Never** reported “never” experiencing three of six bullying behaviors and each of the other three behaviors “a few times a year,” on average. Students bullied **About Weekly** experienced each of three of the six behaviors “once or twice a month” and each of the other three “a few times a year.” All other students were bullied **About Monthly**. On average across the fourth grade countries, 48 percent of the students **Almost Never** experienced these bullying behaviors; across countries the percentages ranged from 17 to 80 percent.

The majority of the fourth grade students reported being bullied either **About Monthly** or **About Weekly**. Internationally, on average across the fourth grade countries, 32 percent of the students were reportedly bullied **About Monthly** and 20 percent were bullied **About Weekly**.

The fourth grade students' reports about being bullied were related to their average science achievement on TIMSS 2011. Each successive category of increased bullying was related to a decrease in average science achievement; there was a 33-point difference in achievement between students who were **Almost Never** bullied and those who were bullied **About Weekly** (497 vs. 464).

Exhibit 6.12 provides the results for the TIMSS 2011 eighth grade assessment for the Students Bullied at School scale, which was based on

## Exhibit 6.11: Students Bullied at School

Reported by Students

Students were scored according to their responses to how often they experienced six bullying behaviors on the *Students Bullied at School* scale. Students bullied **Almost Never** had a score on the scale of at least 10.1, which corresponds to “never” experiencing three of the six bullying behaviors and each of the other three behaviors “a few times a year,” on average. Students bullied **About Weekly** had a score no higher than 8.3, which corresponds to their experiencing each of three of the six behaviors “once or twice a month” and each of the other three “a few times a year,” on average. All other students were bullied **About Monthly**.

Country	Almost Never		About Monthly		About Weekly		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Armenia	80 (0.8)	422 (3.9)	13 (0.7)	413 (6.3)	7 (0.5)	374 (5.8)	11.5 (0.05)
Azerbaijan	75 (1.5)	459 (5.8)	16 (1.0)	432 (6.8)	9 (0.7)	391 (8.3)	11.4 (0.08)
Sweden	68 (1.0)	540 (2.9)	25 (1.0)	529 (3.5)	7 (0.5)	500 (6.7)	10.9 (0.04)
Georgia	66 (1.2)	469 (3.2)	23 (0.8)	457 (5.3)	11 (0.8)	405 (9.9)	10.9 (0.06)
Kazakhstan	64 (1.7)	496 (4.8)	23 (1.2)	506 (7.5)	13 (0.9)	485 (8.8)	10.8 (0.08)
Ireland	64 (1.3)	528 (3.4)	25 (1.0)	511 (3.9)	12 (0.9)	474 (6.1)	10.7 (0.06)
Croatia	61 (1.1)	523 (2.2)	28 (0.9)	512 (2.8)	11 (0.6)	492 (4.6)	10.6 (0.05)
Finland	61 (1.2)	574 (2.7)	30 (0.9)	572 (3.5)	9 (0.6)	547 (4.9)	10.5 (0.04)
Poland	61 (0.9)	511 (3.1)	26 (0.7)	506 (3.2)	13 (0.6)	482 (4.4)	10.6 (0.04)
Denmark	60 (1.1)	535 (2.6)	31 (0.8)	526 (3.5)	9 (0.7)	503 (6.4)	10.5 (0.04)
Serbia	57 (1.2)	523 (3.2)	30 (0.9)	519 (4.2)	13 (0.7)	481 (5.8)	10.5 (0.06)
Northern Ireland	57 (1.3)	523 (2.6)	29 (1.0)	519 (3.2)	14 (1.0)	490 (6.7)	10.4 (0.06)
Austria	53 (1.3)	536 (3.4)	30 (0.9)	532 (3.3)	17 (0.9)	519 (3.9)	10.2 (0.05)
Norway	53 (1.8)	499 (2.7)	33 (1.1)	493 (3.3)	14 (0.9)	482 (4.4)	10.2 (0.06)
Korea, Rep. of	53 (1.2)	587 (2.3)	32 (0.8)	592 (2.4)	15 (0.6)	577 (3.7)	10.3 (0.05)
Chinese Taipei	53 (1.3)	558 (2.5)	30 (0.8)	551 (2.8)	17 (0.8)	535 (4.1)	10.2 (0.05)
United States	51 (0.7)	552 (2.5)	29 (0.5)	547 (2.1)	20 (0.6)	525 (3.6)	10.1 (0.03)
Italy	51 (1.2)	529 (2.9)	33 (1.0)	528 (3.6)	16 (0.7)	508 (4.7)	10.2 (0.05)
Slovenia	50 (1.3)	526 (3.2)	32 (0.8)	526 (3.3)	18 (1.0)	496 (3.9)	10.0 (0.05)
Japan	50 (1.2)	559 (2.2)	33 (0.8)	563 (2.6)	17 (0.8)	550 (3.8)	10.1 (0.05)
Hong Kong SAR	50 (1.2)	540 (3.8)	33 (0.9)	538 (3.7)	17 (0.7)	516 (8.8)	10.1 (0.04)
Portugal	49 (1.4)	526 (4.4)	35 (1.2)	525 (4.4)	17 (0.9)	503 (5.6)	10.1 (0.06)
Germany	48 (1.2)	539 (3.6)	36 (0.9)	530 (2.9)	16 (0.8)	507 (4.3)	10.1 (0.05)
Lithuania	48 (1.3)	524 (2.7)	36 (0.9)	516 (3.1)	17 (0.8)	490 (3.8)	10.0 (0.05)
Romania	47 (1.8)	525 (5.7)	32 (1.5)	504 (7.0)	21 (1.1)	474 (9.0)	9.9 (0.07)
Slovak Republic	46 (1.1)	541 (3.4)	34 (0.8)	532 (4.6)	20 (0.9)	514 (5.0)	9.9 (0.05)
Czech Republic	46 (1.2)	545 (2.8)	34 (1.0)	540 (3.3)	20 (0.8)	514 (5.1)	10.0 (0.05)
Netherlands	46 (1.2)	534 (2.4)	37 (1.1)	535 (2.4)	17 (0.9)	518 (3.7)	9.9 (0.05)
Russian Federation	45 (1.4)	558 (3.8)	35 (1.0)	552 (3.9)	19 (1.0)	543 (4.8)	10.0 (0.06)
England	45 (1.3)	537 (3.6)	36 (1.0)	533 (3.8)	20 (0.8)	505 (5.1)	9.8 (0.05)
Spain	44 (1.3)	512 (3.2)	34 (0.9)	509 (3.4)	23 (1.0)	492 (3.7)	9.8 (0.05)
Yemen	42 (2.1)	218 (8.2)	31 (1.4)	217 (9.0)	27 (1.8)	199 (9.6)	9.7 (0.11)
Malta	42 (0.7)	458 (2.8)	36 (0.7)	448 (3.2)	22 (0.6)	421 (3.5)	9.7 (0.03)
Iran, Islamic Rep. of	41 (1.7)	450 (5.4)	35 (1.2)	456 (5.0)	23 (1.3)	456 (5.0)	9.8 (0.07)
Hungary	40 (1.1)	539 (5.2)	36 (0.8)	543 (3.9)	24 (0.8)	518 (4.5)	9.7 (0.04)
Singapore	39 (0.9)	595 (3.5)	38 (0.6)	587 (3.5)	23 (0.8)	560 (4.4)	9.7 (0.03)
Saudi Arabia	39 (1.7)	450 (6.0)	33 (1.2)	437 (5.7)	27 (1.2)	397 (7.1)	9.6 (0.08)
Tunisia	39 (1.4)	369 (6.3)	37 (1.1)	348 (5.7)	24 (1.2)	312 (7.0)	9.7 (0.06)
Belgium (Flemish)	39 (1.1)	515 (2.2)	41 (0.9)	512 (2.4)	20 (0.8)	490 (3.1)	9.7 (0.04)
Chile	38 (1.1)	494 (2.8)	31 (0.9)	486 (2.8)	31 (1.0)	463 (3.5)	9.5 (0.05)
Australia	38 (1.1)	525 (2.9)	38 (1.0)	519 (3.3)	25 (0.7)	501 (4.1)	9.5 (0.04)
Turkey	37 (0.9)	485 (4.0)	33 (0.7)	470 (4.5)	30 (0.9)	437 (5.6)	9.5 (0.04)
Kuwait	37 (1.5)	372 (6.0)	33 (1.0)	367 (5.5)	30 (1.3)	319 (6.0)	9.5 (0.07)
Morocco	35 (1.9)	286 (7.5)	33 (1.1)	267 (4.9)	32 (1.6)	243 (5.5)	9.4 (0.08)
United Arab Emirates	34 (0.8)	451 (3.1)	35 (0.5)	433 (2.8)	31 (0.8)	402 (3.8)	9.4 (0.04)
New Zealand	32 (1.0)	509 (3.4)	37 (1.0)	505 (3.0)	31 (0.9)	479 (3.1)	9.3 (0.04)
Bahrain	31 (1.1)	479 (4.5)	33 (1.1)	456 (4.5)	36 (1.3)	431 (4.1)	9.2 (0.06)
Oman	31 (1.2)	395 (5.0)	37 (0.9)	379 (4.5)	31 (1.0)	361 (5.6)	9.3 (0.05)
Qatar	30 (1.1)	434 (6.3)	32 (1.0)	411 (5.1)	38 (1.0)	364 (5.4)	9.1 (0.05)
Thailand	17 (1.2)	489 (6.2)	35 (1.2)	477 (6.2)	48 (1.6)	464 (6.2)	8.6 (0.06)
International Avg.	48 (0.2)	497 (0.6)	32 (0.1)	489 (0.6)	20 (0.1)	464 (0.8)	

Centerpoint of scale set at 10.

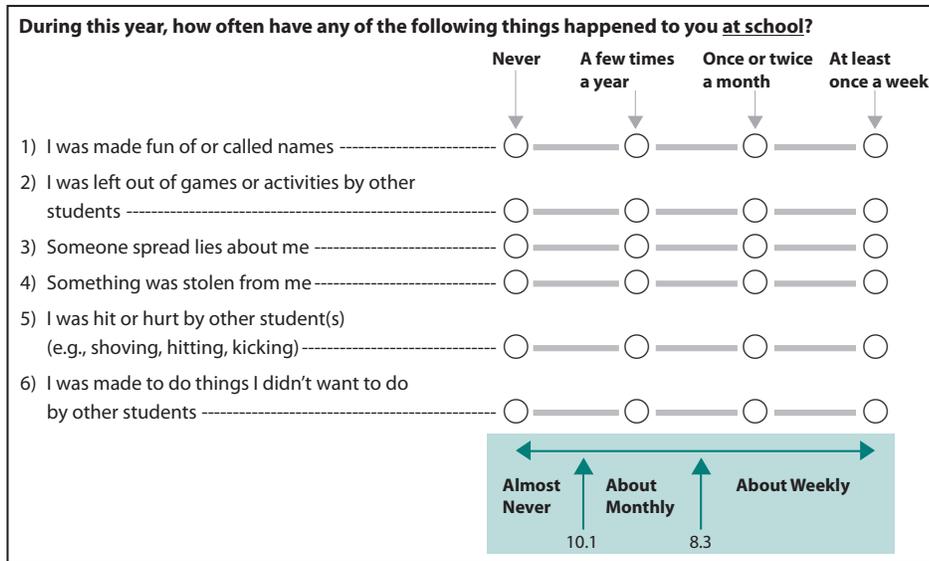
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 6.11: Students Bullied at School (Continued)**

Country	Almost Never		About Monthly		About Weekly		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Sixth Grade Participants</b>							
Yemen	43 (1.9)	354 (8.9)	34 (1.3)	357 (8.0)	23 (1.3)	323 (8.1)	9.8 (0.08)
Honduras	38 (1.2)	439 (6.6)	32 (0.9)	441 (6.1)	30 (1.2)	421 (6.8)	9.5 (0.06)
Botswana	12 (0.7)	416 (10.3)	41 (0.9)	376 (6.6)	47 (1.1)	352 (5.6)	8.6 (0.03)
<b>Benchmarking Participants</b>							
Florida, US	50 (1.4)	553 (4.5)	29 (0.9)	547 (4.1)	21 (1.1)	526 (5.1)	10.1 (0.06)
North Carolina, US	49 (1.5)	547 (4.7)	32 (1.2)	541 (4.5)	19 (1.1)	519 (6.6)	10.0 (0.06)
Quebec, Canada	44 (1.4)	523 (2.9)	37 (1.1)	515 (3.6)	19 (1.1)	502 (3.5)	9.8 (0.05)
Alberta, Canada	42 (1.3)	552 (3.1)	35 (0.9)	543 (3.3)	22 (1.0)	520 (3.3)	9.7 (0.05)
Ontario, Canada	42 (1.1)	533 (3.5)	36 (0.9)	533 (3.5)	22 (1.0)	513 (4.4)	9.7 (0.04)
Dubai, UAE	37 (1.6)	486 (3.6)	35 (0.9)	470 (3.6)	28 (1.2)	431 (5.4)	9.5 (0.06)
Abu Dhabi, UAE	33 (1.4)	434 (6.4)	36 (0.8)	416 (5.5)	31 (1.4)	390 (6.2)	9.4 (0.07)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



## Exhibit 6.12: Students Bullied at School

Reported by Students

Students were scored according to their responses to how often they experienced six bullying behaviors on the *Students Bullied at School* scale. Students bullied **Almost Never** had a score on the scale of at least 9.6, which corresponds to “never” experiencing three of the six bullying behaviors and each of the other three behaviors “a few times a year,” on average. Students bullied **About Weekly** had a score no higher than 7.7, which corresponds to their experiencing each of three of the six behaviors “once or twice a month” and each of the other three “a few times a year,” on average. All other students were bullied **About Monthly**.

Country	Almost Never		About Monthly		About Weekly		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Armenia	87 (0.7)	443 (3.2)	11 (0.6)	439 (6.2)	3 (0.3)	373 (13.6)	11.5 (0.04)
Sweden	79 (0.6)	512 (2.5)	18 (0.5)	512 (3.5)	3 (0.3)	476 (9.1)	10.9 (0.03)
Georgia	79 (0.9)	432 (2.8)	17 (0.8)	415 (4.5)	4 (0.4)	374 (11.8)	11.2 (0.05)
Norway	77 (0.8)	497 (2.6)	19 (0.7)	490 (5.2)	4 (0.3)	464 (11.6)	10.8 (0.04)
Italy	76 (1.1)	503 (2.7)	19 (0.9)	497 (3.4)	5 (0.4)	480 (7.8)	10.7 (0.05)
Kazakhstan	73 (1.1)	489 (4.4)	21 (1.0)	505 (5.7)	5 (0.5)	480 (7.7)	11.0 (0.06)
Finland	71 (0.9)	554 (2.5)	24 (0.8)	551 (3.7)	5 (0.4)	545 (5.5)	10.5 (0.04)
Ukraine	70 (1.2)	506 (3.7)	24 (1.1)	499 (4.6)	6 (0.5)	472 (7.8)	10.4 (0.05)
Russian Federation	69 (0.9)	543 (3.3)	25 (0.7)	546 (3.7)	6 (0.4)	531 (8.3)	10.4 (0.04)
England	68 (1.1)	535 (5.1)	24 (0.7)	537 (5.5)	7 (0.6)	515 (10.9)	10.4 (0.05)
Macedonia, Rep. of	68 (0.9)	426 (5.4)	22 (0.7)	404 (5.7)	10 (0.6)	357 (8.9)	10.3 (0.05)
Chinese Taipei	67 (1.0)	565 (2.7)	26 (0.8)	567 (3.1)	7 (0.4)	547 (4.8)	10.4 (0.05)
Lithuania	65 (1.1)	517 (2.7)	28 (1.0)	518 (3.4)	7 (0.5)	483 (4.8)	10.2 (0.05)
Korea, Rep. of	65 (1.1)	559 (2.2)	28 (0.9)	564 (2.8)	7 (0.5)	555 (4.5)	10.3 (0.05)
Japan	63 (1.2)	555 (2.7)	28 (0.8)	563 (3.3)	9 (0.6)	559 (5.2)	10.3 (0.05)
United States	63 (0.7)	527 (2.7)	28 (0.6)	526 (3.6)	9 (0.3)	518 (3.1)	10.1 (0.02)
Chile	62 (0.9)	468 (2.6)	30 (0.8)	456 (3.1)	9 (0.5)	446 (4.7)	9.9 (0.03)
Hungary	61 (1.2)	525 (3.3)	31 (0.9)	523 (4.1)	8 (0.5)	514 (5.9)	10.0 (0.05)
Saudi Arabia	60 (1.2)	442 (4.0)	30 (1.0)	436 (4.7)	10 (0.6)	412 (5.8)	10.1 (0.06)
Slovenia	59 (1.0)	540 (2.9)	32 (1.0)	550 (3.5)	8 (0.5)	541 (5.8)	9.9 (0.04)
Australia	58 (1.1)	523 (5.0)	31 (1.0)	521 (5.1)	11 (0.7)	502 (6.7)	9.9 (0.05)
Tunisia	58 (1.0)	440 (2.4)	31 (0.7)	439 (3.2)	11 (0.7)	434 (4.5)	9.9 (0.04)
Iran, Islamic Rep. of	56 (1.1)	480 (4.4)	33 (0.8)	474 (4.4)	12 (0.6)	453 (5.2)	9.9 (0.05)
New Zealand	55 (0.9)	517 (4.5)	33 (0.7)	515 (5.5)	12 (0.5)	501 (6.0)	9.8 (0.04)
Bahrain	55 (1.1)	466 (2.6)	29 (1.0)	454 (3.2)	16 (0.6)	415 (5.8)	9.8 (0.04)
Syrian Arab Republic	54 (1.4)	437 (4.4)	31 (1.0)	425 (3.7)	14 (0.8)	402 (5.0)	9.8 (0.06)
Hong Kong SAR	54 (1.3)	536 (3.6)	36 (1.0)	536 (3.2)	10 (0.7)	531 (8.6)	9.7 (0.05)
Lebanon	53 (1.9)	430 (5.8)	30 (1.1)	398 (6.0)	17 (1.3)	351 (5.8)	9.7 (0.08)
Romania	53 (1.2)	478 (3.8)	34 (0.9)	465 (3.7)	13 (0.7)	428 (6.2)	9.7 (0.05)
Turkey	52 (1.1)	495 (4.0)	33 (0.8)	486 (3.8)	15 (0.7)	445 (4.9)	9.7 (0.05)
Singapore	52 (0.8)	596 (4.6)	36 (0.6)	590 (4.6)	12 (0.5)	566 (6.4)	9.7 (0.03)
United Arab Emirates	51 (0.9)	479 (2.5)	33 (0.6)	465 (2.4)	16 (0.5)	424 (3.8)	9.6 (0.04)
Qatar	51 (1.6)	437 (5.7)	31 (1.2)	419 (4.5)	18 (0.8)	380 (6.0)	9.6 (0.06)
Malaysia	49 (1.2)	431 (6.2)	39 (0.9)	431 (6.6)	12 (0.8)	401 (11.2)	9.6 (0.05)
Morocco	49 (1.1)	381 (2.8)	36 (0.8)	382 (2.8)	15 (0.7)	360 (4.0)	9.6 (0.04)
Jordan	48 (1.2)	473 (3.5)	33 (1.0)	457 (4.1)	19 (0.7)	399 (6.1)	9.5 (0.05)
Palestinian Nat'l Auth.	46 (1.2)	446 (2.9)	38 (0.9)	415 (3.6)	16 (0.8)	371 (7.4)	9.5 (0.05)
Indonesia	45 (1.4)	403 (4.2)	34 (0.9)	413 (5.3)	21 (0.9)	402 (5.9)	9.5 (0.07)
Oman	41 (0.9)	445 (2.7)	37 (0.7)	425 (3.7)	21 (0.7)	380 (5.2)	9.2 (0.03)
Thailand	30 (0.8)	451 (4.4)	43 (0.7)	454 (4.4)	27 (0.8)	449 (4.3)	8.8 (0.04)
Ghana	22 (1.0)	327 (5.9)	38 (1.0)	321 (5.6)	40 (1.2)	289 (6.0)	8.4 (0.05)
Israel	--	--	--	--	--	--	--
International Avg.	59 (0.2)	483 (0.6)	29 (0.1)	478 (0.7)	12 (0.1)	452 (1.1)	

Centerpoint of scale set at 10.

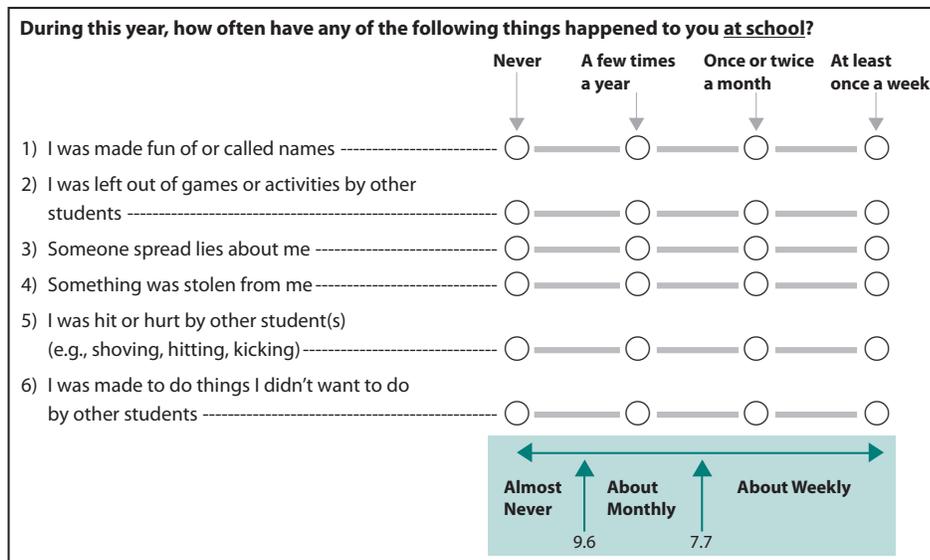
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

A dash (-) indicates comparable data are not available.

**Exhibit 6.12: Students Bullied at School (Continued)**

Country	Almost Never		About Monthly		About Weekly		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Ninth Grade Participants</b>							
Honduras	49 (1.1)	369 (4.6)	36 (0.9)	379 (4.7)	15 (0.6)	356 (4.6)	9.6 (0.04)
South Africa	25 (0.7)	392 (5.1)	42 (0.8)	346 (3.4)	33 (1.0)	287 (4.4)	8.5 (0.04)
Botswana	19 (0.7)	442 (4.0)	48 (0.7)	414 (4.0)	33 (0.7)	377 (4.7)	8.4 (0.02)
<b>Benchmarking Participants</b>							
Quebec, Canada	73 (0.9)	521 (2.7)	22 (0.7)	520 (3.2)	5 (0.4)	515 (5.8)	10.5 (0.04)
Massachusetts, US	71 (1.0)	569 (5.5)	23 (1.0)	567 (6.5)	6 (0.6)	543 (8.7)	10.5 (0.05)
California, US	67 (1.7)	501 (5.0)	24 (1.3)	500 (5.4)	9 (0.6)	486 (7.3)	10.3 (0.07)
Florida, US	64 (1.5)	534 (7.8)	27 (1.4)	536 (7.9)	9 (0.9)	508 (12.3)	10.1 (0.07)
North Carolina, US	64 (1.0)	531 (6.0)	28 (1.0)	536 (6.4)	8 (0.8)	523 (15.8)	10.1 (0.06)
Connecticut, US	63 (1.4)	535 (5.1)	28 (1.0)	535 (5.3)	9 (0.8)	526 (7.0)	10.1 (0.06)
Minnesota, US	61 (1.6)	557 (5.4)	30 (1.4)	548 (5.2)	9 (0.7)	548 (6.5)	10.0 (0.06)
Indiana, US	59 (1.5)	533 (4.9)	30 (1.3)	536 (6.6)	11 (0.9)	530 (6.4)	9.9 (0.07)
Colorado, US	58 (1.8)	543 (4.6)	31 (1.5)	544 (6.0)	11 (1.0)	534 (7.7)	9.9 (0.07)
Ontario, Canada	58 (1.2)	525 (3.3)	31 (0.9)	520 (3.5)	12 (0.8)	506 (3.5)	9.9 (0.05)
Alabama, US	57 (1.9)	489 (6.6)	32 (1.5)	485 (7.7)	11 (0.8)	477 (8.6)	9.9 (0.07)
Dubai, UAE	54 (2.1)	501 (2.9)	32 (1.3)	482 (4.3)	14 (1.1)	439 (6.3)	9.7 (0.09)
Alberta, Canada	52 (1.1)	550 (2.8)	35 (0.8)	547 (2.9)	14 (0.8)	530 (4.0)	9.6 (0.05)
Abu Dhabi, UAE	50 (1.4)	471 (4.4)	33 (0.9)	467 (4.1)	17 (1.0)	427 (6.1)	9.6 (0.06)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

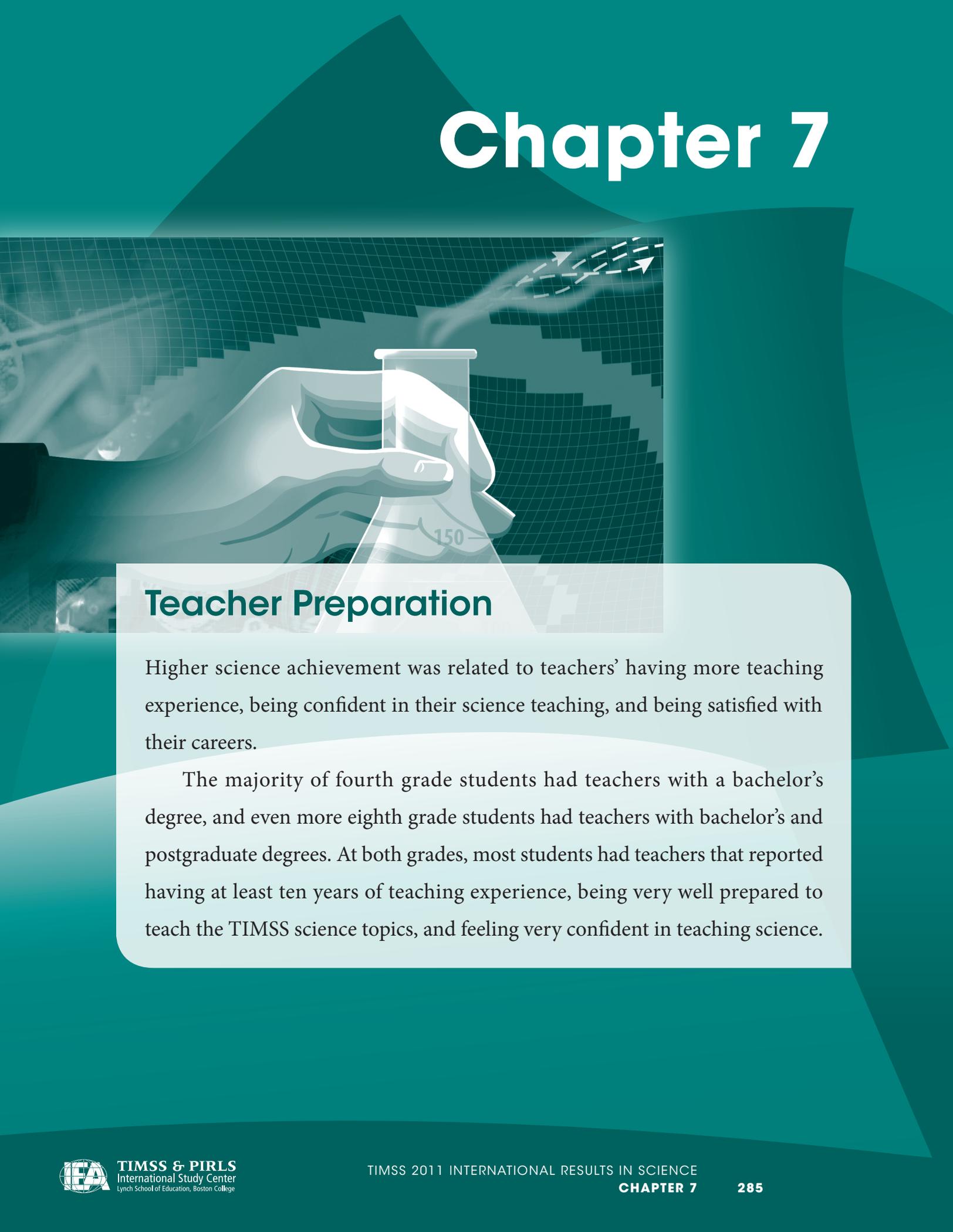


the same six bullying behaviors as the fourth grade scale. In contrast to the previous section, in which principals reported more school discipline and safety problems at the eighth grade than at the fourth grade, the eighth grade students reported experiencing somewhat less bullying behavior than did the fourth grade students. On average across countries, the majority of eighth grade students (59%) **Almost Never** experienced these bullying behaviors, compared to 48 percent at the fourth grade, whereas just 12 percent of the eighth grade students reported being bullied **About Weekly**, compared to 20 percent at the fourth grade. Similar to the fourth grade, there was a negative relationship between the eighth grade students' reports about being bullied and average science achievement, with students who were **Almost Never** bullied having achievement 31 points higher than those students who reported being bullied **About Weekly** (483 vs. 452).





# Chapter 7



## Teacher Preparation

Higher science achievement was related to teachers' having more teaching experience, being confident in their science teaching, and being satisfied with their careers.

The majority of fourth grade students had teachers with a bachelor's degree, and even more eighth grade students had teachers with bachelor's and postgraduate degrees. At both grades, most students had teachers that reported having at least ten years of teaching experience, being very well prepared to teach the TIMSS science topics, and feeling very confident in teaching science.

In view of the importance of a well prepared teaching force to an effective education system, TIMSS 2011 collected a range of information about teacher education. In the *TIMSS 2011 Encyclopedia*, each country chapter describes the educational route to teacher certification, including any additional requirements such as passing an examination or completing an induction year. Each encyclopedia chapter also addresses the requirements and practices for ongoing teacher professional development. Chapter 7 in this report provides information about teachers' education, experience, professional development, and satisfaction with their teaching careers.

### *Science Teachers' Formal Education*

There is growing evidence that teacher preparation is a powerful predictor of students' achievement, perhaps even overcoming socioeconomic and language background factors (Darling-Hammond, 2000).

Exhibits 7.1 and 7.2 present teachers' reports about their highest level of formal education for the TIMSS 2011 fourth and eighth grade assessments, respectively. On average across the fourth grade countries, 23 percent of the students had science teachers with a postgraduate university degree, 57 percent had teachers with a bachelor's degree, 15 percent had teachers who had completed post-secondary education (usually a three-year teacher education program), and six percent had teachers with an upper secondary education. However, it is clear from examining the country-by-country results across the fourth grade, sixth grade, and benchmarking participants that different countries have different educational paths for becoming a primary level teacher. Similar results are shown in Exhibit 7.2 for the eighth grade students, although more students than at the fourth grade had teachers with bachelor's (63% vs. 57%) and postgraduate university degrees (27% vs. 23%).

### *Teachers Majoring in Education and Science*

In addition to the importance of a college or university degree or advanced degree, the literature reports widespread agreement that teachers should have solid mastery of the content in the subject to be taught. For example, in a review of teacher quality research, Rice (2003) examined the relationship between teachers' advanced degrees and student achievement and found a positive relationship between subject-specific advanced degrees and student achievement in mathematics and in science.

Exhibit 7.3 shows the percentages of students in the TIMSS 2011 fourth grade assessment whose teachers had a major or specialization in primary

education and if they also had a major or specialization in science. Similar to the situation with formal education, there was a great deal of variation across countries in the degree of specialization by primary school teachers in science education. On average across the fourth grade countries, 25 percent of the students were taught science by a teacher with a major in both primary education and science, and almost half by a teacher with a major in primary education but not in science. Just 11 percent of the fourth grade students were taught science by a teacher with a major in science but not in primary education, and another 13 percent by a teacher with some other major. In several countries, one-third or more of the fourth grade and sixth grade students had science teachers without university degrees (Italy, Honduras, Morocco, Romania, Tunisia, and Yemen). However, as explained in the *TIMSS 2011 Encyclopedia*, countries have been implementing new policies that increase their teacher education requirements.

Science achievement was highest, on average, among students taught by teachers with a primary education major but not a science major (489), followed by students taught by a teacher with both majors (482), and then students taught by a teacher with some other major (479). Among the fourth grade students whose teachers had college degrees, average achievement was lowest among students taught by a teacher with a major in science but not in primary education (462).

As shown in Exhibit 7.4, the situation for science teachers of eighth grade students was somewhat different. The majority of eighth grade students were taught science by teachers who had a major in science but not in science education (51%), or who had a major in both (28%). There were only small differences in average science achievement associated with the majors of the students' teachers; students taught by teachers with a major in science and science education had somewhat higher achievement (480) than the 11 percent of students taught by teachers majoring in science education but not science (470). Almost all of the eighth grade students were taught science by teachers with college degrees (except in Morocco).

Reported by Teachers

Country	Percent of Students by Teacher Educational Level			
	Completed Postgraduate University Degree**	Completed Bachelor's Degree or Equivalent but Not a Postgraduate Degree	Completed Post-secondary Education but Not a Bachelor's Degree	No Further than Upper-secondary Education
Armenia	79 (3.3)	3 (1.3)	18 (2.9)	1 (0.8)
Australia r	65 (3.3)	27 (2.9)	7 (2.2)	1 (1.1)
Austria	4 (1.3)	2 (0.9)	93 (1.6)	0 (0.3)
Azerbaijan	9 (2.2)	52 (4.0)	37 (3.8)	3 (1.0)
Bahrain	24 (3.7)	72 (3.8)	3 (1.5)	0 (0.0)
Belgium (Flemish)	0 (0.0)	99 (0.6)	0 (0.0)	1 (0.6)
Chile	9 (2.5)	81 (3.6)	10 (2.6)	0 (0.0)
Chinese Taipei	31 (3.6)	65 (3.9)	4 (1.4)	0 (0.0)
Croatia	1 (0.6)	30 (3.3)	69 (3.2)	1 (0.4)
Czech Republic	92 (2.3)	2 (0.9)	3 (1.6)	3 (1.3)
Denmark r	4 (1.5)	83 (2.8)	12 (2.7)	2 (1.0)
England	35 (4.1)	60 (4.2)	4 (1.5)	1 (1.2)
Finland	80 (2.6)	18 (2.4)	0 (0.0)	2 (0.9)
Georgia	74 (3.5)	21 (3.1)	5 (1.5)	0 (0.0)
Germany	2 (1.0)	82 (2.3)	10 (1.7)	6 (1.5)
Hong Kong SAR	19 (3.6)	71 (4.6)	10 (2.8)	0 (0.0)
Hungary	3 (1.0)	96 (1.3)	1 (0.0)	0 (0.0)
Iran, Islamic Rep. of	1 (0.8)	37 (3.4)	49 (3.4)	13 (2.2)
Ireland	18 (2.6)	79 (2.8)	3 (1.0)	0 (0.0)
Italy	6 (1.7)	19 (2.8)	2 (1.1)	73 (3.3)
Japan	6 (2.1)	86 (3.0)	8 (2.1)	0 (0.0)
Kazakhstan	1 (0.7)	74 (3.7)	20 (3.1)	5 (1.9)
Korea, Rep. of	24 (3.4)	69 (3.9)	7 (1.8)	0 (0.0)
Kuwait	6 (2.1)	91 (2.3)	1 (0.9)	2 (1.0)
Lithuania	15 (2.4)	77 (2.6)	7 (1.7)	0 (0.0)
Malta	8 (0.1)	73 (0.1)	13 (0.1)	6 (0.1)
Morocco	0 (0.2)	35 (4.0)	0 (0.0)	65 (4.0)
Netherlands r	1 (0.7)	98 (1.1)	0 (0.0)	1 (0.9)
New Zealand	19 (2.4)	65 (2.7)	16 (2.2)	0 (0.0)
Northern Ireland r	28 (4.1)	69 (4.3)	3 (1.5)	0 (0.0)
Norway	2 (0.9)	94 (1.5)	4 (1.2)	0 (0.0)
Oman	9 (1.5)	76 (2.1)	15 (2.0)	0 (0.2)
Poland	96 (1.4)	3 (1.2)	1 (0.7)	0 (0.0)
Portugal	3 (0.9)	91 (1.7)	6 (1.6)	0 (0.0)
Qatar	27 (3.2)	71 (3.3)	1 (0.6)	1 (0.9)
Romania	7 (2.1)	30 (3.5)	29 (4.0)	34 (3.5)
Russian Federation	80 (2.6)	0 (0.0)	20 (2.6)	0 (0.3)
Saudi Arabia	0 (0.0)	72 (3.3)	27 (3.2)	1 (0.7)
Serbia	2 (0.4)	62 (3.5)	33 (3.5)	3 (1.2)
Singapore	9 (1.7)	64 (2.5)	26 (2.2)	1 (0.5)
Slovak Republic	99 (0.5)	0 (0.3)	1 (0.4)	0 (0.0)
Slovenia	1 (0.5)	57 (3.9)	42 (3.9)	0 (0.0)
Spain	1 (0.7)	99 (0.7)	0 (0.0)	0 (0.0)
Sweden	--	--	--	--
Thailand	11 (2.9)	86 (3.0)	1 (0.7)	1 (1.0)
Tunisia	0 (0.0)	15 (2.7)	40 (3.8)	45 (3.7)
Turkey	4 (1.2)	81 (2.5)	15 (2.3)	0 (0.0)
United Arab Emirates	24 (2.2)	70 (2.3)	6 (1.0)	0 (0.0)
United States r	63 (2.0)	37 (2.0)	0 (0.0)	0 (0.0)
Yemen	0 (0.0)	33 (3.5)	36 (3.7)	32 (3.7)
International Avg.	23 (0.3)	57 (0.4)	15 (0.3)	6 (0.2)

\* Based on countries' categorizations according to UNESCO's International Standard Classification of Education (Operational Manual for ISCED-1997).

\*\* For example, doctorate, master's, or other postgraduate degree or diploma.

() Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

A dash (-) indicates comparable data not available.

An "r" indicates data are available for at least 70% but less than 85% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011

**Exhibit 7.1: Science Teachers' Formal Education\* (Continued)**

Country	Percent of Students by Teacher Educational Level			
	Completed Postgraduate University Degree**	Completed Bachelor's Degree or Equivalent but Not a Postgraduate Degree	Completed Post-secondary Education but Not a Bachelor's Degree	No Further than Upper-secondary Education
<b>Sixth Grade Participants</b>				
Botswana	1 (0.0)	15 (3.0)	83 (3.1)	1 (1.0)
Honduras	0 (0.0)	45 (3.7)	21 (3.7)	34 (4.1)
Yemen	0 (0.0)	41 (4.5)	36 (4.2)	23 (3.5)
<b>Benchmarking Participants</b>				
Alberta, Canada	r 11 (2.5)	89 (2.5)	0 (0.0)	0 (0.0)
Ontario, Canada	15 (2.4)	84 (2.5)	1 (0.8)	0 (0.0)
Quebec, Canada	13 (3.3)	87 (3.3)	0 (0.1)	0 (0.0)
Abu Dhabi, UAE	23 (3.9)	71 (4.0)	6 (2.1)	0 (0.0)
Dubai, UAE	r 29 (4.2)	62 (4.1)	10 (1.5)	0 (0.0)
Florida, US	r 42 (5.1)	57 (5.2)	1 (0.1)	0 (0.0)
North Carolina, US	44 (6.7)	56 (6.7)	0 (0.0)	0 (0.0)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Reported by Teachers

Country	Percent of Students by Teacher Educational Level			
	Completed Postgraduate University Degree**	Completed Bachelor's Degree or Equivalent but Not a Postgraduate Degree	Completed Post-secondary Education but Not a Bachelor's Degree	No Further than Upper-secondary Education
Armenia	94 (1.1)	5 (1.0)	0 (0.0)	1 (0.4)
Australia s	79 (2.8)	21 (2.8)	0 (0.2)	0 (0.0)
Bahrain	27 (2.7)	71 (2.9)	2 (1.3)	0 (0.0)
Chile	9 (2.2)	87 (2.7)	4 (1.6)	0 (0.0)
Chinese Taipei	51 (3.7)	49 (3.7)	0 (0.0)	0 (0.0)
England r	45 (3.2)	54 (3.2)	1 (0.3)	0 (0.3)
Finland	89 (1.4)	10 (1.3)	0 (0.1)	1 (0.5)
Georgia	85 (1.4)	12 (1.4)	3 (0.6)	0 (0.0)
Ghana	2 (0.9)	18 (3.0)	65 (3.4)	15 (2.4)
Hong Kong SAR	39 (4.6)	57 (4.6)	4 (1.9)	0 (0.0)
Hungary	28 (2.3)	72 (2.3)	0 (0.2)	0 (0.0)
Indonesia	1 (0.6)	89 (3.2)	5 (1.3)	5 (3.0)
Iran, Islamic Rep. of	3 (1.1)	70 (2.9)	26 (2.8)	0 (0.0)
Israel	33 (3.1)	63 (3.0)	4 (1.6)	0 (0.0)
Italy	26 (3.1)	74 (3.2)	0 (0.5)	0 (0.0)
Japan	18 (3.1)	82 (3.2)	1 (0.0)	0 (0.0)
Jordan	12 (2.5)	83 (2.8)	4 (1.5)	1 (0.0)
Kazakhstan	4 (1.0)	95 (1.0)	1 (0.4)	1 (0.4)
Korea, Rep. of	34 (3.2)	66 (3.2)	0 (0.0)	0 (0.0)
Lebanon	9 (2.0)	83 (2.5)	6 (1.8)	2 (0.8)
Lithuania	35 (2.2)	60 (2.3)	5 (0.8)	0 (0.0)
Macedonia, Rep. of	2 (0.5)	43 (2.4)	54 (2.4)	0 (0.1)
Malaysia	4 (1.6)	82 (2.8)	12 (2.4)	1 (0.9)
Morocco	4 (0.9)	39 (2.4)	0 (0.0)	57 (2.5)
New Zealand	51 (4.0)	47 (4.0)	2 (0.8)	0 (0.0)
Norway	1 (1.0)	97 (1.6)	2 (1.1)	1 (0.0)
Oman	7 (1.1)	93 (1.1)	0 (0.1)	0 (0.0)
Palestinian Nat'l Auth.	11 (2.8)	83 (3.5)	6 (2.0)	0 (0.0)
Qatar	35 (3.7)	61 (2.5)	0 (0.3)	3 (2.8)
Romania	21 (1.6)	63 (2.4)	15 (1.8)	0 (0.3)
Russian Federation	99 (0.3)	0 (0.0)	0 (0.2)	0 (0.2)
Saudi Arabia	3 (1.3)	94 (2.0)	3 (1.5)	0 (0.0)
Singapore	13 (1.9)	84 (2.2)	3 (0.9)	0 (0.0)
Slovenia	2 (0.7)	55 (2.2)	42 (2.3)	0 (0.0)
Sweden	--	--	--	--
Syrian Arab Republic	1 (0.8)	65 (2.7)	32 (2.6)	2 (0.9)
Thailand	16 (3.1)	82 (3.3)	0 (0.0)	2 (1.0)
Tunisia	1 (0.9)	83 (3.0)	16 (2.9)	0 (0.0)
Turkey	5 (1.6)	86 (2.4)	9 (1.8)	0 (0.0)
Ukraine	3 (0.7)	97 (0.8)	0 (0.1)	0 (0.0)
United Arab Emirates	28 (2.1)	71 (2.1)	1 (0.4)	0 (0.0)
United States r	62 (2.8)	38 (2.8)	0 (0.0)	0 (0.0)
International Avg.	27 (0.4)	63 (0.4)	8 (0.2)	2 (0.1)

\* Based on countries' categorizations according to UNESCO's International Standard Classification of Education (Operational Manual for ISCED-1997).

\*\* For example, doctorate, master's, or other postgraduate degree or diploma.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

A dash (-) indicates comparable data not available.

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students. An "x" indicates data are available for less than 50% of students.

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011

**Exhibit 7.2: Science Teachers' Formal Education\* (Continued)**

Country	Percent of Students by Teacher Educational Level			
	Completed Postgraduate University Degree**	Completed Bachelor's Degree or Equivalent but Not a Postgraduate Degree	Completed Post-secondary Education but Not a Bachelor's Degree	No Further than Upper-secondary Education
<b>Ninth Grade Participants</b>				
Botswana	1 (0.7)	29 (3.8)	69 (3.8)	1 (1.0)
Honduras	3 (1.8)	75 (4.1)	12 (3.0)	10 (3.0)
South Africa	20 (2.7)	33 (4.1)	45 (3.9)	2 (0.9)
<b>Benchmarking Participants</b>				
Alberta, Canada	11 (2.7)	87 (2.8)	1 (1.0)	0 (0.2)
Ontario, Canada	20 (3.6)	80 (3.6)	0 (0.3)	0 (0.0)
Quebec, Canada	24 (3.2)	74 (3.4)	1 (0.0)	1 (0.0)
Abu Dhabi, UAE	20 (3.4)	79 (3.5)	1 (0.7)	0 (0.0)
Dubai, UAE	r 41 (3.7)	58 (3.7)	1 (0.6)	0 (0.0)
Alabama, US	r 66 (8.5)	34 (8.5)	0 (0.0)	0 (0.0)
California, US	s 81 (3.6)	19 (3.6)	0 (0.0)	0 (0.0)
Colorado, US	79 (5.6)	21 (5.6)	0 (0.0)	0 (0.0)
Connecticut, US	r 89 (2.3)	11 (2.3)	0 (0.0)	0 (0.0)
Florida, US	x x	x x	x x	x x
Indiana, US	r 69 (6.0)	31 (6.0)	0 (0.0)	0 (0.0)
Massachusetts, US	r 88 (4.7)	12 (4.7)	0 (0.0)	0 (0.0)
Minnesota, US	r 79 (3.3)	21 (3.3)	0 (0.0)	0 (0.0)
North Carolina, US	s 43 (7.7)	57 (7.7)	0 (0.0)	0 (0.0)

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011

### Exhibit 7.3: Teachers Majored in Education and Science

Reported by Teachers

Country	Major in Primary Education and Major (or Specialization) in Science		Major in Primary Education but No Major (or Specialization) in Science		Major in Science but No Major in Primary Education		All Other Majors		No Formal Education Beyond Upper-secondary*	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	31 (3.9)	414 (6.8)	45 (4.3)	419 (6.2)	4 (1.7)	405 (9.6)	19 (3.4)	424 (7.8)	1 (0.8)	~ ~
Australia	r 9 (2.4)	515 (9.2)	84 (2.8)	520 (3.8)	2 (1.1)	~ ~	4 (1.2)	479 (11.3)	1 (1.1)	~ ~
Austria	--	--	--	--	--	--	--	--	--	--
Azerbaijan	56 (3.8)	444 (8.8)	17 (3.0)	443 (16.6)	19 (3.2)	414 (10.9)	5 (1.5)	452 (12.9)	3 (1.0)	424 (14.4)
Bahrain	19 (3.9)	438 (10.3)	3 (1.5)	518 (26.4)	72 (4.4)	447 (4.1)	6 (1.5)	479 (17.7)	0 (0.0)	~ ~
Belgium (Flemish)	--	--	--	--	--	--	--	--	--	--
Chile	29 (3.7)	486 (6.7)	69 (3.9)	478 (3.4)	1 (0.9)	~ ~	2 (1.0)	~ ~	0 (0.0)	~ ~
Chinese Taipei	34 (4.0)	551 (3.8)	31 (3.7)	557 (3.5)	15 (2.9)	546 (6.3)	20 (3.0)	549 (5.0)	0 (0.0)	~ ~
Croatia	21 (2.9)	509 (4.0)	77 (3.0)	518 (2.3)	1 (0.5)	~ ~	1 (0.5)	~ ~	1 (0.4)	~ ~
Czech Republic	1 (0.7)	~ ~	75 (3.2)	540 (2.7)	6 (1.7)	508 (19.1)	14 (2.7)	535 (7.0)	3 (1.3)	512 (12.1)
Denmark	19 (3.0)	531 (4.5)	25 (2.9)	529 (5.2)	24 (2.9)	537 (4.7)	30 (3.4)	526 (5.4)	2 (0.9)	~ ~
England	25 (3.9)	534 (7.6)	50 (4.3)	526 (4.3)	7 (2.1)	555 (17.9)	17 (3.0)	520 (10.9)	1 (1.2)	~ ~
Finland	15 (2.5)	572 (5.8)	79 (2.7)	570 (2.6)	0 (0.0)	~ ~	5 (1.3)	579 (8.6)	2 (0.9)	~ ~
Georgia	52 (3.4)	453 (4.3)	21 (2.5)	447 (9.6)	17 (3.3)	469 (8.7)	10 (2.1)	448 (15.1)	0 (0.0)	~ ~
Germany	54 (3.4)	531 (3.8)	32 (3.4)	525 (4.3)	4 (1.4)	520 (14.9)	4 (1.4)	509 (18.3)	6 (1.5)	536 (9.7)
Hong Kong SAR	27 (4.2)	536 (5.2)	52 (4.7)	535 (6.2)	6 (2.2)	530 (13.8)	15 (2.9)	532 (7.4)	0 (0.0)	~ ~
Hungary	6 (1.7)	497 (21.6)	91 (1.8)	537 (4.0)	2 (1.1)	~ ~	1 (0.8)	~ ~	0 (0.0)	~ ~
Iran, Islamic Rep. of	24 (3.0)	473 (10.1)	46 (3.6)	448 (5.5)	2 (1.1)	~ ~	16 (2.8)	436 (8.5)	12 (2.2)	460 (11.8)
Ireland	11 (2.3)	526 (8.7)	81 (2.7)	514 (3.7)	1 (0.7)	~ ~	6 (1.6)	526 (9.0)	0 (0.0)	~ ~
Italy	2 (1.1)	~ ~	2 (1.0)	~ ~	2 (0.9)	~ ~	20 (3.1)	527 (4.7)	73 (3.4)	523 (3.4)
Japan	19 (3.1)	560 (4.3)	57 (3.9)	558 (2.0)	3 (1.7)	552 (22.9)	21 (3.2)	560 (4.2)	0 (0.0)	~ ~
Kazakhstan	65 (3.4)	497 (7.3)	27 (3.4)	498 (10.3)	0 (0.4)	~ ~	2 (1.2)	~ ~	5 (1.9)	447 (10.3)
Korea, Rep. of	14 (3.0)	587 (5.2)	81 (3.3)	587 (2.3)	0 (0.0)	~ ~	4 (1.7)	591 (16.6)	0 (0.0)	~ ~
Kuwait	55 (4.5)	347 (7.0)	4 (1.6)	308 (17.8)	39 (4.4)	343 (7.8)	0 (0.0)	~ ~	2 (1.2)	~ ~
Lithuania	14 (2.5)	495 (8.1)	84 (2.7)	518 (2.6)	2 (0.9)	~ ~	0 (0.3)	~ ~	0 (0.0)	~ ~
Malta	17 (0.1)	453 (3.5)	52 (0.1)	438 (2.6)	8 (0.1)	435 (4.7)	17 (0.1)	459 (3.1)	6 (0.1)	474 (5.0)
Morocco	5 (1.8)	309 (38.1)	5 (2.5)	278 (19.2)	7 (1.4)	326 (23.6)	19 (3.5)	257 (11.4)	64 (4.0)	258 (7.3)
Netherlands	r 9 (2.7)	537 (4.4)	90 (2.9)	529 (2.8)	0 (0.0)	~ ~	0 (0.0)	~ ~	1 (0.9)	~ ~
New Zealand	13 (2.1)	495 (9.3)	77 (2.6)	498 (2.8)	1 (0.6)	~ ~	8 (1.5)	493 (9.2)	0 (0.0)	~ ~
Northern Ireland	r 11 (2.8)	538 (7.9)	75 (3.9)	518 (3.4)	3 (1.7)	513 (22.7)	10 (3.0)	490 (19.1)	0 (0.0)	~ ~
Norway	26 (4.3)	490 (4.0)	57 (4.2)	493 (2.9)	5 (2.2)	512 (10.4)	11 (2.6)	503 (5.0)	0 (0.0)	~ ~
Oman	49 (3.1)	379 (6.5)	14 (1.9)	382 (8.2)	29 (2.6)	379 (6.4)	8 (1.7)	359 (10.5)	0 (0.2)	~ ~
Poland	20 (3.0)	505 (6.1)	79 (3.0)	505 (2.8)	0 (0.0)	~ ~	0 (0.0)	~ ~	0 (0.0)	~ ~
Portugal	21 (3.2)	510 (9.2)	75 (3.4)	525 (4.1)	0 (0.0)	~ ~	4 (1.4)	529 (6.0)	0 (0.0)	~ ~
Qatar	23 (2.7)	402 (9.8)	7 (1.7)	476 (14.9)	62 (3.8)	378 (7.2)	7 (2.4)	408 (24.3)	1 (0.9)	~ ~
Romania	21 (3.5)	480 (13.9)	28 (3.6)	517 (8.9)	1 (0.6)	~ ~	16 (2.3)	527 (10.0)	35 (3.5)	502 (8.1)
Russian Federation	55 (3.8)	553 (5.0)	42 (3.9)	551 (4.4)	2 (1.0)	~ ~	1 (0.7)	~ ~	0 (0.3)	~ ~
Saudi Arabia	31 (3.8)	417 (12.1)	9 (2.6)	454 (15.5)	53 (4.4)	426 (7.5)	7 (2.2)	469 (18.3)	1 (0.8)	~ ~
Serbia	26 (3.4)	523 (5.7)	69 (3.6)	513 (3.9)	1 (0.6)	~ ~	1 (0.8)	~ ~	3 (1.2)	509 (12.1)
Singapore	43 (2.8)	581 (5.7)	21 (2.0)	590 (6.8)	15 (2.2)	594 (8.1)	20 (2.2)	570 (7.8)	1 (0.5)	~ ~
Slovak Republic	11 (2.3)	539 (5.8)	80 (2.6)	531 (4.4)	4 (1.4)	541 (14.9)	5 (1.6)	530 (8.1)	0 (0.0)	~ ~
Slovenia	6 (1.8)	519 (8.8)	94 (1.9)	520 (2.8)	1 (0.0)	~ ~	0 (0.0)	~ ~	0 (0.0)	~ ~
Spain	29 (3.7)	503 (5.7)	55 (3.8)	506 (3.4)	8 (2.1)	516 (9.7)	8 (2.2)	493 (9.2)	0 (0.0)	~ ~
Sweden	r 55 (4.3)	531 (3.7)	35 (3.9)	536 (4.2)	6 (1.7)	563 (10.3)	3 (1.2)	532 (15.8)	1 (0.9)	~ ~
Thailand	13 (2.9)	467 (13.4)	30 (4.2)	477 (12.1)	23 (4.2)	470 (11.4)	33 (4.2)	472 (7.7)	1 (1.0)	~ ~
Tunisia	15 (2.7)	334 (10.6)	7 (2.0)	333 (16.3)	11 (2.7)	344 (16.3)	21 (3.3)	325 (10.9)	46 (3.8)	360 (8.2)
Turkey	19 (2.6)	458 (8.5)	58 (3.2)	472 (6.0)	8 (1.8)	460 (14.7)	15 (2.3)	432 (17.7)	0 (0.0)	~ ~
United Arab Emirates	29 (2.1)	420 (6.0)	7 (1.0)	503 (9.4)	56 (2.5)	422 (4.5)	8 (1.2)	448 (7.8)	0 (0.0)	~ ~
United States	r 10 (1.8)	550 (10.1)	75 (2.5)	547 (2.4)	2 (0.7)	~ ~	13 (1.7)	531 (6.0)	0 (0.0)	~ ~
Yemen	17 (3.3)	206 (15.4)	11 (2.8)	191 (19.7)	21 (3.9)	237 (11.8)	18 (3.3)	215 (14.7)	32 (3.8)	191 (13.0)
International Avg.	25 (0.4)	482 (1.5)	48 (0.4)	489 (1.3)	12 (0.3)	462 (2.4)	10 (0.3)	479 (1.9)	6 (0.2)	433 (2.9)

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011

\* Countries have been increasing their certification requirements and providing professional development to teachers certified under earlier guidelines.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students.

**Exhibit 7.3: Teachers Majored in Education and Science (Continued)**

Country	Major in Primary Education and Major (or Specialization) in Science		Major in Primary Education but No Major (or Specialization) in Science		Major in Science but No Major in Primary Education		All Other Majors		No Formal Education Beyond Upper-secondary*	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
<b>Sixth Grade Participants</b>										
Botswana	31 (3.9)	384 (16.6)	39 (4.3)	360 (9.6)	15 (3.1)	361 (15.5)	13 (3.0)	381 (12.1)	2 (1.1)	~ ~
Honduras	12 (3.6)	461 (21.4)	26 (3.7)	432 (7.9)	6 (1.6)	446 (11.7)	24 (3.8)	434 (13.1)	33 (4.0)	426 (8.9)
Yemen	20 (3.8)	341 (11.3)	11 (2.5)	295 (22.2)	35 (4.6)	366 (10.9)	11 (2.7)	347 (19.6)	23 (3.5)	335 (15.8)
<b>Benchmarking Participants</b>										
Alberta, Canada	r 13 (3.1)	545 (5.8)	75 (4.2)	540 (3.6)	3 (1.2)	550 (6.5)	9 (2.6)	541 (5.8)	0 (0.0)	~ ~
Ontario, Canada	10 (2.2)	536 (7.7)	66 (3.5)	526 (3.7)	2 (0.9)	~ ~	21 (3.0)	528 (5.6)	0 (0.0)	~ ~
Quebec, Canada	7 (2.0)	530 (10.8)	85 (3.0)	517 (2.8)	1 (0.4)	~ ~	8 (2.4)	505 (7.0)	0 (0.0)	~ ~
Abu Dhabi, UAE	31 (4.2)	394 (9.3)	5 (2.0)	475 (22.2)	58 (4.3)	413 (7.0)	6 (2.1)	421 (15.1)	0 (0.0)	~ ~
Dubai, UAE	r 27 (3.9)	454 (12.8)	15 (1.8)	528 (11.1)	45 (4.2)	445 (9.4)	13 (1.7)	485 (7.6)	0 (0.0)	~ ~
Florida, US	r 6 (3.4)	530 (17.2)	70 (4.8)	546 (4.7)	2 (1.2)	~ ~	22 (4.1)	543 (10.2)	0 (0.0)	~ ~
North Carolina, US	3 (1.9)	543 (16.2)	90 (3.1)	536 (4.9)	0 (0.0)	~ ~	7 (2.5)	548 (17.3)	0 (0.0)	~ ~

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

## Exhibit 7.4: Teachers Majored in Education and Science

Reported by Teachers

Country	Major in Science and Science Education		Major in Science Education but No Major in Science		Major in Science but No Major in Science Education		All Other Majors		No Formal Education Beyond Upper-secondary*	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	33 (2.5)	436 (4.7)	1 (0.3)	~ ~	64 (2.5)	440 (4.0)	1 (0.4)	~ ~	1 (0.4)	~ ~
Australia <sup>s</sup>	55 (4.0)	530 (7.8)	6 (1.3)	525 (17.5)	25 (3.4)	526 (10.5)	14 (2.6)	507 (8.1)	0 (0.0)	~ ~
Bahrain	36 (3.2)	465 (6.1)	9 (1.2)	461 (6.7)	52 (3.2)	443 (3.6)	2 (0.9)	~ ~	0 (0.0)	~ ~
Chile	34 (3.8)	477 (5.5)	16 (3.1)	457 (7.1)	16 (3.2)	472 (9.8)	35 (3.9)	442 (4.8)	0 (0.0)	~ ~
Chinese Taipei	35 (4.1)	563 (4.3)	2 (1.2)	~ ~	61 (4.0)	566 (3.6)	1 (1.0)	~ ~	0 (0.0)	~ ~
England <sup>r</sup>	54 (3.1)	535 (6.8)	3 (0.9)	502 (17.0)	39 (3.1)	537 (6.7)	3 (1.1)	506 (16.1)	0 (0.3)	~ ~
Finland	11 (1.7)	557 (4.8)	0 (0.0)	~ ~	69 (2.0)	555 (2.6)	19 (1.7)	543 (3.4)	1 (0.5)	~ ~
Georgia	34 (2.5)	427 (4.1)	4 (1.0)	405 (12.2)	60 (2.5)	417 (3.8)	2 (0.6)	~ ~	0 (0.0)	~ ~
Ghana	28 (3.7)	297 (12.8)	20 (3.0)	292 (10.0)	13 (2.7)	330 (15.6)	24 (3.2)	301 (11.0)	15 (2.5)	338 (19.8)
Hong Kong SAR	39 (4.4)	538 (5.6)	14 (3.2)	527 (17.5)	35 (4.7)	529 (7.2)	13 (3.0)	548 (12.1)	0 (0.0)	~ ~
Hungary	18 (2.0)	523 (5.6)	68 (2.3)	525 (3.6)	9 (1.8)	520 (9.0)	4 (1.3)	493 (16.7)	0 (0.0)	~ ~
Indonesia	21 (3.7)	414 (9.9)	6 (2.4)	397 (19.5)	60 (4.1)	411 (4.7)	8 (2.4)	383 (8.3)	5 (3.1)	342 (18.8)
Iran, Islamic Rep. of	16 (2.1)	484 (9.5)	68 (3.1)	474 (5.2)	10 (1.9)	475 (13.9)	6 (1.6)	457 (13.4)	0 (0.0)	~ ~
Israel	60 (4.1)	513 (5.6)	7 (1.9)	527 (8.8)	31 (3.7)	519 (9.0)	2 (0.9)	~ ~	0 (0.0)	~ ~
Italy <sup>r</sup>	0 (0.0)	~ ~	0 (0.0)	~ ~	90 (2.2)	503 (2.9)	10 (2.2)	492 (8.1)	0 (0.0)	~ ~
Japan	27 (3.5)	556 (3.8)	5 (1.9)	556 (7.3)	64 (3.9)	560 (3.2)	3 (1.6)	547 (5.6)	0 (0.0)	~ ~
Jordan	8 (2.3)	445 (12.7)	19 (2.9)	446 (10.2)	69 (3.7)	448 (5.7)	3 (0.9)	473 (10.6)	1 (0.0)	~ ~
Kazakhstan	34 (3.0)	493 (6.6)	1 (0.3)	~ ~	64 (3.0)	490 (4.9)	0 (0.2)	~ ~	1 (0.4)	~ ~
Korea, Rep. of	23 (3.1)	562 (4.3)	4 (1.2)	560 (5.4)	70 (3.4)	559 (2.7)	2 (0.8)	~ ~	0 (0.0)	~ ~
Lebanon	32 (3.3)	415 (8.1)	4 (1.5)	408 (21.3)	59 (3.7)	403 (6.4)	4 (1.4)	392 (21.7)	2 (0.9)	~ ~
Lithuania	22 (1.6)	514 (3.7)	3 (0.7)	511 (10.5)	71 (1.9)	514 (2.8)	3 (0.8)	514 (8.3)	0 (0.0)	~ ~
Macedonia, Rep. of	10 (1.5)	442 (10.8)	2 (0.9)	~ ~	86 (1.6)	406 (5.8)	2 (0.5)	~ ~	0 (0.1)	~ ~
Malaysia	20 (3.2)	429 (12.0)	19 (2.8)	385 (15.3)	43 (4.2)	434 (9.2)	16 (2.9)	440 (15.5)	2 (0.9)	~ ~
Morocco	7 (1.3)	374 (7.8)	0 (0.0)	~ ~	37 (2.3)	376 (3.5)	0 (0.3)	~ ~	56 (2.4)	377 (2.8)
New Zealand	40 (4.2)	519 (7.0)	3 (1.4)	496 (12.4)	51 (4.1)	511 (6.3)	6 (1.3)	485 (23.4)	0 (0.0)	~ ~
Norway	8 (2.3)	491 (8.2)	13 (3.2)	489 (6.7)	27 (3.3)	500 (4.5)	52 (3.9)	492 (3.7)	1 (0.0)	~ ~
Oman	36 (3.5)	424 (6.2)	3 (1.3)	472 (11.9)	60 (3.7)	417 (4.5)	0 (0.0)	~ ~	0 (0.0)	~ ~
Palestinian Nat'l Auth.	11 (2.6)	427 (8.6)	20 (3.3)	403 (9.4)	65 (4.0)	429 (4.7)	4 (1.2)	399 (28.9)	0 (0.0)	~ ~
Qatar	25 (3.6)	438 (15.3)	3 (1.4)	421 (28.1)	67 (3.1)	414 (5.9)	2 (1.3)	~ ~	3 (2.8)	468 (7.4)
Romania	52 (2.8)	464 (4.1)	0 (0.0)	~ ~	45 (2.5)	467 (4.1)	3 (0.9)	426 (13.4)	0 (0.3)	~ ~
Russian Federation	53 (2.2)	544 (3.8)	0 (0.2)	~ ~	45 (2.0)	542 (3.7)	1 (0.3)	~ ~	0 (0.2)	~ ~
Saudi Arabia	27 (4.2)	443 (10.3)	11 (2.9)	462 (8.0)	61 (3.9)	428 (4.1)	1 (0.9)	~ ~	0 (0.0)	~ ~
Singapore	37 (2.8)	578 (7.7)	2 (0.8)	~ ~	57 (2.7)	597 (5.7)	4 (1.2)	602 (23.4)	0 (0.0)	~ ~
Slovenia	17 (1.7)	543 (4.5)	5 (1.2)	549 (7.3)	75 (2.0)	542 (2.8)	3 (0.6)	549 (5.8)	0 (0.0)	~ ~
Sweden <sup>r</sup>	48 (3.5)	511 (4.0)	19 (3.1)	520 (6.0)	25 (3.2)	508 (5.0)	5 (1.8)	497 (11.2)	2 (1.0)	~ ~
Syrian Arab Republic	16 (2.9)	423 (9.6)	3 (1.3)	431 (11.8)	73 (3.5)	425 (4.9)	5 (1.4)	419 (15.3)	2 (0.9)	~ ~
Thailand	13 (2.7)	455 (8.8)	29 (3.8)	456 (7.5)	35 (3.8)	454 (8.1)	21 (3.4)	445 (11.6)	2 (1.1)	~ ~
Tunisia	9 (2.2)	439 (5.9)	0 (0.0)	~ ~	90 (2.3)	437 (2.6)	2 (1.2)	~ ~	0 (0.0)	~ ~
Turkey	36 (3.5)	481 (8.2)	36 (3.3)	476 (5.7)	28 (3.0)	496 (7.2)	0 (0.3)	~ ~	0 (0.0)	~ ~
Ukraine	32 (2.9)	506 (5.6)	1 (0.3)	~ ~	60 (3.0)	500 (3.7)	7 (1.3)	484 (7.0)	0 (0.0)	~ ~
United Arab Emirates	24 (2.0)	477 (6.7)	12 (1.7)	437 (6.8)	62 (2.4)	461 (3.1)	2 (0.6)	~ ~	0 (0.0)	~ ~
United States <sup>s</sup>	32 (2.2)	530 (4.5)	13 (1.8)	526 (9.8)	30 (2.5)	520 (5.8)	24 (2.1)	530 (5.8)	0 (0.0)	~ ~
International Avg.	28 (0.5)	480 (1.2)	11 (0.3)	470 (2.2)	51 (0.5)	478 (1.0)	8 (0.3)	476 (2.7)	2 (0.1)	~ ~

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

\* Countries have been increasing their certification requirements and providing professional development to teachers certified under earlier guidelines.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

An "x" indicates data are available for less than 50% of students.

**Exhibit 7.4: Teachers Majored in Education and Science (Continued)**

Country	Major in Science and Science Education		Major in Science Education but No Major in Science		Major in Science but No Major in Science Education		All Other Majors		No Formal Education Beyond Upper-secondary*	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
<b>Ninth Grade Participants</b>										
Botswana	28 (4.1)	402 (8.4)	23 (3.5)	400 (7.5)	47 (4.2)	406 (5.8)	1 (0.8)	~ ~	1 (1.0)	~ ~
Honduras	42 (4.9)	371 (6.5)	6 (2.1)	363 (17.0)	35 (4.6)	373 (8.3)	7 (2.8)	361 (19.4)	10 (3.0)	360 (14.6)
South Africa	20 (3.3)	359 (13.3)	8 (1.8)	309 (21.4)	54 (4.2)	326 (6.3)	17 (2.9)	306 (11.3)	2 (0.9)	~ ~
<b>Benchmarking Participants</b>										
Alberta, Canada	36 (3.3)	551 (3.7)	6 (1.9)	538 (7.1)	20 (3.3)	548 (5.1)	37 (3.8)	541 (3.8)	0 (0.2)	~ ~
Ontario, Canada	18 (3.0)	523 (6.1)	6 (1.6)	543 (10.6)	20 (3.2)	529 (6.2)	56 (3.9)	517 (3.2)	0 (0.0)	~ ~
Quebec, Canada	45 (4.4)	516 (5.7)	14 (2.6)	533 (9.1)	24 (3.1)	529 (5.7)	17 (3.3)	508 (5.6)	1 (0.0)	~ ~
Abu Dhabi, UAE	22 (3.4)	464 (10.5)	13 (3.0)	435 (10.8)	63 (4.3)	463 (5.6)	3 (1.4)	467 (22.3)	0 (0.0)	~ ~
Dubai, UAE	r 34 (4.2)	507 (7.3)	7 (1.4)	413 (16.6)	54 (4.3)	475 (5.1)	5 (0.4)	443 (12.1)	0 (0.0)	~ ~
Alabama, US	r 47 (5.9)	477 (9.7)	11 (4.8)	472 (18.1)	37 (6.4)	493 (10.0)	4 (2.3)	494 (17.8)	0 (0.0)	~ ~
California, US	s 25 (4.3)	493 (8.2)	7 (2.7)	461 (16.5)	42 (5.6)	505 (10.5)	26 (5.1)	510 (11.5)	0 (0.0)	~ ~
Colorado, US	41 (6.1)	549 (7.2)	8 (4.1)	501 (30.1)	39 (5.7)	547 (8.4)	11 (4.1)	524 (19.2)	0 (0.0)	~ ~
Connecticut, US	r 24 (4.9)	538 (12.1)	22 (5.7)	547 (24.5)	35 (5.3)	529 (9.3)	20 (4.8)	516 (15.4)	0 (0.0)	~ ~
Florida, US	x x	x x	x x	x x	x x	x x	x x	x x	x x	x x
Indiana, US	r 50 (5.3)	536 (6.7)	25 (5.2)	521 (10.5)	9 (2.7)	541 (22.8)	16 (5.6)	545 (11.3)	0 (0.0)	~ ~
Massachusetts, US	s 39 (6.8)	569 (9.2)	12 (4.5)	569 (20.1)	30 (6.6)	573 (18.0)	19 (5.9)	534 (18.8)	0 (0.0)	~ ~
Minnesota, US	r 56 (6.6)	544 (8.1)	12 (4.2)	545 (11.5)	22 (5.8)	563 (9.6)	9 (4.8)	587 (12.3)	0 (0.0)	~ ~
North Carolina, US	s 37 (6.5)	527 (19.1)	12 (5.1)	560 (15.3)	37 (7.2)	512 (12.6)	14 (4.4)	539 (23.2)	0 (0.0)	~ ~

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

### *Teachers' Years of Experience*

It is difficult to examine the effects of teacher experience on student achievement, because sometimes more experienced teachers are assigned to students of higher ability and with fewer discipline problems, and other times the more experienced teachers are assigned to the lower-achieving students in need of more help. However, some research has addressed this selection bias problem; and experience can have a large positive impact primarily in the first few years of teaching, although the benefits can continue beyond the first five years of a teacher's career (Harris & Sass, 2011; Leigh, 2010).

Exhibit 7.5 presents teachers' reports about their years of experience for participants in the TIMSS fourth grade assessment. On average across the fourth grade countries, teachers of science had been teaching for an average of 17 years. Forty percent of the students, on average, had teachers with 20 years or more of experience, and another 30 percent had teachers with at least 10 (but less than 20) years of experience. On average across countries, science achievement was highest for students whose teachers had 20 or more years of experience (494), compared to those whose teachers had between 10 and 20 years of experience (485), between 5 and 10 years of experience (483), or less than five years of experience (482).

Exhibit 7.6 shows science teachers' reports from the eighth grade assessment about their years of experience. On average, the eighth grade teachers were somewhat less experienced than their fourth grade counterparts (15 years vs. 17 years), leading to lesser percentages of students taught by experienced teachers—62 percent were taught by teachers with at least ten years of experience, compared to 70 percent of fourth grade students. Also, the relationship between teacher experience and average student achievement was less pronounced among the eighth grade students. On average across countries, achievement was highest for students whose teachers had 20 or more years of experience or between 10 and 20 years of experience (480 in each case), compared to students whose teachers had between 5 and 10 years of experience (475), or less than five years of experience (471).

### *Teachers' Professional Development*

Evidence from recent meta-analyses of research conducted in the United States shows that teacher professional development focused on science content has a significant positive effect on student achievement (Blank & de las Alas, 2009) and that the amount of professional development (more than 14 hours) was an important factor (Yoon, Duncan, Lee, Scarloss, & Shapley, 2007).

Exhibit 7.7 presents, for the fourth grade TIMSS assessment, teachers' reports about areas of professional development in science in which they had participated in the past two years. Although there was considerable variation across countries, the most common areas of science professional development for teachers of fourth grade students were science content (35%), science pedagogy and instruction (34%), and science curriculum (34%). On average, about one-third of students had teachers who had professional development in each of these three areas. Integrating information technology into science and science assessment were somewhat less common areas of professional development, with 28 percent and 27 percent of students, respectively, taught by teachers who had professional development in these areas in the past two years.

As shown in Exhibit 7.8, science teachers of students in the TIMSS eighth grade assessment reported somewhat higher levels of participation in science professional development than teachers of the fourth grade students. On average across the eighth grade countries, the majority of students were taught by science teachers who had participated in professional development in science pedagogy and instruction (58%), science content (55%), or science curriculum (53%) in the past two years. Slightly less than half of the students had teachers with professional development in integrating information technology into science, science assessment, and improving students' critical thinking or inquiry skills.

## Exhibit 7.5: Teachers' Years of Experience

Reported by Teachers

Country	20 Years or More		At Least 10 but Less than 20 Years		At Least 5 but Less than 10 Years		Less than 5 Years		Average Years of Experience
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Armenia	73 (3.8)	417 (4.5)	21 (3.7)	415 (7.8)	3 (1.2)	421 (12.0)	3 (1.0)	404 (30.5)	26 (0.8)
Australia	r 41 (4.1)	519 (5.5)	24 (3.7)	524 (6.3)	19 (2.8)	510 (10.5)	16 (3.1)	518 (8.3)	17 (0.9)
Austria	55 (2.9)	537 (3.4)	25 (2.7)	526 (4.9)	11 (1.9)	528 (7.7)	9 (1.7)	519 (7.8)	21 (0.6)
Azerbaijan	r 48 (4.1)	440 (7.0)	30 (3.8)	442 (12.7)	14 (2.6)	418 (14.5)	7 (2.2)	462 (19.9)	21 (0.9)
Bahrain	11 (2.8)	444 (7.1)	52 (5.2)	446 (5.6)	25 (4.2)	454 (9.5)	13 (2.3)	461 (12.2)	12 (0.6)
Belgium (Flemish)	42 (3.4)	512 (2.9)	29 (3.4)	506 (3.3)	19 (3.2)	508 (4.2)	10 (2.3)	499 (7.9)	17 (0.7)
Chile	39 (3.7)	482 (5.1)	26 (3.9)	483 (7.3)	12 (2.6)	475 (10.1)	23 (3.5)	479 (8.9)	17 (0.9)
Chinese Taipei	43 (4.2)	555 (3.2)	37 (4.0)	546 (3.8)	13 (2.9)	550 (7.1)	7 (1.6)	562 (7.4)	17 (0.7)
Croatia	56 (3.4)	520 (2.3)	30 (2.9)	509 (3.8)	9 (2.0)	518 (4.2)	5 (1.4)	519 (6.4)	21 (0.7)
Czech Republic	49 (4.1)	536 (3.9)	26 (3.4)	533 (4.0)	11 (2.8)	546 (9.1)	14 (2.7)	538 (7.1)	19 (0.8)
Denmark	23 (3.1)	532 (5.2)	25 (3.6)	533 (6.0)	25 (3.3)	524 (5.1)	27 (3.5)	529 (5.5)	13 (0.8)
England	18 (2.8)	551 (9.0)	30 (4.2)	536 (6.1)	22 (3.7)	534 (6.2)	30 (3.8)	511 (6.4)	12 (0.7)
Finland	40 (3.1)	569 (2.9)	35 (3.2)	572 (4.0)	12 (2.0)	575 (5.0)	14 (2.1)	569 (7.0)	17 (0.7)
Georgia	58 (3.6)	452 (3.7)	30 (3.4)	454 (7.5)	7 (1.5)	467 (21.5)	4 (1.6)	464 (18.3)	23 (0.7)
Germany	44 (3.4)	529 (4.4)	25 (2.8)	527 (6.0)	13 (2.5)	529 (7.2)	18 (2.6)	529 (6.4)	18 (0.9)
Hong Kong SAR	23 (4.3)	525 (10.5)	46 (4.4)	540 (4.8)	16 (3.8)	533 (18.4)	15 (3.4)	535 (7.9)	13 (0.8)
Hungary	71 (3.0)	536 (4.1)	20 (2.5)	527 (12.6)	7 (1.8)	538 (10.4)	3 (1.2)	529 (13.0)	24 (0.6)
Iran, Islamic Rep. of	41 (3.6)	477 (6.2)	41 (3.5)	440 (6.9)	10 (1.9)	443 (16.3)	9 (1.8)	414 (14.5)	17 (0.6)
Ireland	25 (3.1)	525 (7.7)	21 (3.4)	517 (8.2)	27 (3.1)	514 (5.3)	27 (3.2)	511 (6.6)	12 (0.6)
Italy	64 (3.1)	525 (3.5)	24 (2.9)	525 (5.0)	7 (1.6)	527 (11.6)	4 (1.4)	530 (10.3)	23 (0.7)
Japan	46 (3.9)	559 (2.9)	15 (3.3)	558 (5.0)	18 (3.1)	558 (4.2)	22 (3.5)	558 (4.1)	17 (1.0)
Kazakhstan	53 (4.0)	498 (6.8)	31 (3.4)	502 (9.4)	8 (2.3)	459 (18.6)	8 (2.1)	489 (23.3)	20 (0.8)
Korea, Rep. of	37 (4.1)	585 (2.8)	30 (4.3)	589 (3.8)	18 (3.2)	589 (4.0)	15 (3.3)	582 (6.4)	16 (0.8)
Kuwait	1 (1.0)	~ ~	15 (2.6)	346 (12.5)	39 (3.8)	354 (7.0)	45 (4.0)	341 (7.4)	6 (0.4)
Lithuania	70 (2.8)	514 (3.2)	28 (2.6)	516 (4.8)	2 (1.0)	~ ~	1 (0.5)	~ ~	24 (0.5)
Malta	14 (0.1)	458 (2.9)	42 (0.1)	442 (2.5)	31 (0.1)	445 (2.9)	13 (0.1)	451 (5.7)	12 (0.0)
Morocco	55 (4.2)	261 (6.9)	33 (4.4)	255 (10.1)	7 (2.3)	258 (26.3)	5 (1.3)	353 (20.6)	21 (0.6)
Netherlands	r 31 (4.8)	530 (4.4)	27 (4.3)	530 (4.1)	29 (5.0)	532 (5.9)	13 (3.0)	524 (5.8)	16 (1.2)
New Zealand	25 (2.6)	497 (5.2)	26 (2.6)	497 (5.0)	26 (2.8)	502 (5.1)	23 (2.8)	495 (5.5)	13 (0.6)
Northern Ireland	r 32 (4.7)	515 (4.8)	36 (4.0)	520 (5.5)	24 (4.2)	515 (8.4)	8 (2.5)	523 (20.3)	16 (1.0)
Norway	29 (4.2)	493 (3.7)	39 (4.2)	498 (3.1)	16 (3.3)	495 (5.7)	17 (3.5)	495 (5.4)	15 (1.0)
Oman	6 (1.2)	383 (26.6)	19 (2.5)	391 (9.8)	56 (2.6)	378 (4.7)	19 (1.9)	362 (12.6)	9 (0.3)
Poland	83 (2.2)	505 (3.0)	11 (2.1)	510 (7.7)	4 (1.5)	485 (10.6)	2 (0.9)	~ ~	23 (0.4)
Portugal	36 (3.2)	537 (5.4)	46 (3.8)	509 (6.1)	14 (2.9)	514 (9.8)	4 (1.6)	550 (15.7)	17 (0.6)
Qatar	11 (2.5)	461 (20.7)	22 (2.5)	402 (14.7)	33 (4.6)	386 (11.9)	33 (3.8)	370 (11.3)	9 (0.6)
Romania	57 (3.7)	517 (5.9)	31 (3.5)	488 (11.3)	9 (2.3)	479 (21.8)	2 (1.0)	~ ~	23 (0.8)
Russian Federation	71 (2.9)	554 (3.7)	23 (2.7)	550 (8.9)	3 (1.1)	524 (19.5)	4 (1.5)	548 (13.2)	24 (0.7)
Saudi Arabia	25 (3.8)	431 (8.5)	45 (4.4)	434 (10.7)	15 (3.1)	454 (13.6)	15 (2.8)	406 (12.1)	14 (0.6)
Serbia	63 (3.3)	514 (4.2)	31 (3.2)	523 (4.7)	5 (1.3)	487 (11.8)	2 (1.0)	~ ~	22 (0.6)
Singapore	10 (1.4)	581 (10.4)	28 (2.5)	582 (6.9)	26 (2.4)	588 (7.8)	37 (2.0)	582 (5.2)	9 (0.4)
Slovak Republic	57 (2.9)	531 (5.1)	21 (2.2)	530 (4.8)	12 (2.4)	529 (11.0)	10 (2.1)	527 (9.3)	20 (0.6)
Slovenia	57 (3.8)	521 (2.8)	26 (3.2)	525 (4.7)	10 (2.2)	504 (8.1)	6 (1.6)	518 (10.4)	21 (0.7)
Spain	59 (4.2)	512 (3.3)	21 (3.9)	497 (6.5)	6 (1.5)	509 (11.0)	14 (3.2)	487 (10.0)	21 (0.9)
Sweden	r 32 (4.4)	543 (4.2)	43 (4.7)	529 (4.7)	16 (2.8)	524 (6.0)	9 (2.7)	551 (8.5)	16 (1.0)
Thailand	47 (4.5)	479 (5.3)	25 (4.0)	466 (18.7)	14 (3.2)	462 (14.5)	15 (3.4)	477 (13.3)	19 (1.1)
Tunisia	57 (3.6)	359 (7.7)	23 (3.6)	336 (11.6)	10 (2.4)	354 (16.2)	11 (2.5)	310 (14.6)	19 (0.6)
Turkey	21 (2.7)	498 (7.3)	38 (3.0)	475 (5.2)	20 (2.5)	450 (11.8)	21 (2.8)	415 (11.7)	13 (0.5)
United Arab Emirates	r 10 (1.8)	450 (9.3)	31 (2.4)	429 (5.7)	30 (1.8)	425 (7.1)	29 (2.5)	434 (6.2)	9 (0.4)
United States	r 26 (2.6)	550 (4.2)	36 (2.8)	545 (3.6)	23 (2.4)	542 (5.0)	14 (1.8)	542 (5.8)	14 (0.6)
Yemen	9 (2.9)	206 (20.6)	58 (4.4)	196 (8.9)	17 (3.0)	258 (10.9)	16 (3.5)	219 (17.8)	12 (0.6)
International Avg.	40 (0.5)	494 (1.1)	30 (0.5)	485 (1.1)	16 (0.4)	483 (1.6)	14 (0.4)	482 (1.8)	17 (0.1)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students.

**Exhibit 7.5: Teachers' Years of Experience (Continued)**

Country	20 Years or More		At Least 10 but Less than 20 Years		At Least 5 but Less than 10 Years		Less than 5 Years		Average Years of Experience	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement		
<b>Sixth Grade Participants</b>										
Botswana	23 (3.9)	372 (15.1)	33 (4.3)	376 (14.7)	27 (4.0)	354 (10.8)	17 (3.5)	376 (15.8)	13 (0.8)	
Honduras	29 (4.2)	449 (7.1)	37 (4.6)	415 (8.3)	17 (3.7)	447 (11.1)	17 (4.0)	442 (23.8)	14 (0.9)	
Yemen	12 (2.7)	367 (17.1)	59 (4.5)	339 (8.9)	14 (3.3)	365 (20.2)	14 (3.2)	344 (18.2)	13 (0.6)	
<b>Benchmarking Participants</b>										
Alberta, Canada	r 35 (4.3)	548 (4.4)	23 (4.1)	538 (5.1)	27 (4.3)	536 (7.2)	15 (3.5)	539 (5.5)	15 (0.9)	
Ontario, Canada	16 (2.3)	528 (7.1)	39 (3.4)	524 (4.4)	33 (3.3)	530 (4.4)	11 (2.5)	524 (10.0)	11 (0.4)	
Quebec, Canada	28 (3.9)	516 (4.5)	38 (4.6)	518 (3.9)	23 (4.2)	514 (5.6)	11 (2.6)	520 (7.1)	14 (0.7)	
Abu Dhabi, UAE	r 7 (2.2)	429 (23.4)	34 (4.6)	403 (11.3)	28 (3.8)	407 (10.8)	31 (4.1)	430 (9.7)	9 (0.6)	
Dubai, UAE	r 14 (4.2)	491 (17.1)	31 (3.0)	475 (5.5)	33 (4.4)	464 (11.1)	22 (2.6)	449 (11.0)	10 (0.8)	
Florida, US	r 17 (3.1)	543 (11.5)	34 (4.9)	552 (5.9)	30 (4.2)	542 (8.9)	19 (3.9)	532 (9.2)	12 (0.9)	
North Carolina, US	22 (4.7)	546 (8.0)	32 (4.7)	547 (6.2)	22 (4.0)	541 (8.8)	24 (4.8)	513 (7.9)	12 (1.1)	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

## Exhibit 7.6: Teachers' Years of Experience

Reported by Teachers

Country	20 Years or More		At Least 10 but Less than 20 Years		At Least 5 but Less than 10 Years		Less than 5 Years		Average Years of Experience
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Armenia	51 (1.8)	439 (3.5)	33 (2.2)	437 (4.5)	8 (1.3)	431 (7.7)	8 (1.3)	445 (8.8)	21 (0.4)
Australia <sup>s</sup>	32 (3.3)	528 (8.0)	21 (2.7)	524 (9.6)	21 (3.4)	523 (10.5)	26 (2.9)	526 (8.9)	14 (0.8)
Bahrain	27 (3.5)	461 (7.8)	47 (3.5)	436 (5.2)	18 (2.2)	479 (3.9)	7 (1.0)	473 (8.5)	15 (0.5)
Chile	43 (3.9)	458 (4.7)	23 (3.4)	465 (7.8)	18 (3.4)	462 (7.7)	16 (3.1)	460 (8.3)	18 (1.0)
Chinese Taipei	28 (3.7)	570 (6.1)	28 (3.9)	571 (4.6)	26 (3.9)	556 (6.4)	18 (3.0)	555 (6.3)	13 (0.6)
England <sup>r</sup>	18 (2.9)	525 (10.0)	27 (2.7)	545 (9.5)	24 (2.7)	521 (8.4)	32 (2.9)	533 (9.3)	11 (0.7)
Finland	38 (2.5)	552 (2.5)	33 (2.5)	557 (3.6)	15 (1.5)	554 (4.3)	15 (1.7)	540 (5.1)	16 (0.5)
Georgia	61 (2.0)	417 (3.7)	21 (1.8)	427 (4.2)	9 (1.2)	425 (6.1)	8 (1.1)	423 (7.1)	24 (0.6)
Ghana	7 (1.8)	311 (20.7)	15 (3.0)	329 (15.4)	33 (4.4)	289 (9.7)	45 (4.2)	310 (8.5)	7 (0.5)
Hong Kong SAR	25 (3.9)	541 (8.9)	31 (4.0)	521 (9.2)	18 (3.8)	545 (11.9)	27 (4.5)	538 (7.8)	13 (0.8)
Hungary	62 (2.5)	524 (3.4)	25 (2.1)	522 (4.7)	7 (1.4)	521 (8.3)	6 (1.1)	512 (9.2)	22 (0.5)
Indonesia	23 (2.8)	420 (6.9)	31 (4.1)	408 (10.7)	24 (3.5)	408 (5.7)	22 (4.1)	382 (9.0)	12 (0.6)
Iran, Islamic Rep. of	32 (2.6)	495 (6.2)	46 (3.5)	476 (6.2)	14 (2.6)	441 (9.1)	7 (1.7)	433 (11.3)	16 (0.5)
Israel	38 (3.8)	532 (6.4)	33 (3.2)	520 (7.3)	13 (2.5)	479 (14.3)	16 (2.5)	504 (11.6)	16 (0.7)
Italy	59 (4.1)	505 (3.4)	22 (3.3)	490 (7.1)	11 (2.5)	508 (9.2)	8 (2.1)	499 (12.8)	22 (0.9)
Japan	49 (4.4)	557 (3.3)	16 (3.2)	573 (6.9)	13 (2.7)	556 (5.0)	22 (3.6)	549 (4.9)	17 (0.9)
Jordan	7 (1.8)	453 (12.4)	22 (3.3)	469 (6.1)	33 (3.6)	449 (9.1)	38 (3.8)	436 (8.0)	8 (0.5)
Kazakhstan	48 (1.8)	496 (5.1)	27 (1.9)	488 (5.2)	12 (1.4)	478 (7.5)	13 (1.4)	489 (8.4)	19 (0.4)
Korea, Rep. of	42 (3.6)	563 (3.5)	17 (2.7)	561 (5.1)	20 (3.1)	564 (4.6)	21 (2.8)	551 (3.5)	15 (0.7)
Lebanon	18 (2.5)	418 (10.5)	26 (2.7)	420 (9.0)	29 (2.7)	390 (7.1)	27 (3.1)	405 (9.1)	11 (0.6)
Lithuania	64 (2.4)	513 (2.6)	24 (1.9)	515 (4.2)	5 (1.1)	517 (9.8)	6 (0.9)	516 (7.5)	23 (0.6)
Macedonia, Rep. of	51 (2.1)	397 (6.5)	25 (2.0)	412 (7.9)	9 (1.2)	425 (10.8)	15 (1.5)	425 (9.3)	20 (0.5)
Malaysia	22 (2.9)	417 (15.9)	25 (3.6)	423 (11.9)	17 (3.0)	416 (14.2)	37 (3.6)	437 (11.0)	11 (0.6)
Morocco	53 (2.1)	378 (2.7)	28 (2.2)	377 (4.2)	9 (1.4)	378 (7.4)	11 (1.3)	370 (5.7)	19 (0.4)
New Zealand	29 (3.0)	510 (7.1)	27 (3.0)	518 (6.9)	25 (3.6)	511 (9.0)	20 (2.5)	506 (12.3)	14 (0.7)
Norway	32 (4.1)	495 (3.5)	23 (3.5)	492 (6.0)	16 (3.4)	494 (7.0)	29 (3.6)	494 (4.3)	15 (1.1)
Oman	5 (1.2)	416 (13.7)	26 (2.3)	432 (8.3)	34 (2.9)	416 (5.2)	36 (2.8)	419 (5.1)	7 (0.2)
Palestinian Nat'l Auth.	14 (2.8)	413 (12.6)	40 (3.9)	437 (6.2)	26 (3.4)	427 (6.6)	20 (2.8)	384 (8.2)	11 (0.6)
Qatar	17 (2.9)	422 (18.2)	31 (3.3)	427 (12.1)	32 (4.3)	417 (14.4)	20 (3.1)	397 (13.2)	11 (0.6)
Romania	48 (2.5)	475 (3.5)	30 (2.3)	462 (6.3)	13 (2.1)	447 (5.8)	9 (1.5)	450 (7.1)	19 (0.6)
Russian Federation	62 (2.2)	543 (3.6)	29 (2.0)	540 (4.2)	5 (0.7)	552 (7.8)	4 (0.8)	549 (8.0)	23 (0.4)
Saudi Arabia	9 (2.4)	446 (12.1)	53 (4.2)	443 (5.9)	20 (3.2)	427 (6.8)	19 (2.9)	424 (9.3)	12 (0.6)
Singapore	13 (1.8)	586 (12.5)	17 (1.8)	578 (14.9)	25 (2.5)	597 (7.1)	46 (2.5)	592 (6.6)	8 (0.4)
Slovenia	54 (2.5)	540 (2.9)	25 (1.8)	546 (3.8)	11 (1.4)	551 (3.8)	9 (1.5)	543 (4.5)	20 (0.5)
Sweden <sup>r</sup>	24 (2.8)	509 (5.7)	36 (3.7)	512 (4.3)	27 (3.2)	511 (5.1)	13 (2.7)	506 (6.5)	14 (0.6)
Syrian Arab Republic <sup>r</sup>	13 (2.1)	431 (8.9)	21 (3.1)	428 (8.7)	23 (3.1)	437 (7.8)	43 (3.7)	421 (5.4)	9 (0.6)
Thailand	30 (3.4)	448 (7.2)	24 (3.8)	462 (10.8)	18 (3.4)	449 (12.2)	28 (3.6)	443 (7.3)	14 (0.8)
Tunisia	30 (3.8)	453 (5.9)	38 (3.9)	437 (3.3)	28 (3.4)	425 (3.8)	3 (1.1)	415 (13.5)	15 (0.6)
Turkey	13 (2.2)	497 (11.0)	32 (3.0)	498 (7.8)	21 (2.9)	476 (6.5)	35 (3.4)	467 (5.8)	10 (0.5)
Ukraine	59 (2.4)	503 (3.7)	26 (2.1)	502 (5.4)	8 (1.4)	486 (6.8)	8 (1.1)	494 (6.5)	22 (0.5)
United Arab Emirates <sup>r</sup>	17 (1.9)	451 (6.8)	42 (2.5)	462 (4.4)	24 (2.1)	467 (4.5)	17 (1.9)	465 (6.3)	12 (0.3)
United States <sup>r</sup>	24 (2.2)	542 (7.4)	38 (2.5)	523 (5.0)	21 (1.6)	530 (5.3)	16 (1.6)	503 (5.7)	14 (0.5)
International Avg.	33 (0.4)	480 (1.3)	29 (0.5)	480 (1.2)	19 (0.4)	475 (1.3)	20 (0.4)	471 (1.3)	15 (0.1)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

(1) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

An "x" indicates data are available for less than 50% of students.

**Exhibit 7.6: Teachers' Years of Experience (Continued)**

Country	20 Years or More		At Least 10 but Less than 20 Years		At Least 5 but Less than 10 Years		Less than 5 Years		Average Years of Experience
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Ninth Grade Participants</b>									
Botswana	1 (0.8)	~ ~	33 (4.4)	402 (6.4)	23 (4.0)	416 (8.3)	43 (4.2)	398 (6.0)	7 (0.4)
Honduras	11 (2.8)	364 (10.6)	27 (4.5)	373 (8.3)	28 (4.4)	363 (6.3)	34 (4.9)	373 (10.3)	9 (0.7)
South Africa	29 (3.3)	346 (9.3)	31 (3.6)	304 (7.1)	20 (3.2)	341 (9.8)	20 (2.9)	345 (15.0)	14 (0.6)
<b>Benchmarking Participants</b>									
Alberta, Canada	19 (2.7)	547 (4.9)	36 (3.8)	549 (3.4)	21 (2.7)	546 (4.6)	23 (3.4)	540 (6.2)	12 (0.6)
Ontario, Canada	11 (2.4)	520 (4.5)	46 (4.3)	523 (3.9)	32 (3.7)	525 (4.9)	11 (2.7)	522 (5.3)	11 (0.4)
Quebec, Canada	21 (3.2)	528 (7.0)	30 (4.2)	515 (5.4)	34 (4.0)	518 (6.5)	15 (3.4)	525 (8.9)	12 (0.6)
Abu Dhabi, UAE	r 21 (3.5)	447 (9.3)	42 (4.3)	464 (6.6)	27 (3.5)	459 (6.7)	10 (2.4)	465 (9.3)	13 (0.6)
Dubai, UAE	r 13 (2.9)	481 (10.3)	39 (4.8)	489 (7.7)	27 (4.3)	477 (9.3)	21 (2.8)	472 (9.1)	11 (0.5)
Alabama, US	r 18 (5.0)	509 (11.4)	37 (6.9)	472 (10.6)	21 (6.3)	487 (9.5)	25 (6.5)	477 (11.2)	12 (0.9)
California, US	s 29 (5.4)	514 (10.3)	36 (4.7)	491 (11.0)	18 (3.6)	494 (11.5)	17 (4.6)	500 (14.4)	13 (1.0)
Colorado, US	25 (5.7)	559 (10.4)	34 (5.5)	528 (9.7)	21 (3.9)	545 (8.7)	20 (6.1)	540 (17.4)	13 (1.3)
Connecticut, US	r 31 (6.0)	561 (10.7)	36 (6.6)	527 (15.1)	23 (4.4)	501 (12.2)	11 (3.5)	548 (23.3)	16 (1.3)
Florida, US	x x	x x	x x	x x	x x	x x	x x	x x	x x
Indiana, US	r 29 (5.7)	540 (7.8)	41 (6.2)	539 (7.8)	20 (4.3)	517 (11.2)	11 (3.6)	538 (22.8)	16 (1.3)
Massachusetts, US	r 17 (5.3)	549 (24.3)	37 (6.9)	572 (12.3)	38 (6.4)	554 (12.4)	9 (3.9)	594 (24.3)	13 (1.2)
Minnesota, US	r 29 (5.8)	551 (9.0)	28 (5.9)	548 (16.1)	25 (4.9)	554 (11.5)	18 (3.9)	551 (9.0)	13 (1.1)
North Carolina, US	s 22 (6.5)	564 (15.2)	24 (6.8)	535 (26.1)	32 (7.1)	521 (16.6)	22 (6.7)	494 (12.0)	12 (1.1)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 7.7: Teacher Participation in Professional Development in Science in the Past Two Years**

Reported by Teachers

Country	Percent of Students by Teacher's Area of Professional Development				
	Science Content	Science Pedagogy / Instruction	Science Curriculum	Integrating Information Technology into Science	Science Assessment
Armenia	s 32 (4.0)	s 37 (4.6)	s 52 (4.6)	s 30 (4.7)	s 46 (4.1)
Australia	r 32 (3.2)	r 33 (3.2)	r 38 (3.8)	r 26 (2.9)	r 26 (2.8)
Austria	46 (3.6)	26 (2.9)	26 (3.0)	10 (2.0)	5 (1.4)
Azerbaijan	71 (3.5)	61 (3.7)	44 (3.7)	47 (3.9)	78 (2.9)
Bahrain	50 (5.3)	63 (5.0)	54 (5.1)	60 (4.2)	52 (5.1)
Belgium (Flemish)	39 (4.3)	30 (3.8)	47 (4.0)	30 (3.6)	7 (2.1)
Chile	r 23 (3.8)	r 18 (3.3)	r 22 (3.3)	r 23 (3.9)	r 15 (3.3)
Chinese Taipei	70 (3.4)	50 (4.0)	64 (3.8)	59 (4.7)	32 (4.1)
Croatia	59 (3.9)	48 (3.4)	52 (3.5)	17 (2.7)	38 (3.2)
Czech Republic	18 (3.0)	10 (2.4)	9 (2.5)	15 (2.9)	5 (1.5)
Denmark	r 20 (3.4)	r 17 (3.1)	r 13 (2.7)	r 10 (2.3)	r 11 (2.9)
England	29 (4.6)	43 (5.2)	28 (4.0)	23 (4.2)	42 (5.1)
Finland	10 (2.1)	10 (1.8)	3 (1.1)	5 (1.3)	4 (1.4)
Georgia	19 (3.1)	29 (3.8)	32 (4.1)	21 (3.2)	32 (4.2)
Germany	37 (3.4)	24 (3.0)	18 (2.7)	7 (1.8)	17 (2.9)
Hong Kong SAR	43 (4.5)	45 (4.5)	29 (4.0)	44 (4.4)	23 (4.0)
Hungary	16 (2.7)	26 (3.4)	6 (1.9)	20 (3.1)	7 (1.8)
Iran, Islamic Rep. of	41 (4.0)	39 (3.9)	27 (3.2)	17 (3.0)	24 (3.0)
Ireland	23 (3.4)	16 (2.9)	24 (3.5)	17 (2.8)	9 (2.1)
Italy	21 (2.8)	21 (3.3)	17 (3.0)	10 (2.0)	8 (2.0)
Japan	37 (4.5)	41 (4.2)	18 (3.4)	19 (3.3)	14 (2.8)
Kazakhstan	58 (4.3)	59 (3.8)	64 (4.1)	71 (3.8)	60 (3.9)
Korea, Rep. of	49 (4.7)	48 (4.5)	58 (3.9)	23 (3.5)	28 (4.3)
Kuwait	64 (3.4)	65 (3.6)	70 (4.0)	40 (4.1)	42 (3.8)
Lithuania	27 (2.7)	27 (3.3)	44 (3.6)	52 (3.6)	38 (2.6)
Malta	40 (0.1)	28 (0.1)	32 (0.1)	32 (0.1)	30 (0.1)
Morocco	r 7 (1.8)	r 9 (1.8)	r 9 (2.0)	r 6 (1.4)	r 5 (1.4)
Netherlands	r 4 (1.9)	r 3 (1.9)	r 3 (1.5)	r 9 (2.8)	r 3 (1.7)
New Zealand	16 (2.6)	14 (2.6)	16 (2.3)	14 (2.4)	9 (1.9)
Northern Ireland	r 26 (4.1)	r 28 (3.8)	r 29 (3.8)	r 22 (3.7)	r 5 (1.7)
Norway	10 (2.5)	9 (2.7)	6 (2.1)	5 (1.9)	3 (1.5)
Oman	36 (2.9)	44 (3.4)	30 (2.8)	21 (2.6)	37 (3.0)
Poland	34 (3.4)	19 (2.9)	26 (3.3)	25 (3.3)	11 (2.5)
Portugal	31 (3.5)	34 (3.6)	25 (3.2)	20 (3.3)	12 (2.8)
Qatar	59 (3.2)	54 (4.8)	62 (3.3)	56 (3.4)	56 (3.4)
Romania	46 (4.1)	34 (3.9)	40 (4.1)	33 (4.2)	49 (4.2)
Russian Federation	46 (4.6)	49 (4.5)	66 (4.4)	56 (3.6)	54 (4.5)
Saudi Arabia	48 (3.9)	54 (3.8)	54 (4.3)	37 (3.8)	46 (4.2)
Serbia	38 (3.9)	24 (3.1)	24 (3.6)	15 (2.9)	23 (3.5)
Singapore	75 (2.2)	78 (1.9)	66 (2.6)	59 (2.8)	70 (2.8)
Slovak Republic	16 (2.5)	18 (2.8)	41 (3.1)	43 (3.4)	17 (2.8)
Slovenia	43 (3.1)	31 (3.1)	37 (3.7)	36 (3.5)	30 (2.6)
Spain	19 (3.8)	22 (3.9)	15 (3.2)	40 (4.0)	9 (2.7)
Sweden	r 20 (3.6)	r 14 (3.1)	r 24 (3.4)	r 4 (1.4)	r 12 (2.6)
Thailand	59 (4.3)	61 (4.3)	70 (4.3)	49 (4.8)	50 (4.3)
Tunisia	23 (3.6)	48 (4.0)	25 (4.0)	15 (2.9)	40 (4.4)
Turkey	9 (1.7)	9 (1.9)	8 (2.0)	9 (1.9)	8 (1.8)
United Arab Emirates	46 (2.5)	54 (2.9)	54 (2.3)	56 (2.4)	52 (2.8)
United States	r 39 (2.7)	r 28 (2.4)	r 39 (2.6)	r 27 (2.6)	r 27 (2.1)
Yemen	21 (3.8)	37 (4.4)	24 (4.3)	10 (2.8)	20 (3.7)
International Avg.	35 (0.5)	34 (0.5)	34 (0.5)	28 (0.5)	27 (0.4)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.  
An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 7.7: Teacher Participation in Professional Development in Science in the Past Two Years (Continued)**

Country	Percent of Students by Teacher's Area of Professional Development				
	Science Content	Science Pedagogy / Instruction	Science Curriculum	Integrating Information Technology into Science	Science Assessment
<b>Sixth Grade Participants</b>					
Botswana	r 26 (3.3)	r 16 (3.0)	r 20 (3.4)	r 18 (3.2)	r 33 (4.3)
Honduras	30 (4.4)	26 (4.2)	21 (3.7)	16 (3.8)	28 (4.3)
Yemen	22 (4.0)	42 (4.3)	20 (4.0)	9 (2.6)	23 (3.8)
<b>Benchmarking Participants</b>					
Alberta, Canada	r 25 (4.1)	r 20 (4.0)	r 25 (4.1)	r 30 (4.5)	r 21 (3.1)
Ontario, Canada	r 12 (2.6)	r 10 (2.4)	r 16 (3.0)	r 11 (2.4)	r 7 (1.9)
Quebec, Canada	23 (3.9)	23 (4.1)	12 (2.1)	16 (3.6)	13 (3.3)
Abu Dhabi, UAE	48 (4.1)	63 (4.4)	57 (3.8)	63 (4.4)	54 (4.6)
Dubai, UAE	r 48 (2.5)	r 47 (4.0)	r 53 (2.4)	r 56 (2.3)	r 51 (3.1)
Florida, US	s 54 (6.0)	s 33 (5.2)	s 56 (4.9)	s 43 (5.9)	s 30 (5.0)
North Carolina, US	24 (5.6)	25 (5.0)	r 27 (5.1)	r 31 (6.5)	14 (3.6)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 7.8: Teacher Participation in Professional Development in Science in the Past Two Years**

Reported by Teachers

Country	Percent of Students by Teacher's Area of Professional Development					
	Science Content	Science Pedagogy / Instruction	Science Curriculum	Integrating Information Technology into Science	Improving Students' Critical Thinking or Inquiry Skills	Science Assessment
Armenia	65 (2.1)	77 (2.0)	88 (1.5)	40 (2.6)	44 (2.9)	88 (1.4)
Australia	s 53 (3.4)	s 48 (4.1)	s 61 (3.4)	s 64 (3.5)	s 53 (3.4)	s 40 (3.9)
Bahrain	39 (2.7)	61 (2.8)	35 (3.2)	61 (3.0)	56 (3.0)	53 (3.4)
Chile	49 (4.1)	31 (3.7)	37 (4.1)	47 (4.1)	34 (3.9)	24 (3.5)
Chinese Taipei	78 (3.3)	66 (3.8)	68 (3.6)	69 (3.6)	36 (4.1)	40 (4.3)
England	r 57 (3.4)	r 75 (3.1)	r 66 (2.8)	36 (3.0)	r 39 (2.7)	55 (3.1)
Finland	25 (1.9)	23 (2.3)	6 (1.1)	29 (2.5)	6 (1.0)	6 (1.2)
Georgia	21 (2.1)	33 (2.6)	35 (2.5)	42 (2.5)	42 (2.6)	40 (2.3)
Ghana	63 (4.0)	53 (4.1)	54 (3.9)	32 (3.9)	53 (4.4)	70 (3.9)
Hong Kong SAR	72 (4.3)	64 (4.8)	61 (4.2)	40 (5.3)	47 (4.7)	51 (4.2)
Hungary	31 (2.3)	51 (2.5)	14 (1.7)	39 (2.1)	16 (1.9)	16 (1.7)
Indonesia	75 (3.8)	50 (4.1)	67 (4.2)	45 (4.2)	63 (4.0)	72 (3.7)
Iran, Islamic Rep. of	62 (3.2)	65 (3.1)	47 (3.0)	34 (3.4)	33 (3.2)	43 (3.0)
Israel	75 (3.5)	76 (3.3)	76 (3.5)	52 (4.8)	55 (3.8)	43 (3.7)
Italy	22 (3.2)	35 (4.0)	19 (3.1)	28 (3.6)	13 (2.4)	16 (3.1)
Japan	78 (3.2)	73 (3.3)	50 (4.6)	34 (4.2)	20 (3.6)	33 (3.7)
Jordan	25 (3.6)	42 (4.5)	25 (3.3)	32 (3.6)	50 (3.9)	33 (3.3)
Kazakhstan	76 (1.9)	83 (1.8)	73 (2.1)	90 (1.2)	66 (2.6)	65 (2.8)
Korea, Rep. of	65 (4.0)	69 (3.6)	59 (3.8)	30 (3.0)	45 (4.2)	44 (4.0)
Lebanon	56 (4.1)	56 (4.1)	41 (4.0)	61 (3.6)	60 (3.1)	60 (3.2)
Lithuania	69 (2.2)	51 (2.0)	82 (1.7)	64 (2.3)	36 (2.0)	59 (2.1)
Macedonia, Rep. of	89 (1.4)	r 64 (2.2)	88 (1.4)	90 (1.3)	65 (2.4)	88 (1.3)
Malaysia	44 (3.2)	39 (3.1)	43 (3.7)	44 (3.5)	38 (3.3)	48 (3.7)
Morocco	49 (2.7)	64 (2.2)	56 (2.4)	50 (2.3)	17 (1.8)	47 (2.7)
New Zealand	64 (3.3)	65 (4.3)	78 (3.9)	53 (3.6)	53 (3.4)	45 (3.6)
Norway	19 (2.9)	18 (3.1)	13 (2.6)	6 (2.1)	10 (2.6)	25 (3.9)
Oman	33 (3.1)	50 (2.9)	27 (2.7)	31 (2.5)	37 (2.9)	41 (3.0)
Palestinian Nat'l Auth.	39 (3.8)	39 (4.4)	32 (3.8)	39 (3.7)	44 (4.0)	33 (3.8)
Qatar	57 (3.4)	67 (4.2)	57 (3.5)	63 (4.3)	69 (3.6)	60 (4.2)
Romania	60 (2.7)	58 (2.7)	38 (2.9)	54 (2.4)	39 (2.6)	50 (2.5)
Russian Federation	67 (2.0)	74 (1.9)	72 (2.1)	74 (1.9)	47 (2.4)	53 (2.2)
Saudi Arabia	56 (3.6)	65 (4.0)	60 (4.3)	41 (3.8)	38 (3.6)	35 (3.6)
Singapore	71 (2.2)	88 (1.6)	67 (2.7)	70 (2.5)	74 (2.1)	65 (2.4)
Slovenia	81 (1.6)	74 (1.9)	70 (1.9)	74 (2.3)	28 (2.3)	47 (2.6)
Sweden	r 30 (3.1)	r 24 (2.8)	r 47 (3.4)	r 12 (2.4)	r 13 (2.2)	r 33 (3.6)
Syrian Arab Republic	r 25 (3.6)	r 42 (3.4)	r 36 (3.6)	r 33 (3.9)	r 56 (4.2)	r 45 (3.9)
Thailand	80 (3.9)	78 (3.0)	84 (3.1)	65 (3.2)	63 (3.8)	63 (3.8)
Tunisia	66 (3.5)	78 (3.0)	60 (3.8)	59 (3.7)	36 (3.5)	63 (3.7)
Turkey	36 (3.4)	40 (3.6)	37 (3.1)	35 (3.5)	38 (3.3)	26 (3.0)
Ukraine	75 (2.6)	80 (2.3)	78 (2.4)	79 (2.6)	66 (2.8)	76 (2.6)
United Arab Emirates	48 (2.7)	60 (2.3)	54 (2.4)	52 (2.2)	59 (2.2)	49 (2.2)
United States	r 75 (2.2)	r 67 (2.0)	r 73 (2.5)	r 70 (2.3)	s 70 (2.3)	s 57 (2.7)
International Avg.	55 (0.5)	58 (0.5)	53 (0.5)	49 (0.5)	43 (0.5)	48 (0.5)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.  
 An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.  
 An "x" indicates data are available for less than 50% of students.

**Exhibit 7.8: Teacher Participation in Professional Development in Science in the Past Two Years (Continued)**

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent of Students by Teacher's Area of Professional Development					
	Science Content	Science Pedagogy / Instruction	Science Curriculum	Integrating Information Technology into Science	Improving Students' Critical Thinking or Inquiry Skills	Science Assessment
<b>Ninth Grade Participants</b>						
Botswana	24 (3.3)	34 (4.1)	30 (3.9)	20 (3.3)	29 (4.2)	29 (4.1)
Honduras	55 (4.4)	44 (4.5)	39 (4.3)	28 (4.4)	35 (5.0)	45 (4.8)
South Africa	64 (3.6)	37 (3.3)	67 (3.5)	39 (4.4)	48 (3.8)	63 (3.6)
<b>Benchmarking Participants</b>						
Alberta, Canada	72 (3.6)	57 (4.1)	46 (3.4)	72 (3.8)	59 (4.2)	48 (4.0)
Ontario, Canada	37 (4.4)	29 (3.9)	34 (3.8)	36 (3.9)	62 (4.2)	18 (3.3)
Quebec, Canada	50 (4.5)	49 (4.2)	40 (3.8)	39 (3.9)	11 (2.5)	43 (3.6)
Abu Dhabi, UAE	r 48 (4.3)	r 62 (4.2)	r 53 (4.7)	r 49 (4.3)	r 56 (3.4)	r 45 (4.4)
Dubai, UAE	r 53 (4.6)	r 54 (4.7)	r 60 (3.3)	r 64 (2.7)	r 64 (4.7)	r 64 (3.3)
Alabama, US	r 77 (5.0)	r 69 (6.2)	r 70 (7.2)	r 80 (6.1)	r 71 (7.2)	r 45 (8.8)
California, US	s 66 (6.3)	s 63 (5.9)	s 61 (6.2)	s 59 (5.9)	s 64 (5.0)	s 43 (6.6)
Colorado, US	r 77 (4.5)	r 65 (5.3)	r 77 (3.7)	r 69 (4.4)	r 67 (6.9)	r 46 (5.4)
Connecticut, US	r 70 (4.3)	r 63 (6.3)	r 77 (4.8)	r 69 (6.2)	r 76 (5.4)	r 65 (5.3)
Florida, US	x x	x x	x x	x x	x x	x x
Indiana, US	r 61 (6.4)	r 61 (6.9)	r 79 (4.7)	r 65 (5.8)	r 63 (5.5)	r 56 (6.2)
Massachusetts, US	r 75 (6.9)	r 73 (6.1)	r 88 (5.0)	r 68 (6.4)	r 61 (4.6)	r 53 (8.1)
Minnesota, US	r 75 (6.6)	r 70 (5.6)	r 79 (5.4)	r 67 (6.5)	r 64 (7.1)	r 57 (5.8)
North Carolina, US	s 88 (5.6)	s 74 (6.9)	s 87 (5.8)	s 84 (4.0)	s 81 (6.2)	s 59 (7.2)

### *Teachers' Preparation to Teach the TIMSS Science Topics*

Although a sound knowledge of science would seem to be a prerequisite for effective science teaching, evidence directly linking teacher preparation in science to the achievement of their students is scarce. A meta-analysis of the effects of teachers' subject matter preparation on their students' achievement in mathematics and science found some studies showing a positive effect, but in general results were mixed (Wilson, Floden, & Ferrini-Mundi, 2002).

TIMSS 2011 gathered information from the teachers of students taking the assessment about whether they felt very well prepared, somewhat prepared, or not well prepared to teach the science content topics assessed by TIMSS. Exhibit 7.9 presents reports of teachers about their level of preparation to teach the science topics in the fourth grade assessment. The 20 science topics are shown on the second page of the exhibit, grouped by content domain (life science, physical science, and earth science). The exhibit presents for each participant the percentage of students taught by teachers who felt "very well" prepared to teach the TIMSS topics. The results are averaged across all 20 topics for a perspective on science overall, as well as separately by content domain: six topics in life science, eight topics in physical science, and six topics in earth science. On average across the fourth grade countries, 62 percent of students were taught by teachers who felt very well prepared to teach the TIMSS science topics. Across the content domains, a larger percentage of students had teachers who felt very well prepared to teach the life science topics (70%) than the physical science topics (62%) and the earth science topics (53%). However, these results varied considerably across countries; for example, in several countries larger percentages of students were taught by teachers who felt very well prepared to teach the physical science topics than the topics in the other two domains.

Exhibit 7.10 presents reports of teachers about their level of preparation to teach the science topics in the four content domains covered by the eighth grade assessment. The 20 topics are shown on the second page of the exhibit, grouped by content domain (biology, chemistry, physics, and earth science). Compared to the fourth grade, a larger percentage of eighth grade students (72%) were taught by teachers who felt very well prepared to teach the TIMSS science topics. Across the content domains, most students had teachers who felt very well prepared to teach biology topics (77%), chemistry topics (82%), and physics topics (78%); however, fewer than half of the students (47%) had teachers who felt well prepared to teach the earth science topics. While the results varied across countries, this general pattern was observed in many of the eighth grade countries, ninth grade countries, and benchmarking participants.

### *Teachers' Confidence in Teaching Science*

Teachers with a strong sense of personal ability to organize and execute their teaching are more open to new ideas and less likely to experience emotional burnout. Research has shown that teachers' self-confidence in their teaching skills is not only associated with their professional behavior, but also with students' performance and motivation (Bandura, 1997; Henson, 2002).

To investigate teachers' confidence in teaching science, teachers of students taking the fourth and eighth grade TIMSS assessments were asked to indicate how confident they feel about doing each of the following:

- ◆ Answer students' questions about science;
- ◆ Explain science principles or concepts by doing science experiments;
- ◆ Provide challenging tasks for capable students;
- ◆ Adapt their teaching to engage students' interest; and
- ◆ Help students appreciate the value of learning science.

Reported by Teachers

Country	Percent of Students Whose Teachers Feel “Very Well” Prepared to Teach TIMSS Science Topics			
	Overall Science (20 Topics)	Life Science (6 Topics)	Physical Science (8 Topics)	Earth Science (6 Topics)
Armenia	s 61 (2.5)	s 66 (3.1)	s 55 (3.9)	s 66 (3.1)
Australia	r 51 (3.2)	r 60 (4.1)	r 47 (3.7)	r 49 (3.5)
Austria	--	--	--	--
Azerbaijan	60 (2.4)	64 (2.5)	58 (2.9)	60 (2.8)
Bahrain	82 (2.0)	85 (2.5)	89 (2.3)	70 (3.1)
Belgium (Flemish)	49 (2.5)	62 (2.9)	47 (3.7)	40 (2.2)
Chile	r 74 (2.4)	r 87 (2.1)	r 62 (3.5)	r 77 (3.0)
Chinese Taipei	63 (2.0)	69 (2.7)	79 (2.3)	37 (2.7)
Croatia	67 (2.0)	86 (1.9)	66 (3.2)	50 (1.7)
Czech Republic	62 (2.5)	79 (2.5)	56 (3.5)	55 (2.5)
Denmark	r 58 (1.9)	s 68 (2.7)	s 45 (3.0)	r 67 (2.4)
England	69 (2.4)	71 (3.1)	77 (2.9)	57 (2.9)
Finland	51 (1.9)	63 (2.3)	41 (2.4)	51 (2.4)
Georgia	69 (2.4)	82 (2.3)	60 (3.6)	69 (2.8)
Germany	43 (2.0)	55 (2.8)	36 (2.6)	40 (2.0)
Hong Kong SAR	49 (2.7)	61 (3.7)	49 (3.5)	39 (2.9)
Hungary	58 (2.2)	71 (2.5)	56 (2.9)	49 (2.4)
Iran, Islamic Rep. of	68 (2.0)	68 (2.9)	78 (2.1)	53 (2.4)
Ireland	63 (2.5)	65 (2.8)	60 (2.9)	63 (2.7)
Italy	31 (2.3)	38 (2.6)	26 (2.5)	32 (2.6)
Japan	29 (2.5)	21 (2.7)	44 (3.6)	18 (2.0)
Kazakhstan	--	--	--	--
Korea, Rep. of	56 (3.0)	61 (3.8)	63 (3.5)	42 (3.7)
Kuwait	91 (1.2)	93 (1.3)	93 (1.3)	86 (1.9)
Lithuania	73 (1.7)	85 (1.6)	60 (2.5)	78 (2.0)
Malta	57 (0.1)	63 (0.1)	61 (0.1)	46 (0.1)
Morocco	r 51 (3.7)	r 65 (4.0)	r 55 (4.6)	r 33 (4.1)
Netherlands	s 45 (3.0)	s 58 (3.9)	s 37 (4.0)	s 43 (2.9)
New Zealand	42 (2.2)	47 (2.7)	35 (2.8)	47 (2.5)
Northern Ireland	r 54 (3.4)	r 62 (3.9)	r 56 (3.6)	r 44 (3.7)
Norway	37 (2.9)	42 (3.6)	28 (3.4)	42 (3.0)
Oman	73 (1.3)	91 (1.2)	86 (1.6)	40 (2.1)
Poland	82 (1.3)	94 (1.1)	80 (2.5)	74 (1.4)
Portugal	76 (2.1)	87 (2.1)	64 (3.9)	82 (1.5)
Qatar	79 (2.1)	88 (2.1)	86 (2.1)	63 (3.9)
Romania	84 (1.7)	87 (1.9)	84 (2.0)	80 (2.0)
Russian Federation	--	--	--	--
Saudi Arabia	84 (1.6)	91 (1.4)	88 (2.0)	70 (2.6)
Serbia	68 (2.6)	78 (2.6)	69 (3.2)	57 (2.7)
Singapore	58 (1.5)	67 (2.1)	75 (1.8)	25 (2.0)
Slovak Republic	75 (1.5)	88 (1.5)	68 (1.9)	71 (1.6)
Slovenia	60 (1.8)	72 (2.2)	60 (2.2)	48 (2.1)
Spain	69 (2.5)	77 (3.0)	62 (3.3)	70 (2.6)
Sweden	r 50 (3.6)	r 55 (4.3)	r 45 (4.2)	r 52 (3.8)
Thailand	38 (3.0)	45 (3.3)	40 (3.6)	28 (3.0)
Tunisia	58 (1.7)	76 (2.6)	74 (2.6)	20 (2.1)
Turkey	77 (2.0)	79 (2.6)	82 (2.0)	67 (2.3)
United Arab Emirates	82 (0.8)	91 (1.1)	91 (0.9)	63 (1.3)
United States	r 60 (1.9)	r 64 (2.2)	r 60 (2.2)	r 56 (2.0)
Yemen	67 (2.1)	76 (2.7)	78 (2.7)	43 (2.5)
International Avg.	62 (0.3)	70 (0.4)	62 (0.4)	53 (0.4)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

A dash (–) indicates comparable data not available.

An “r” indicates data are available for at least 70% but less than 85% of the students. An “s” indicates data are available for at least 50% but less than 70% of the students.

SOURCE: IEA’s Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 7.9: Teachers Feel “Very Well” Prepared to Teach TIMSS Science Topics (Continued)**

Country	Percent of Students Whose Teachers Feel “Very Well” Prepared to Teach TIMSS Science Topics			
	Overall Science (20 Topics)	Life Science (6 Topics)	Physical Science (8 Topics)	Earth Science (6 Topics)
<b>Sixth Grade Participants</b>				
Botswana	80 (1.8)	r 91 (1.4)	r 83 (2.1)	r 66 (2.8)
Honduras	63 (2.8)	r 81 (2.6)	r 48 (3.8)	r 66 (3.1)
Yemen	71 (1.9)	r 84 (2.3)	r 83 (2.3)	r 44 (3.4)
<b>Benchmarking Participants</b>				
Alberta, Canada	r 66 (2.4)	r 75 (3.4)	r 74 (2.8)	r 46 (3.2)
Ontario, Canada	r 55 (2.6)	r 71 (3.2)	r 55 (3.1)	r 39 (3.0)
Quebec, Canada	r 41 (2.8)	r 45 (3.4)	r 35 (3.5)	r 44 (3.2)
Abu Dhabi, UAE	r 83 (1.5)	r 90 (2.2)	r 92 (1.4)	r 63 (2.6)
Dubai, UAE	r 81 (0.8)	r 92 (0.9)	r 88 (0.9)	r 59 (2.0)
Florida, US	s 69 (3.9)	s 68 (4.3)	s 68 (4.3)	s 72 (4.2)
North Carolina, US	r 42 (4.3)	r 52 (5.3)	r 45 (5.3)	r 27 (4.2)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**TIMSS 2011 Science Topics**

**A. Life Science**

- 1) Major body structures and their functions in humans and other organisms (plants and animals)
- 2) Life cycles and reproduction in plants and animals
- 3) Physical features, behavior, and survival of organisms living in different environments
- 4) Relationships in a given community (e.g., simple food chains, predator-prey relationships)
- 5) Changes in environments (effects of human activity, pollution and its prevention)
- 6) Human health (e.g., transmission/prevention of communicable diseases, signs of health/illness, diet, exercise)

**B. Physical Science**

- 1) States of matter (solids, liquids, gases) and differences in their physical properties (shape, volume), including changes in state of matter by heating and cooling
- 2) Classification of objects/materials based on physical properties (e.g., weight/mass, volume, magnetic attraction)
- 3) Forming and separating mixtures
- 4) Familiar changes in materials (e.g., decaying, burning, rusting, cooking)
- 5) Common energy sources/forms and their practical uses (e.g., the Sun, electricity, water, wind)
- 6) Light (e.g., sources, behavior)
- 7) Electrical circuits and properties of magnets
- 8) Forces that cause objects to move (e.g., gravity, push/pull forces)

**C. Earth Science**

- 1) Water on Earth (location, types, and movement) and air (composition, proof of its existence, uses)
- 2) Common features of Earth's landscape (e.g., mountains, plains, rivers, deserts) and relationship to human use (e.g., farming, irrigation, land development)
- 3) Weather conditions from day to day or over the seasons
- 4) Fossils of animals and plants (age, location, formation)
- 5) Earth's solar system (planets, Sun, moon)
- 6) Day, night, and shadows due to Earth's rotation and its relationship to the Sun

Reported by Teachers

Country	Percent of Students Whose Teachers Feel “Very Well” Prepared to Teach TIMSS Science Topics				
	Overall Science (20 Topics)	Biology (7 Topics)	Chemistry (4 Topics)	Physics (5 Topics)	Earth Science (4 Topics)
Armenia	84 (1.1)	87 (1.5)	90 (1.9)	95 (1.6)	56 (3.6)
Australia	s 78 (1.6)	s 84 (1.9)	s 87 (2.0)	s 79 (2.1)	s 58 (3.1)
Bahrain	78 (1.5)	82 (2.2)	88 (2.0)	78 (2.2)	60 (2.5)
Chile	71 (2.1)	81 (2.3)	69 (3.5)	62 (3.0)	65 (3.2)
Chinese Taipei	62 (2.0)	--	86 (2.6)	82 (2.7)	14 (2.8)
England	r 84 (1.2)	r 89 (1.5)	r 91 (1.5)	r 84 (1.8)	r 70 (2.3)
Finland	81 (1.3)	84 (2.4)	86 (1.8)	86 (1.9)	62 (2.9)
Georgia	76 (2.0)	80 (2.6)	--	86 (2.8)	57 (3.4)
Ghana	81 (1.4)	88 (1.9)	90 (1.6)	86 (1.8)	51 (3.0)
Hong Kong SAR	59 (2.5)	64 (3.8)	77 (3.7)	69 (3.8)	18 (3.0)
Hungary	70 (1.6)	71 (3.0)	86 (2.5)	79 (2.9)	44 (2.8)
Indonesia	46 (2.7)	58 (3.3)	r 46 (5.3)	58 (3.9)	r 9 (2.3)
Iran, Islamic Rep. of	75 (1.7)	77 (2.0)	80 (2.1)	77 (2.1)	66 (2.3)
Israel	71 (1.2)	86 (1.6)	90 (1.7)	77 (2.4)	r 18 (2.7)
Italy	51 (2.1)	55 (2.7)	49 (3.1)	47 (2.8)	51 (3.0)
Japan	51 (2.6)	48 (3.4)	75 (3.2)	63 (3.6)	19 (2.7)
Jordan	77 (1.7)	79 (2.5)	84 (2.3)	78 (2.5)	67 (2.4)
Kazakhstan	--	--	--	--	--
Korea, Rep. of	60 (2.1)	62 (3.1)	75 (3.0)	68 (2.8)	33 (2.4)
Lebanon	r 87 (1.5)	83 (2.4)	94 (1.6)	88 (2.1)	--
Lithuania	89 (0.8)	92 (1.6)	97 (0.9)	96 (1.0)	66 (2.8)
Macedonia, Rep. of	r 89 (0.9)	r 94 (1.1)	r 96 (1.5)	94 (1.3)	r 68 (3.2)
Malaysia	68 (1.7)	79 (2.3)	84 (2.1)	78 (2.7)	21 (1.9)
Morocco	75 (1.5)	82 (1.9)	r 88 (2.0)	81 (2.4)	r 45 (2.6)
New Zealand	80 (1.3)	83 (2.0)	92 (1.5)	85 (2.1)	56 (2.7)
Norway	54 (2.5)	63 (3.4)	48 (3.5)	49 (3.8)	51 (3.4)
Oman	74 (1.1)	79 (1.5)	88 (1.9)	81 (2.0)	45 (2.5)
Palestinian Nat'l Auth.	81 (1.6)	87 (2.3)	91 (2.0)	86 (2.2)	56 (3.2)
Qatar	85 (1.0)	90 (1.2)	94 (1.3)	91 (2.2)	62 (2.7)
Romania	85 (1.3)	88 (1.9)	92 (2.2)	95 (1.7)	62 (3.6)
Russian Federation	--	--	--	--	--
Saudi Arabia	81 (1.7)	90 (1.7)	86 (2.3)	77 (3.0)	63 (3.2)
Singapore	57 (1.4)	60 (2.8)	80 (2.2)	75 (2.0)	6 (1.1)
Slovenia	80 (1.2)	77 (2.4)	91 (1.7)	87 (1.7)	63 (3.1)
Sweden	r 67 (1.7)	s 81 (2.3)	s 81 (2.5)	s 78 (2.9)	s 17 (3.4)
Syrian Arab Republic	r 68 (2.2)	r 75 (3.0)	r 79 (2.9)	r 75 (3.0)	r 36 (4.2)
Thailand	53 (2.5)	54 (3.3)	57 (3.0)	49 (3.4)	51 (3.3)
Tunisia	61 (2.0)	80 (2.5)	--	--	26 (2.6)
Turkey	77 (1.7)	80 (2.1)	88 (1.9)	82 (2.0)	56 (2.2)
Ukraine	56 (2.1)	52 (3.3)	68 (3.3)	66 (3.7)	39 (3.2)
United Arab Emirates	81 (1.0)	r 86 (1.3)	r 90 (1.4)	r 87 (1.4)	r 55 (1.9)
United States	r 76 (1.3)	s 83 (1.6)	s 80 (2.0)	s 77 (1.7)	r 57 (2.7)
International Avg.	72 (0.3)	77 (0.4)	82 (0.4)	78 (0.4)	47 (0.5)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

A dash (–) indicates comparable data not available.

An “r” indicates data are available for at least 70% but less than 85% of the students. An “s” indicates data are available for at least 50% but less than 70% of the students.

An “x” indicates data are available for less than 50% of students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percent of Students Whose Teachers Feel “Very Well” Prepared to Teach TIMSS Science Topics				
	Overall Science (20 Topics)	Biology (7 Topics)	Chemistry (4 Topics)	Physics (5 Topics)	Earth Science (4 Topics)
<b>Ninth Grade Participants</b>					
Botswana	76 (1.7)	87 (1.9)	88 (2.4)	83 (2.5)	37 (3.2)
Honduras	75 (1.7)	85 (2.5)	81 (2.1)	68 (2.6)	60 (3.5)
South Africa	76 (1.5)	84 (2.0)	79 (2.0)	76 (2.3)	57 (3.1)
<b>Benchmarking Participants</b>					
Alberta, Canada	72 (2.5)	80 (2.7)	78 (2.9)	75 (2.9)	49 (3.6)
Ontario, Canada	61 (2.5)	72 (3.0)	50 (4.1)	63 (3.3)	48 (3.0)
Quebec, Canada	71 (2.2)	74 (2.9)	77 (2.6)	70 (2.9)	63 (3.7)
Abu Dhabi, UAE	r 83 (1.6)	r 88 (2.1)	r 92 (2.3)	r 90 (2.3)	r 55 (3.9)
Dubai, UAE	r 83 (1.1)	s 88 (1.9)	s 93 (1.4)	s 90 (1.2)	s 55 (3.1)
Alabama, US	r 74 (4.0)	s 88 (5.3)	r 87 (5.0)	r 82 (4.1)	r 24 (5.9)
California, US	s 67 (2.2)	x x	s 84 (3.1)	s 81 (2.8)	s 34 (4.2)
Colorado, US	r 78 (2.3)	r 84 (4.6)	r 91 (2.2)	r 85 (2.6)	r 47 (6.4)
Connecticut, US	r 76 (3.1)	r 85 (4.4)	r 80 (4.5)	r 76 (4.6)	r 57 (5.2)
Florida, US	x x	x x	x x	x x	x x
Indiana, US	r 81 (1.7)	r 86 (3.3)	r 86 (3.2)	r 84 (2.0)	r 62 (5.1)
Massachusetts, US	r 71 (2.7)	s 74 (5.2)	r 81 (4.3)	s 76 (3.3)	r 50 (5.6)
Minnesota, US	r 77 (4.4)	s 75 (7.6)	r 71 (5.7)	r 74 (5.2)	r 90 (3.5)
North Carolina, US	s 72 (4.0)	s 84 (4.2)	s 80 (4.7)	s 61 (6.6)	s 58 (6.8)

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011

TIMSS 2011 Science Topics	
<b>A. Biology</b>	
1)	Major organs and organ systems in humans and other organisms (structure/function, life processes that maintain stable bodily conditions)
2)	Cells and their functions, including respiration and photosynthesis as cellular processes
3)	Reproduction (sexual and asexual) and heredity (passing on of traits, inherited versus acquired/learned characteristics)
4)	Role of variation and adaptation in survival/extinction of species in a changing environment
5)	Interdependence of populations of organisms in an ecosystem (e.g., energy flow, food webs, competition, predation) and the impact of changes in the physical environment on populations (e.g., climate, water supply)
6)	Reasons for increase in world's human population (e.g., advances in medicine, sanitation), and the effects of population growth on the environment
7)	Human health (causes of infectious diseases, methods of infection, prevention, immunity) and the importance of diet and exercise in maintaining health
<b>B. Chemistry</b>	
1)	Classification, composition, and particulate structure of matter (elements, compounds, mixtures, molecules, atoms, protons, neutrons, electrons)
2)	Solutions (solvent, solute, concentration/dilution, effect of temperature on solubility)
3)	Properties and uses of common acids and bases
4)	Chemical change (transformation of reactants, evidence of chemical change, conservation of matter, common oxidation reactions - combustion, rusting, tarnishing)
<b>C. Physics</b>	
1)	Physical states and changes in matter (explanations of properties in terms of movement and distance between particles; phase change, thermal expansion, and changes in volume and/or pressure)
2)	Energy forms, transformations, heat, and temperature
3)	Basic properties/behaviors of light (reflection, refraction, light and color, simple ray diagrams) and sound (transmission through media, loudness, pitch, amplitude, frequency, relative speed of light and sound)
4)	Electric circuits (flow of current; types of circuits - parallel/series; current/voltage relationship) and properties and uses of permanent magnets and electromagnets
5)	Forces and motion (types of forces, basic description of motion, effects of density and pressure)
<b>D. Earth Science</b>	
1)	Earth's structure and physical features (Earth's crust, mantle and core; composition and relative distribution of water, and composition of air)
2)	Earth's processes, cycles, and history (rock cycle; water cycle; weather patterns; major geological events; formation of fossils and fossil fuels)
3)	Earth's resources, their use, and conservation (e.g., renewable/nonrenewable resources, human use of land/soil, water resources)
4)	Earth in the solar system and the universe (phenomena on Earth - day/night, tides, phases of moon, eclipses, seasons; physical features of Earth compared to other bodies; the Sun as a star)

Exhibit 7.11 shows the fourth grade TIMSS assessment results for the Confidence in Teaching Science scale. Students were scored according to their teachers' responses, with **Very Confident** teachers being "very confident" in using three of the five instructional strategies and "somewhat confident" in using the other two, on average. All other teachers were considered to be **Somewhat Confident**. On average across countries, the majority of fourth grade students (59%) had teachers who were **Very Confident** in teaching science to the class; however, there was no significant difference between the average science achievement of these students (487) and that of the 41 percent of students whose teachers were only **Somewhat Confident** (485). There was considerable variation across countries, with the percentage of students having teachers who were **Very Confident** ranging from 14 to 95 percent.

Exhibit 7.12 provides further information about the components of the Confidence in Teaching Science scale by showing the percentage of students whose teachers reported feeling "very confident" in using each of the five instructional strategies. On average across the fourth grade countries, teachers were most often very confident about helping students appreciate the value of learning science (68% of students taught by such teachers), adapting their teaching to engage student interests (63%), and answering student questions about science (62%). Teachers were less often very confident about explaining science concepts or principles by doing science experiments (51% of students) and providing challenging tasks for capable students (43%).

Exhibit 7.13 shows results for the Confidence in Teaching Science scale for the eighth grade TIMSS assessment. On average across countries, a larger percentage of students had teachers who were **Very Confident** (73%) than at fourth grade, and unlike fourth grade, students who had teachers who were **Very Confident** had higher achievement (479) than did students who had teachers who were **Somewhat Confident** (467). Again, there was considerable variation among countries, with the percentage of students with **Very Confident** teachers ranging from 33 to 99 percent.

Exhibit 7.14 provides information about the components of the Confidence in Teaching Science scale for the eighth grade assessment. Patterns of teacher confidence differed from those at fourth grade—on average across countries, teachers were most often very confident about answering student questions about science (81% of students taught by such teachers), explaining science concepts or principles by doing science experiments (72%), and helping students appreciate the value of science (70%). Teachers were less often very confident about adapting their teaching to engage student interests (65% of students) and providing challenging tasks for capable students (57%).

## Exhibit 7.11: Confidence in Teaching Science

Reported by Teachers

Students were scored according to their teachers' responses to how confident they felt in using five instructional strategies on the *Confidence in Teaching Science* scale. Students with **Very Confident** teachers had a score on the scale of at least 9.9, which corresponds to their teachers being "very confident" in using three of the five instructional strategies and "somewhat confident" in using the other two, on average. All other students had **Somewhat Confident** teachers.

Country	Very Confident		Somewhat Confident		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Romania	95 (1.4)	502 (6.2)	5 (1.4)	543 (11.2)	11.9 (0.07)
Russian Federation	92 (2.0)	552 (3.4)	8 (2.0)	547 (12.2)	11.5 (0.07)
Kazakhstan	91 (2.4)	495 (5.3)	9 (2.4)	493 (14.2)	11.6 (0.11)
United Arab Emirates	90 (1.3)	430 (2.7)	10 (1.3)	426 (13.0)	11.4 (0.06)
Chile	r 87 (2.9)	483 (3.4)	13 (2.9)	472 (10.0)	11.3 (0.13)
Qatar	84 (2.5)	397 (5.3)	16 (2.5)	373 (13.5)	11.1 (0.10)
Azerbaijan	84 (2.8)	442 (6.8)	16 (2.8)	425 (11.0)	10.9 (0.11)
Georgia	84 (2.8)	454 (4.2)	16 (2.8)	462 (6.7)	11.0 (0.10)
Croatia	82 (2.6)	516 (2.4)	18 (2.6)	517 (3.9)	11.1 (0.11)
Kuwait	81 (3.4)	347 (5.3)	19 (3.4)	343 (10.3)	10.9 (0.13)
Oman	78 (2.7)	379 (4.0)	22 (2.7)	373 (11.0)	10.7 (0.10)
Poland	78 (3.0)	506 (2.9)	22 (3.0)	502 (4.6)	10.7 (0.10)
Serbia	77 (3.4)	516 (3.8)	23 (3.4)	516 (4.9)	10.9 (0.13)
Bahrain	76 (3.2)	452 (4.1)	24 (3.2)	439 (8.6)	10.7 (0.15)
Iran, Islamic Rep. of	75 (3.5)	454 (4.5)	25 (3.5)	448 (8.4)	10.6 (0.11)
Lithuania	73 (2.9)	515 (2.8)	27 (2.9)	514 (5.3)	10.6 (0.11)
Saudi Arabia	73 (3.5)	436 (5.5)	27 (3.5)	411 (11.4)	10.5 (0.13)
Portugal	71 (4.7)	524 (5.5)	29 (4.7)	517 (4.6)	10.6 (0.18)
Hungary	69 (3.7)	530 (4.5)	31 (3.7)	541 (7.3)	10.4 (0.14)
Turkey	66 (3.1)	466 (5.6)	34 (3.1)	455 (8.4)	10.1 (0.11)
Armenia	r 66 (3.7)	417 (4.9)	34 (3.7)	414 (7.0)	10.3 (0.11)
Spain	65 (4.0)	508 (3.6)	35 (4.0)	502 (4.6)	10.2 (0.15)
Yemen	64 (4.5)	204 (9.1)	36 (4.5)	213 (9.9)	10.2 (0.14)
Tunisia	64 (4.0)	344 (6.8)	36 (4.0)	350 (8.3)	10.1 (0.12)
England	63 (4.6)	532 (5.0)	37 (4.6)	521 (6.0)	10.1 (0.20)
Slovak Republic	63 (2.9)	532 (4.3)	37 (2.9)	530 (5.4)	10.1 (0.10)
Chinese Taipei	58 (3.7)	555 (2.9)	42 (3.7)	546 (3.8)	10.1 (0.15)
United States	r 57 (2.2)	545 (3.0)	43 (2.2)	543 (3.1)	9.9 (0.11)
Singapore	56 (2.6)	580 (4.7)	44 (2.6)	587 (5.6)	9.9 (0.11)
Malta	54 (0.1)	447 (2.5)	46 (0.1)	445 (1.8)	9.8 (0.00)
Norway	50 (5.1)	492 (3.2)	50 (5.1)	494 (3.6)	9.4 (0.16)
Slovenia	49 (3.7)	521 (3.5)	51 (3.7)	519 (3.6)	9.6 (0.14)
Denmark	s 47 (4.2)	533 (3.6)	53 (4.2)	527 (5.1)	9.5 (0.16)
Sweden	r 45 (4.6)	534 (4.4)	55 (4.6)	535 (3.7)	9.4 (0.19)
Morocco	r 44 (4.8)	272 (8.6)	56 (4.8)	254 (6.0)	9.5 (0.20)
Australia	r 43 (3.9)	524 (4.6)	57 (3.9)	516 (5.2)	9.3 (0.17)
Korea, Rep. of	42 (4.0)	588 (2.8)	58 (4.0)	586 (2.7)	9.4 (0.17)
Ireland	41 (4.2)	526 (4.7)	59 (4.2)	510 (4.4)	9.2 (0.18)
Northern Ireland	r 40 (4.1)	515 (4.9)	60 (4.1)	519 (3.9)	9.1 (0.21)
Belgium (Flemish)	39 (3.3)	507 (3.4)	61 (3.3)	510 (2.9)	9.3 (0.13)
Netherlands	r 39 (4.1)	531 (4.3)	61 (4.1)	529 (3.0)	8.9 (0.14)
Thailand	39 (4.2)	475 (8.1)	61 (4.2)	471 (7.7)	9.0 (0.17)
Czech Republic	34 (3.3)	535 (3.8)	66 (3.3)	537 (3.0)	8.9 (0.13)
Finland	32 (3.0)	574 (4.0)	68 (3.0)	570 (2.7)	9.0 (0.12)
Austria	30 (3.0)	530 (4.3)	70 (3.0)	532 (3.4)	8.7 (0.11)
Germany	27 (3.3)	523 (5.4)	73 (3.3)	532 (2.9)	8.6 (0.12)
Italy	27 (3.7)	527 (5.4)	73 (3.7)	526 (3.3)	8.5 (0.14)
Hong Kong SAR	26 (4.0)	523 (9.0)	74 (4.0)	540 (4.8)	8.5 (0.17)
New Zealand	26 (2.4)	503 (5.6)	74 (2.4)	496 (2.6)	8.4 (0.11)
Japan	14 (2.9)	560 (5.0)	86 (2.9)	558 (2.0)	7.8 (0.13)
International Avg.	59 (0.5)	487 (0.7)	41 (0.5)	485 (1.0)	

Centerpoint of scale set at 10.

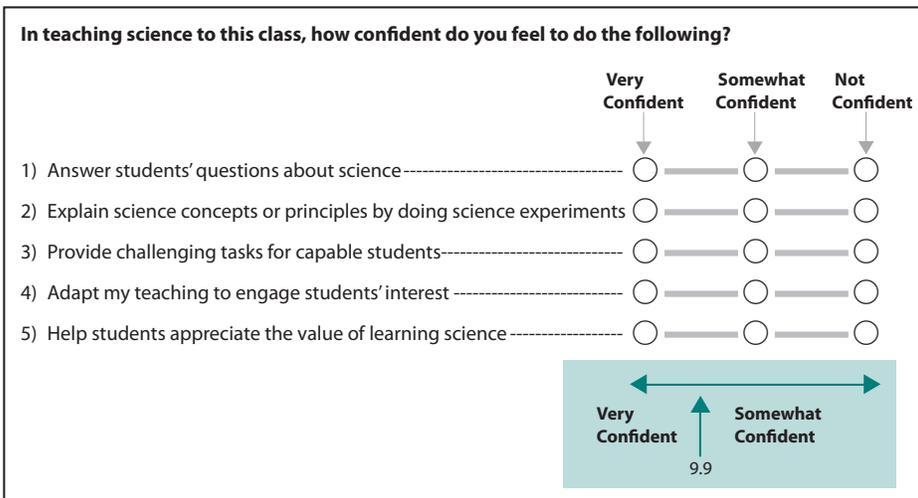
() Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

**Exhibit 7.11: Confidence in Teaching Science (Continued)**

Country	Very Confident		Somewhat Confident		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Sixth Grade Participants</b>					
Honduras	86 (3.0)	432 (6.9)	14 (3.0)	424 (14.4)	11.2 (0.14)
Botswana	81 (3.3)	379 (6.4)	19 (3.3)	351 (16.4)	11.0 (0.14)
Yemen	64 (4.4)	349 (9.5)	36 (4.4)	334 (9.8)	10.1 (0.15)
<b>Benchmarking Participants</b>					
Abu Dhabi, UAE	90 (2.7)	415 (5.0)	10 (2.7)	403 (29.1)	11.5 (0.13)
Dubai, UAE	90 (1.3)	461 (3.7)	10 (1.3)	497 (9.0)	11.6 (0.06)
Alberta, Canada	66 (4.2)	545 (3.5)	34 (4.2)	535 (5.8)	10.2 (0.20)
Florida, US	53 (5.5)	542 (5.8)	47 (5.5)	543 (6.3)	9.8 (0.25)
Ontario, Canada	49 (3.8)	529 (4.0)	51 (3.8)	524 (4.2)	9.5 (0.16)
North Carolina, US	42 (5.8)	541 (5.9)	58 (5.8)	534 (6.8)	9.3 (0.24)
Quebec, Canada	28 (4.1)	515 (4.8)	72 (4.1)	517 (3.0)	8.4 (0.15)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



**Exhibit 7.12: Components of Confidence in Teaching Science Scale**

Reported by Teachers

Country	Percent of Students Whose Teachers Feel Very Confident to									
	Answer Student Questions About Science	Explain Science Concepts or Principles by Doing Science Experiments	Provide Challenging Tasks for Capable Students	Adapt Teaching to Engage Student Interests	Help Students Appreciate the Value of Learning Science					
Armenia	r	77 (3.4)	r	47 (4.1)	r	36 (3.7)	r	71 (3.4)	r	84 (3.1)
Australia	r	42 (4.1)	r	40 (4.0)	r	38 (3.9)	r	53 (3.8)	r	48 (4.0)
Austria		38 (3.1)		17 (2.9)		17 (2.5)		54 (3.0)		45 (3.2)
Azerbaijan		91 (2.2)		75 (3.2)		68 (3.4)		56 (3.7)		89 (2.5)
Bahrain		82 (2.6)		69 (4.8)		51 (5.3)		71 (4.0)		78 (3.3)
Belgium (Flemish)		45 (4.1)		31 (3.6)		21 (3.1)		60 (3.3)		68 (3.3)
Chile	r	90 (2.5)	r	68 (3.6)	r	76 (3.7)	r	80 (3.6)	r	91 (2.4)
Chinese Taipei		58 (4.1)		73 (3.6)		42 (3.9)		65 (3.4)		57 (3.9)
Croatia		83 (2.5)		65 (3.3)		68 (3.2)		83 (2.5)		92 (1.9)
Czech Republic		29 (3.5)		25 (3.1)		23 (3.2)		53 (3.9)		58 (4.0)
Denmark	s	52 (4.1)	s	46 (4.5)	s	32 (4.4)	s	60 (4.1)	s	54 (4.1)
England		62 (4.6)		59 (5.0)	r	41 (5.0)		70 (4.3)		65 (4.3)
Finland		43 (3.2)		29 (3.2)		19 (2.8)		39 (3.3)		65 (3.4)
Georgia		84 (2.9)		62 (3.3)		57 (3.7)		82 (3.2)		94 (1.5)
Germany		32 (3.2)		20 (2.9)		18 (2.6)		49 (3.5)		40 (3.5)
Hong Kong SAR		36 (4.6)		29 (4.3)		20 (3.3)		36 (4.2)		26 (4.0)
Hungary		60 (3.1)		52 (3.8)		59 (3.8)		77 (3.2)		80 (3.2)
Iran, Islamic Rep. of		77 (3.7)		77 (2.7)		44 (3.7)		67 (3.7)		82 (2.7)
Ireland		39 (3.8)		44 (4.0)		28 (3.5)		44 (3.9)		54 (4.0)
Italy		27 (3.5)		21 (3.1)		19 (3.1)		40 (3.7)		48 (3.9)
Japan		19 (3.5)		20 (3.4)		8 (2.3)		16 (3.0)		22 (3.4)
Kazakhstan		91 (2.7)		84 (3.3)		83 (3.1)		81 (3.2)		91 (2.4)
Korea, Rep. of		45 (4.3)		51 (3.8)		27 (3.8)		52 (4.5)		54 (4.2)
Kuwait		80 (3.1)		79 (3.2)		56 (4.5)		77 (3.4)		78 (3.3)
Lithuania		70 (2.8)		54 (3.4)		61 (3.4)		78 (2.8)		86 (1.9)
Malta		53 (0.1)		48 (0.1)		43 (0.1)		58 (0.1)		66 (0.1)
Morocco	r	50 (4.9)	r	43 (5.0)	r	29 (4.4)	r	55 (4.6)	r	64 (4.5)
Netherlands	r	46 (4.3)	r	21 (3.4)	s	16 (3.2)	r	53 (4.2)	r	51 (4.7)
New Zealand		23 (2.3)		23 (2.3)		21 (2.2)		40 (3.1)		36 (3.1)
Northern Ireland	r	42 (4.4)	r	36 (4.3)	r	31 (4.4)	r	50 (4.4)	r	44 (4.6)
Norway		65 (4.9)		37 (4.4)		20 (3.2)		51 (4.8)		61 (4.8)
Oman		76 (2.3)		78 (2.8)		56 (3.2)		72 (3.0)		77 (3.0)
Poland		90 (2.1)		50 (4.0)		49 (3.5)		75 (3.3)		92 (2.1)
Portugal		71 (4.5)		52 (5.1)		52 (4.9)		83 (3.2)		85 (2.9)
Qatar		86 (2.4)		82 (2.6)		63 (3.5)		81 (2.8)		84 (2.8)
Romania		91 (1.7)		81 (2.8)		95 (1.7)		97 (1.1)		97 (1.1)
Russian Federation		91 (1.6)		84 (2.7)		78 (2.5)		78 (3.1)		96 (1.4)
Saudi Arabia		79 (3.3)		66 (4.0)		46 (4.1)		69 (3.3)		78 (4.1)
Serbia		80 (3.3)		60 (4.3)		59 (4.0)		81 (2.9)		88 (2.4)
Singapore		57 (2.3)		66 (2.6)		42 (2.8)		53 (2.5)		56 (2.7)
Slovak Republic		62 (3.2)		45 (2.7)		47 (3.1)		73 (3.0)		74 (3.0)
Slovenia		56 (3.5)		35 (3.7)		27 (3.1)		64 (3.8)		64 (3.5)
Spain		75 (3.5)		36 (4.6)		50 (4.3)		72 (3.7)		79 (3.7)
Sweden	r	57 (5.0)	r	41 (4.7)	r	25 (4.0)	r	51 (4.7)	r	55 (4.0)
Thailand		47 (4.9)		35 (3.4)		34 (4.1)		42 (4.4)		39 (4.2)
Tunisia		61 (3.9)		64 (3.2)		43 (4.0)		61 (4.2)		71 (3.9)
Turkey		69 (3.2)		44 (3.2)		46 (3.2)		75 (2.7)		68 (3.1)
United Arab Emirates		88 (1.2)		84 (1.6)		69 (2.1)		88 (1.5)		90 (1.4)
United States	r	54 (2.5)	r	52 (2.5)	r	39 (2.4)	r	63 (2.1)	r	67 (2.4)
Yemen		82 (3.4)		53 (4.7)		41 (4.5)		63 (4.1)		70 (4.0)
International Avg.		62 (0.5)		51 (0.5)		43 (0.5)		63 (0.5)		68 (0.5)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 7.12: Components of Confidence in Teaching Science Scale (Continued)**

Country	Percent of Students Whose Teachers Feel Very Confident to				
	Answer Student Questions About Science	Explain Science Concepts or Principles by Doing Science Experiments	Provide Challenging Tasks for Capable Students	Adapt Teaching to Engage Student Interests	Help Students Appreciate the Value of Learning Science
<b>Sixth Grade Participants</b>					
Botswana	84 (3.1)	67 (4.4)	64 (4.0)	79 (3.4)	87 (2.8)
Honduras	87 (2.8)	59 (4.8)	75 (3.9)	88 (3.3)	94 (2.1)
Yemen	81 (3.5)	46 (4.6)	44 (4.9)	59 (4.4)	69 (3.9)
<b>Benchmarking Participants</b>					
Alberta, Canada	r 60 (4.3)	r 69 (4.2)	r 44 (4.7)	r 69 (5.0)	r 67 (4.3)
Ontario, Canada	50 (4.0)	44 (3.9)	36 (3.5)	59 (3.8)	55 (3.5)
Quebec, Canada	22 (3.9)	20 (3.5)	28 (3.6)	37 (3.8)	39 (4.1)
Abu Dhabi, UAE	89 (2.5)	86 (3.0)	72 (3.5)	88 (2.9)	88 (3.0)
Dubai, UAE	r 89 (1.3)	r 86 (1.4)	r 78 (1.6)	r 87 (1.4)	r 90 (1.6)
Florida, US	s 54 (5.6)	s 48 (5.9)	s 42 (5.0)	s 62 (5.5)	s 62 (5.1)
North Carolina, US	45 (5.8)	42 (5.2)	29 (5.5)	54 (5.8)	53 (6.4)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

## Exhibit 7.13: Confidence in Teaching Science

Reported by Teachers

Students were scored according to their teachers' responses to how confident they felt in using five instructional strategies on the *Confidence in Teaching Science* scale. Students with **Very Confident** teachers had a score on the scale of at least 9.3, which corresponds to their teachers being "very confident" in using three of the five instructional strategies and "somewhat confident" in using the other two, on average. All other students had **Somewhat Confident** teachers.

Country	Very Confident		Somewhat Confident		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Kazakhstan	99 (0.4)	491 (4.3)	1 (0.4)	~ ~	11.7 (0.05)
Russian Federation	98 (0.5)	543 (3.2)	2 (0.5)	~ ~	11.5 (0.04)
Ukraine	98 (0.9)	502 (3.5)	2 (0.9)	~ ~	11.5 (0.06)
Macedonia, Rep. of	s 96 (0.8)	430 (6.3)	4 (0.8)	370 (21.7)	11.3 (0.06)
Ghana	95 (1.9)	307 (5.6)	5 (1.9)	290 (32.0)	11.1 (0.10)
Romania	95 (1.3)	465 (3.7)	5 (1.3)	452 (9.9)	11.3 (0.07)
Lithuania	94 (1.1)	516 (2.6)	6 (1.1)	495 (7.0)	11.1 (0.06)
Indonesia	91 (2.1)	405 (4.8)	9 (2.1)	410 (11.4)	10.7 (0.11)
United Arab Emirates	87 (1.6)	464 (2.6)	13 (1.6)	449 (5.5)	10.6 (0.07)
Qatar	86 (2.7)	426 (4.9)	14 (2.7)	372 (16.8)	10.8 (0.12)
England	r 84 (2.0)	532 (5.9)	16 (2.0)	531 (8.5)	10.7 (0.10)
Chile	84 (2.6)	463 (3.0)	16 (2.6)	447 (7.3)	10.6 (0.13)
Israel	84 (2.9)	520 (4.8)	16 (2.9)	509 (10.9)	10.6 (0.15)
United States	s 84 (2.0)	532 (3.5)	16 (2.0)	519 (9.4)	10.5 (0.10)
Lebanon	83 (2.3)	411 (5.2)	17 (2.3)	378 (7.9)	10.5 (0.12)
Oman	83 (2.1)	420 (3.4)	17 (2.1)	417 (8.8)	10.3 (0.09)
New Zealand	80 (2.9)	515 (5.0)	20 (2.9)	499 (13.6)	10.3 (0.13)
Slovenia	78 (1.7)	543 (2.8)	22 (1.7)	543 (3.0)	10.2 (0.08)
Georgia	78 (1.9)	421 (3.1)	22 (1.9)	418 (5.1)	10.2 (0.08)
Australia	s 77 (3.7)	529 (7.3)	23 (3.7)	518 (8.6)	10.3 (0.15)
Saudi Arabia	76 (3.1)	439 (4.6)	24 (3.1)	429 (7.7)	9.9 (0.13)
Hungary	74 (1.9)	522 (3.4)	26 (1.9)	521 (4.2)	10.0 (0.09)
Tunisia	74 (3.8)	440 (2.9)	26 (3.8)	434 (4.7)	10.0 (0.13)
Malaysia	74 (3.5)	426 (6.2)	26 (3.5)	424 (13.5)	10.0 (0.18)
Armenia	71 (2.6)	442 (3.8)	29 (2.6)	428 (5.7)	9.8 (0.10)
Bahrain	71 (3.2)	458 (3.4)	29 (3.2)	442 (3.6)	9.9 (0.11)
Palestinian Nat'l Auth.	68 (3.6)	421 (3.8)	32 (3.6)	419 (7.4)	9.6 (0.15)
Norway	67 (3.8)	493 (3.5)	33 (3.8)	496 (3.6)	9.6 (0.15)
Turkey	66 (3.5)	484 (4.6)	34 (3.5)	480 (6.7)	9.5 (0.13)
Syrian Arab Republic	65 (4.0)	421 (4.3)	35 (4.0)	435 (7.9)	9.3 (0.13)
Sweden	r 63 (3.1)	513 (3.6)	37 (3.1)	508 (3.8)	9.5 (0.13)
Jordan	63 (3.7)	451 (6.1)	37 (3.7)	446 (6.8)	9.5 (0.15)
Chinese Taipei	62 (4.0)	565 (3.1)	38 (4.0)	561 (4.9)	9.5 (0.17)
Morocco	60 (2.6)	379 (2.9)	40 (2.6)	372 (3.1)	9.5 (0.11)
Singapore	60 (2.5)	595 (5.6)	40 (2.5)	583 (7.8)	9.4 (0.11)
Finland	56 (2.5)	554 (3.1)	44 (2.5)	549 (2.7)	9.1 (0.11)
Iran, Islamic Rep. of	49 (3.6)	482 (5.4)	51 (3.6)	467 (5.6)	8.9 (0.13)
Hong Kong SAR	48 (4.4)	540 (5.8)	52 (4.4)	531 (6.1)	8.9 (0.19)
Thailand	42 (4.4)	454 (6.7)	58 (4.4)	449 (5.4)	8.4 (0.18)
Korea, Rep. of	40 (3.6)	559 (3.1)	60 (3.6)	561 (2.5)	8.4 (0.15)
Italy	33 (3.3)	504 (5.1)	67 (3.3)	500 (3.4)	8.0 (0.15)
Japan	33 (3.6)	556 (3.0)	67 (3.6)	559 (3.3)	7.9 (0.16)
International Avg.	73 (0.4)	479 (0.7)	27 (0.4)	467 (1.5)	

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

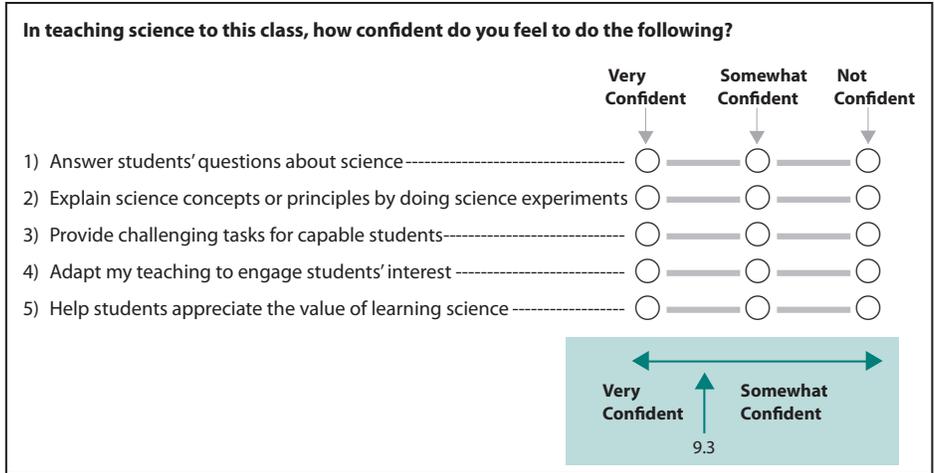
An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

An "x" indicates data are available for less than 50% of students.

**Exhibit 7.13: Confidence in Teaching Science (Continued)**

Country	Very Confident		Somewhat Confident		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Ninth Grade Participants</b>					
Honduras	93 (2.5)	370 (4.7)	7 (2.5)	349 (13.3)	11.0 (0.15)
Botswana	86 (2.9)	405 (4.0)	14 (2.9)	396 (9.1)	10.6 (0.12)
South Africa	81 (3.1)	332 (4.7)	19 (3.1)	317 (12.3)	10.2 (0.15)
<b>Benchmarking Participants</b>					
Dubai, UAE	r 92 (0.8)	487 (2.8)	8 (0.8)	405 (10.3)	11.0 (0.09)
Indiana, US	s 91 (3.2)	530 (5.2)	9 (3.2)	548 (15.5)	10.8 (0.18)
Minnesota, US	r 89 (4.5)	555 (7.2)	11 (4.5)	537 (11.3)	10.7 (0.21)
Connecticut, US	s 89 (3.4)	537 (7.6)	11 (3.4)	529 (20.1)	10.9 (0.14)
Massachusetts, US	s 89 (3.7)	565 (7.7)	11 (3.7)	564 (15.2)	10.7 (0.20)
California, US	s 87 (3.4)	509 (7.6)	13 (3.4)	476 (13.3)	10.6 (0.21)
Abu Dhabi, UAE	86 (2.6)	462 (5.0)	14 (2.6)	458 (7.8)	10.5 (0.13)
Quebec, Canada	83 (3.6)	521 (3.1)	17 (3.6)	519 (6.8)	10.6 (0.15)
Colorado, US	s 82 (4.6)	541 (7.1)	18 (4.6)	553 (14.3)	10.6 (0.23)
Alabama, US	s 82 (4.7)	484 (8.6)	18 (4.7)	489 (10.1)	10.6 (0.21)
North Carolina, US	s 78 (7.1)	517 (11.6)	22 (7.1)	563 (19.4)	10.3 (0.36)
Alberta, Canada	73 (3.5)	547 (3.0)	27 (3.5)	542 (3.9)	10.0 (0.17)
Ontario, Canada	r 59 (4.2)	524 (4.1)	41 (4.2)	516 (4.0)	9.5 (0.18)
Florida, US	x x	x x	x x	x x	x x

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



**Exhibit 7.14: Components of Confidence in Teaching Science Scale**
*Reported by Teachers*

Country	Percent of Students Whose Teachers Feel Very Confident to				
	Answer Student Questions About Science	Explain Science Concepts or Principles by Doing Science Experiments	Provide Challenging Tasks for Capable Students	Adapt Teaching to Engage Student Interests	Help Students Appreciate the Value of Learning Science
Armenia	88 (1.8)	53 (2.9)	61 (2.8)	56 (2.5)	73 (2.6)
Australia	s 88 (2.4)	s 86 (2.3)	s 59 (3.8)	s 65 (4.3)	s 68 (3.7)
Bahrain	87 (2.6)	68 (3.4)	51 (2.8)	62 (3.3)	69 (3.6)
Chile	86 (2.8)	68 (4.1)	74 (3.3)	84 (3.0)	85 (2.6)
Chinese Taipei	71 (4.0)	73 (3.6)	60 (4.0)	50 (4.1)	44 (3.6)
England	r 96 (1.0)	r 93 (1.5)	r 75 (2.9)	r 70 (2.6)	r 65 (3.1)
Finland	70 (2.3)	66 (2.2)	47 (2.9)	40 (2.5)	51 (2.3)
Georgia	83 (1.7)	53 (2.5)	64 (2.7)	74 (2.2)	86 (1.6)
Ghana	97 (1.3)	82 (3.2)	66 (3.7)	92 (2.2)	96 (1.4)
Hong Kong SAR	72 (4.1)	73 (4.1)	37 (4.6)	37 (4.5)	33 (4.2)
Hungary	81 (2.0)	72 (1.9)	64 (2.4)	61 (2.1)	67 (2.2)
Indonesia	93 (2.0)	82 (3.2)	61 (4.4)	78 (3.3)	92 (1.8)
Iran, Islamic Rep. of	63 (3.7)	43 (3.9)	28 (3.1)	54 (3.6)	62 (3.3)
Israel	92 (2.3)	88 (2.8)	63 (4.2)	77 (3.4)	74 (3.3)
Italy	45 (3.5)	24 (3.1)	24 (3.0)	35 (3.4)	52 (3.9)
Japan	49 (4.3)	55 (3.9)	24 (3.4)	27 (3.9)	21 (3.6)
Jordan	69 (3.8)	55 (4.1)	48 (3.9)	63 (3.7)	69 (3.3)
Kazakhstan	98 (0.5)	97 (0.7)	92 (1.6)	92 (1.3)	97 (0.9)
Korea, Rep. of	57 (3.5)	56 (3.8)	24 (3.2)	38 (3.7)	37 (3.8)
Lebanon	87 (2.1)	75 (2.7)	64 (3.2)	81 (2.5)	79 (2.4)
Lithuania	97 (0.8)	86 (1.6)	89 (1.4)	78 (1.8)	85 (1.6)
Macedonia, Rep. of	s 94 (1.1)	s 82 (2.3)	s 82 (2.3)	s 96 (1.0)	s 92 (1.3)
Malaysia	76 (3.5)	78 (3.4)	50 (3.8)	61 (3.8)	77 (3.4)
Morocco	67 (2.3)	64 (2.4)	43 (2.5)	59 (2.7)	64 (2.2)
New Zealand	90 (2.1)	88 (2.0)	63 (3.5)	59 (3.8)	67 (3.5)
Norway	85 (2.6)	61 (3.4)	49 (4.2)	47 (4.3)	69 (4.1)
Oman	90 (2.1)	85 (2.4)	56 (2.9)	62 (3.2)	78 (2.7)
Palestinian Nat'l Auth.	72 (3.3)	68 (3.6)	43 (4.2)	65 (3.6)	64 (3.8)
Qatar	88 (2.5)	86 (2.6)	72 (3.0)	77 (3.4)	81 (3.0)
Romania	95 (1.3)	83 (2.0)	89 (1.5)	93 (1.4)	90 (1.4)
Russian Federation	98 (0.4)	97 (0.8)	85 (1.3)	87 (1.5)	97 (0.6)
Saudi Arabia	85 (3.3)	59 (3.6)	53 (4.2)	71 (3.4)	75 (3.5)
Singapore	80 (2.2)	69 (2.2)	49 (2.5)	47 (2.9)	51 (2.5)
Slovenia	84 (1.5)	69 (1.9)	61 (2.1)	70 (1.8)	75 (2.1)
Sweden	r 84 (2.8)	r 77 (3.1)	r 47 (3.7)	r 47 (3.4)	r 51 (3.3)
Syrian Arab Republic	67 (3.0)	45 (4.0)	42 (3.9)	70 (3.5)	69 (4.0)
Thailand	58 (4.1)	52 (4.4)	36 (4.4)	36 (4.3)	33 (4.1)
Tunisia	82 (2.7)	87 (2.3)	40 (3.7)	63 (3.8)	72 (3.6)
Turkey	70 (3.5)	61 (3.6)	49 (3.4)	63 (3.1)	63 (3.7)
Ukraine	99 (0.6)	85 (2.5)	92 (1.6)	86 (2.0)	98 (0.6)
United Arab Emirates	88 (1.6)	84 (2.0)	59 (2.2)	80 (1.9)	82 (1.8)
United States	s 90 (1.6)	s 85 (2.1)	s 67 (2.6)	s 72 (2.5)	s 72 (2.5)
International Avg.	81 (0.4)	72 (0.5)	57 (0.5)	65 (0.5)	70 (0.5)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students. An "x" indicates data are available for less than 50% of students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 7.14: Components of Confidence in Teaching Science Scale (Continued)**

Country	Percent of Students Whose Teachers Feel Very Confident to				
	Answer Student Questions About Science	Explain Science Concepts or Principles by Doing Science Experiments	Provide Challenging Tasks for Capable Students	Adapt Teaching to Engage Student Interests	Help Students Appreciate the Value of Learning Science
<b>Ninth Grade Participants</b>					
Botswana	94 (2.1)	85 (3.3)	60 (4.0)	68 (4.3)	90 (2.5)
Honduras	93 (2.6)	80 (4.2)	67 (4.7)	91 (2.3)	92 (2.2)
South Africa	87 (2.3)	61 (3.5)	61 (4.0)	73 (3.7)	82 (2.6)
<b>Benchmarking Participants</b>					
Alberta, Canada	81 (3.7)	77 (3.7)	51 (4.1)	66 (3.6)	66 (3.8)
Ontario, Canada	r 61 (3.9)	r 63 (4.4)	r 56 (4.0)	r 59 (4.1)	r 61 (4.4)
Quebec, Canada	89 (2.7)	85 (2.5)	74 (3.8)	72 (3.9)	72 (4.1)
Abu Dhabi, UAE	r 88 (2.7)	81 (3.6)	r 53 (4.4)	r 77 (3.8)	r 84 (3.2)
Dubai, UAE	r 93 (1.0)	r 90 (1.5)	r 75 (1.9)	r 86 (1.5)	r 79 (4.0)
Alabama, US	s 92 (2.5)	s 85 (4.7)	s 65 (6.4)	s 70 (5.6)	s 79 (5.3)
California, US	s 95 (2.2)	s 87 (3.3)	s 68 (5.8)	s 76 (5.5)	s 70 (5.9)
Colorado, US	s 93 (2.8)	s 87 (4.2)	s 64 (5.7)	s 68 (7.0)	s 74 (6.2)
Connecticut, US	s 93 (3.4)	s 94 (2.3)	s 78 (4.6)	s 74 (4.4)	s 78 (3.9)
Florida, US	x x	x x	x x	x x	x x
Indiana, US	s 97 (2.7)	s 90 (3.0)	s 69 (5.3)	s 76 (5.5)	s 80 (4.7)
Massachusetts, US	s 95 (3.2)	s 86 (4.8)	s 65 (6.7)	s 81 (4.3)	s 76 (5.4)
Minnesota, US	r 94 (2.8)	r 92 (3.1)	r 76 (5.7)	r 67 (7.0)	r 71 (6.4)
North Carolina, US	s 90 (4.7)	s 74 (7.1)	s 72 (7.4)	s 62 (9.3)	s 70 (8.4)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

### *Teachers' Career Satisfaction*

Teachers who are satisfied with their profession and the working conditions at their school are more motivated to teach and prepare their instruction. Further, having teachers that can provide leadership is a dimension of teacher quality. However, developing master teachers requires retention in the profession. Teachers need to be committed to the profession and like it enough to continue teaching. It may be that some subject areas and locales would benefit from policies to reduce teacher attrition in order to improve student achievement (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2009).

Exhibit 7.15 shows the fourth grade TIMSS assessment results for the TIMSS 2011 Teacher Career Satisfaction scale, based on how much teachers agreed with each of the following six statements:

- ◆ I am content with my profession as a teacher;
- ◆ I am satisfied with being a teacher at this school;
- ◆ I had more enthusiasm when I began teaching than I have now (reverse coded);
- ◆ I do important work as a teacher;
- ◆ I plan to continue as a teacher for as long as I can; and,
- ◆ I am frustrated as a teacher (reverse coded).

Students were scored according to their teachers responses, with **Satisfied** teachers “agreeing a lot” with three of the six statements and “agreeing a little” with the other three, on average. Internationally, on average, the majority of fourth grade students (54%) had teachers **Satisfied** with their careers. Another 41 percent of the students, on average, had teachers that reported being **Somewhat Satisfied** (mostly agreed “a little” instead of “a lot”). Despite the fact that satisfaction could be relative, and dependent on the teaching situation, very few fourth grade students had science teachers that expressed any dissatisfaction except in a small number of countries.

On average across countries, at the fourth grade, science achievement was higher for students of **Satisfied** teachers (490) than for students of **Somewhat Satisfied** (483) or **Less Than Satisfied Teachers** (483), though this varied considerably from country to country. In particular, it is noteworthy that several of the highest-performing countries in science at the fourth grade—Singapore, Japan, and Korea—had among the lowest percentages of students taught by **Satisfied** teachers.

As shown in Exhibit 7.16, on average across countries, the eighth grade science teachers reported somewhat lower levels of career satisfaction than the fourth grade teachers, with 47 percent of students taught by **Satisfied** teachers (compared to 54% at the fourth grade). However, taken together, almost all of the eighth grade students (92%) were taught science by teachers who were **Satisfied** or **Somewhat Satisfied** with their careers. Similar to the fourth grade results, on average across countries, the eighth grade students taught by **Satisfied** teachers had higher science achievement (481) than those taught by **Somewhat Satisfied** (474) or **Less Than Satisfied** teachers (473).

## Exhibit 7.15: Teacher Career Satisfaction

Reported by Teachers

Students were scored according to their teachers' degree of agreement with six statements on the *Teacher Career Satisfaction* scale. Students with **Satisfied** teachers had a score on the scale of at least 10.1, which corresponds to their teachers "agreeing a lot" with three of the six statements and "agreeing a little" with the other three, on average. Students with **Less Than Satisfied** teachers had a score no higher than 6.6, which corresponds to their teachers "disagreeing a little" with three of the six statements and "agreeing a little" with the other three, on average. All other students had **Somewhat Satisfied** teachers.

Country	Satisfied		Somewhat Satisfied		Less Than Satisfied		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Croatia	83 (2.7)	515 (2.4)	16 (2.5)	522 (3.9)	1 (0.9)	~ ~	11.1 (0.11)
Chile	79 (2.9)	482 (3.4)	18 (2.6)	473 (7.5)	3 (1.2)	484 (8.4)	11.2 (0.14)
Georgia	77 (3.6)	454 (4.6)	21 (3.1)	458 (7.0)	2 (1.3)	~ ~	11.3 (0.15)
Armenia	77 (3.0)	415 (4.2)	21 (2.9)	418 (7.7)	1 (0.7)	~ ~	11.1 (0.13)
Thailand	69 (3.6)	470 (5.3)	31 (3.6)	477 (13.8)	0 (0.0)	~ ~	10.1 (0.11)
Spain	69 (4.0)	514 (3.4)	27 (3.7)	488 (4.9)	4 (1.6)	485 (9.6)	11.0 (0.19)
Ireland	68 (3.4)	516 (3.9)	29 (3.4)	518 (7.8)	2 (0.8)	~ ~	10.9 (0.12)
Denmark	68 (3.8)	530 (2.9)	29 (3.8)	532 (6.1)	3 (1.3)	511 (22.7)	10.5 (0.16)
Malta	66 (0.1)	452 (2.2)	32 (0.1)	437 (2.6)	2 (0.0)	~ ~	10.9 (0.00)
Iran, Islamic Rep. of	66 (3.3)	457 (5.0)	31 (3.5)	444 (6.8)	3 (1.1)	457 (25.6)	10.4 (0.11)
United Arab Emirates	65 (2.0)	435 (3.9)	29 (2.0)	425 (4.8)	6 (1.2)	400 (8.6)	10.5 (0.09)
Poland	64 (3.0)	503 (3.0)	36 (3.0)	509 (4.2)	1 (0.5)	~ ~	10.6 (0.11)
Qatar	62 (3.9)	399 (7.1)	32 (3.9)	390 (11.0)	6 (2.0)	360 (16.0)	10.1 (0.16)
Turkey	62 (3.4)	475 (5.1)	34 (3.4)	445 (8.3)	4 (1.5)	429 (11.3)	10.4 (0.14)
Belgium (Flemish)	62 (3.6)	510 (2.3)	34 (3.3)	507 (3.3)	4 (1.2)	505 (13.9)	10.3 (0.14)
Austria	61 (3.5)	534 (3.5)	34 (3.5)	529 (4.4)	5 (1.4)	524 (17.4)	10.5 (0.13)
Kazakhstan	60 (3.4)	505 (7.0)	39 (3.3)	479 (9.2)	1 (0.4)	~ ~	10.2 (0.10)
Russian Federation	60 (3.0)	552 (4.2)	37 (2.9)	552 (4.4)	4 (1.3)	546 (4.1)	10.2 (0.13)
Azerbaijan	60 (3.5)	440 (7.7)	40 (3.5)	434 (7.1)	1 (0.5)	~ ~	10.2 (0.11)
Serbia	59 (4.3)	517 (3.7)	38 (4.2)	512 (5.3)	3 (1.4)	525 (18.2)	10.2 (0.15)
Romania	57 (4.2)	512 (8.1)	42 (4.3)	494 (8.4)	1 (0.6)	~ ~	10.5 (0.14)
Lithuania	57 (3.8)	517 (3.4)	40 (3.7)	512 (4.7)	3 (1.0)	493 (18.1)	10.2 (0.13)
Northern Ireland	r 55 (4.3)	520 (3.8)	40 (4.6)	513 (5.7)	5 (1.9)	512 (12.5)	10.2 (0.18)
Saudi Arabia	55 (4.2)	434 (8.4)	42 (4.1)	427 (7.5)	3 (1.2)	374 (20.0)	10.0 (0.17)
Hungary	54 (3.6)	544 (4.6)	42 (3.5)	522 (5.4)	3 (0.9)	506 (15.9)	10.0 (0.13)
Slovak Republic	54 (3.4)	533 (5.4)	41 (3.3)	529 (4.2)	5 (1.4)	541 (18.1)	9.9 (0.13)
Tunisia	54 (4.4)	354 (6.1)	41 (4.3)	340 (9.1)	6 (1.9)	305 (24.5)	9.9 (0.15)
Australia	r 53 (3.8)	526 (4.1)	41 (3.7)	512 (5.4)	6 (1.7)	505 (10.3)	10.0 (0.16)
England	52 (3.9)	534 (4.3)	37 (3.8)	531 (7.1)	11 (2.7)	507 (8.9)	9.9 (0.18)
Yemen	52 (4.7)	207 (9.1)	46 (4.8)	213 (10.8)	2 (1.1)	~ ~	10.0 (0.17)
Norway	52 (4.2)	495 (2.9)	38 (3.8)	492 (4.2)	10 (2.8)	492 (6.4)	9.6 (0.17)
Bahrain	50 (4.1)	455 (5.0)	36 (4.2)	450 (7.5)	14 (2.7)	429 (13.3)	9.7 (0.17)
Kuwait	49 (4.1)	351 (7.1)	44 (4.1)	346 (7.6)	7 (2.1)	327 (12.6)	9.7 (0.16)
Germany	49 (3.3)	528 (4.2)	46 (3.3)	529 (3.5)	5 (1.6)	525 (8.1)	10.0 (0.12)
New Zealand	49 (3.0)	499 (3.9)	45 (3.0)	498 (3.8)	6 (1.3)	479 (10.3)	10.0 (0.13)
Czech Republic	48 (3.7)	542 (3.8)	45 (4.0)	532 (3.7)	7 (2.2)	526 (7.5)	9.7 (0.15)
United States	r 48 (2.4)	546 (3.0)	46 (2.3)	546 (3.3)	7 (1.3)	522 (9.1)	9.8 (0.11)
Hong Kong SAR	46 (4.3)	537 (4.3)	49 (4.3)	534 (7.4)	5 (2.0)	519 (15.9)	9.5 (0.16)
Slovenia	44 (3.0)	521 (3.5)	53 (3.1)	520 (3.9)	3 (0.7)	517 (11.6)	9.7 (0.08)
Oman	43 (3.1)	390 (4.2)	47 (3.4)	371 (7.0)	11 (2.1)	353 (11.1)	9.5 (0.11)
Finland	40 (3.2)	575 (3.7)	52 (3.5)	568 (3.1)	8 (2.2)	564 (6.0)	9.4 (0.13)
Netherlands	r 40 (4.5)	530 (4.8)	53 (4.6)	531 (2.8)	7 (2.6)	524 (12.2)	9.4 (0.18)
Chinese Taipei	36 (3.1)	556 (4.2)	55 (3.7)	550 (2.7)	9 (2.4)	540 (6.7)	9.0 (0.14)
Morocco	36 (3.9)	280 (9.6)	50 (4.1)	250 (6.0)	15 (3.0)	272 (13.8)	8.9 (0.20)
Portugal	36 (4.0)	527 (5.9)	59 (4.3)	520 (4.8)	5 (1.8)	511 (11.5)	9.5 (0.19)
Italy	35 (3.4)	528 (4.8)	57 (3.7)	523 (4.0)	8 (2.0)	521 (10.9)	9.3 (0.12)
Singapore	32 (2.6)	592 (6.3)	56 (2.7)	580 (4.4)	12 (1.7)	572 (10.7)	8.9 (0.10)
Sweden	r 29 (3.6)	531 (5.7)	60 (4.0)	536 (3.4)	11 (2.8)	536 (9.2)	8.9 (0.17)
Japan	26 (3.6)	559 (3.6)	60 (4.1)	559 (2.4)	15 (3.0)	555 (5.2)	8.6 (0.14)
Korea, Rep. of	21 (3.3)	586 (3.4)	68 (4.0)	588 (2.5)	10 (2.8)	578 (6.0)	8.4 (0.13)
International Avg.	54 (0.5)	490 (0.7)	41 (0.5)	483 (0.9)	5 (0.2)	483 (2.1)	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

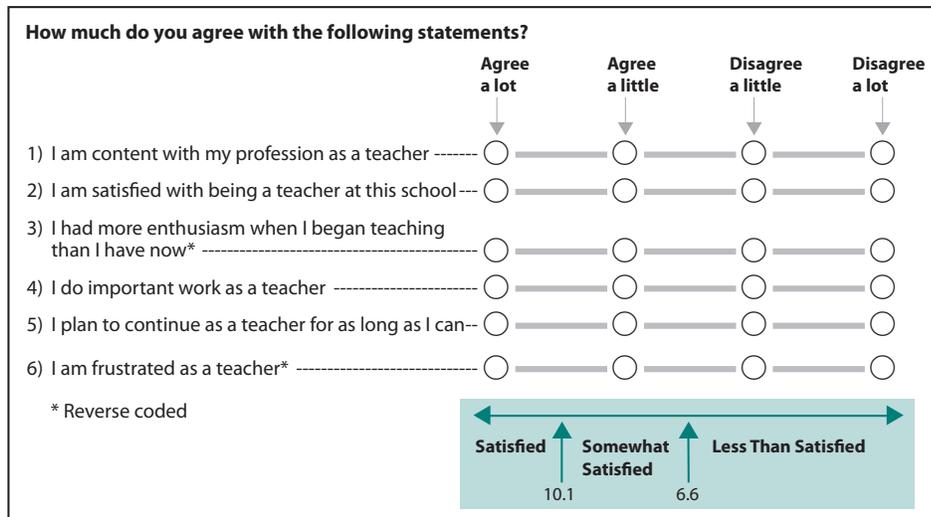
A tilde (~) indicates insufficient data to report achievement.

An "r" indicates data are available for at least 70% but less than 85% of the students.

**Exhibit 7.15: Teacher Career Satisfaction (Continued)**

Country	Satisfied		Somewhat Satisfied		Less Than Satisfied		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Sixth Grade Participants</b>							
Honduras	95 (1.8)	433 (6.4)	5 (1.8)	419 (23.1)	0 (0.0)	~ ~	12.2 (0.13)
Yemen	51 (4.5)	349 (9.5)	45 (4.5)	342 (10.5)	4 (1.6)	363 (15.8)	9.9 (0.14)
Botswana	25 (3.5)	381 (12.8)	62 (4.1)	368 (8.1)	13 (2.8)	362 (19.2)	8.6 (0.14)
<b>Benchmarking Participants</b>							
Dubai, UAE	72 (1.8)	472 (3.3)	23 (1.8)	455 (7.6)	5 (1.0)	431 (23.4)	10.6 (0.11)
Abu Dhabi, UAE	68 (3.8)	416 (7.1)	27 (3.6)	414 (9.1)	5 (1.8)	380 (12.6)	10.6 (0.15)
Ontario, Canada	60 (3.6)	528 (3.6)	37 (3.4)	526 (4.7)	4 (1.4)	526 (9.0)	10.2 (0.13)
Alberta, Canada r	60 (4.4)	547 (3.8)	40 (4.3)	535 (3.6)	1 (0.7)	~ ~	10.2 (0.15)
Quebec, Canada	45 (4.0)	522 (4.0)	48 (4.2)	511 (3.4)	7 (2.4)	520 (9.3)	9.6 (0.15)
Florida, US r	42 (5.5)	547 (7.2)	52 (5.6)	541 (6.2)	6 (2.6)	551 (19.7)	9.8 (0.21)
North Carolina, US	33 (5.7)	543 (6.5)	58 (5.2)	537 (6.4)	10 (3.5)	522 (10.9)	9.1 (0.24)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



## Exhibit 7.16: Teacher Career Satisfaction

Reported by Teachers

Students were scored according to their teachers' degree of agreement with six statements on the *Teacher Career Satisfaction* scale. Students with **Satisfied** teachers had a score on the scale of at least 10.4, which corresponds to their teachers "agreeing a lot" with three of the six statements and "agreeing a little" with the other three, on average. Students with **Less Than Satisfied** teachers had a score no higher than 7.0, which corresponds to their teachers "disagreeing a little" with three of the six statements and "agreeing a little" with the other three, on average. All other students had **Somewhat Satisfied** teachers.

Country	Satisfied		Somewhat Satisfied		Less Than Satisfied		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Thailand	71 (3.7)	451 (5.4)	27 (3.4)	446 (6.1)	2 (1.2)	~ ~	10.5 (0.11)
Chile	68 (3.8)	465 (3.9)	28 (3.5)	452 (5.9)	4 (2.2)	452 (17.2)	10.9 (0.17)
Georgia	67 (2.3)	421 (3.6)	31 (2.2)	417 (4.4)	2 (0.5)	~ ~	10.9 (0.09)
Malaysia	66 (3.6)	429 (6.5)	34 (3.6)	419 (10.6)	0 (0.0)	~ ~	10.4 (0.09)
Indonesia	63 (3.8)	405 (6.1)	36 (3.9)	405 (6.8)	1 (0.8)	~ ~	10.7 (0.12)
Syrian Arab Republic	62 (3.3)	426 (4.7)	35 (3.3)	427 (6.2)	4 (1.4)	414 (13.3)	10.7 (0.15)
Israel	61 (3.8)	528 (5.1)	37 (3.7)	496 (7.0)	2 (0.9)	~ ~	10.7 (0.15)
Ukraine	61 (2.9)	506 (4.2)	38 (2.9)	493 (4.5)	2 (0.6)	~ ~	10.4 (0.10)
Armenia	59 (2.7)	437 (4.0)	38 (2.7)	441 (4.2)	3 (0.7)	435 (16.6)	10.6 (0.10)
Turkey	58 (3.3)	493 (5.5)	35 (3.1)	472 (5.6)	7 (1.9)	456 (11.6)	10.4 (0.14)
Qatar	57 (3.4)	429 (8.4)	38 (3.2)	403 (7.5)	5 (1.6)	421 (27.4)	10.5 (0.13)
Saudi Arabia	56 (3.9)	442 (4.4)	39 (3.8)	427 (6.8)	6 (2.0)	442 (20.8)	10.5 (0.16)
United Arab Emirates	56 (2.4)	465 (3.3)	38 (2.4)	457 (4.1)	7 (1.3)	459 (10.5)	10.5 (0.11)
Norway	56 (3.6)	496 (3.2)	41 (3.3)	491 (4.3)	4 (1.7)	490 (23.8)	10.4 (0.16)
Iran, Islamic Rep. of	53 (3.2)	480 (5.4)	42 (3.3)	472 (6.8)	5 (1.3)	442 (22.2)	10.2 (0.11)
Kazakhstan	53 (2.5)	493 (4.7)	46 (2.6)	487 (5.5)	1 (0.4)	~ ~	10.4 (0.07)
Bahrain	52 (3.0)	469 (4.0)	30 (2.8)	442 (5.1)	18 (2.4)	424 (6.8)	10.0 (0.14)
Macedonia, Rep. of	51 (1.8)	432 (6.5)	47 (1.8)	384 (6.4)	2 (0.6)	~ ~	10.5 (0.07)
Palestinian Nat'l Auth.	50 (3.9)	423 (4.6)	41 (4.1)	418 (6.7)	9 (2.3)	417 (14.1)	10.0 (0.15)
Romania	49 (2.4)	466 (4.0)	45 (2.7)	464 (4.6)	5 (1.1)	458 (7.3)	10.2 (0.09)
Tunisia	49 (4.2)	438 (3.9)	46 (4.0)	441 (4.1)	5 (1.6)	420 (7.7)	10.2 (0.14)
Russian Federation	44 (2.0)	551 (3.6)	50 (2.2)	538 (3.8)	6 (1.0)	522 (8.5)	9.9 (0.08)
Lebanon	43 (3.2)	416 (6.9)	50 (3.2)	405 (6.5)	7 (2.0)	350 (11.6)	9.9 (0.12)
Lithuania	42 (2.2)	519 (3.0)	49 (2.1)	511 (3.0)	9 (1.2)	504 (5.9)	9.7 (0.10)
Italy	42 (3.9)	499 (4.6)	49 (3.9)	504 (4.2)	9 (2.2)	507 (13.5)	9.7 (0.14)
Finland	42 (2.4)	553 (3.2)	49 (2.2)	551 (2.5)	10 (1.4)	552 (5.8)	9.7 (0.11)
New Zealand	41 (3.7)	514 (7.7)	48 (4.3)	509 (6.7)	11 (2.9)	511 (14.0)	9.9 (0.19)
Hungary	40 (2.6)	526 (4.0)	48 (2.5)	523 (4.0)	12 (1.8)	512 (8.4)	9.7 (0.13)
United States	40 (2.6)	533 (4.9)	51 (2.9)	527 (4.5)	10 (1.4)	500 (8.3)	9.7 (0.10)
Morocco	39 (2.5)	380 (3.3)	49 (2.3)	374 (2.9)	12 (1.6)	377 (5.8)	9.6 (0.12)
England	39 (2.8)	526 (8.6)	46 (3.1)	533 (6.7)	15 (2.4)	542 (8.4)	9.5 (0.13)
Australia	38 (3.9)	525 (7.8)	52 (4.3)	526 (6.1)	10 (2.3)	522 (13.5)	9.7 (0.18)
Hong Kong SAR	38 (4.4)	542 (6.9)	53 (4.3)	534 (4.9)	9 (2.7)	508 (23.5)	9.6 (0.17)
Oman	37 (2.9)	423 (5.9)	50 (3.3)	421 (4.8)	14 (2.0)	408 (10.3)	9.5 (0.10)
Ghana	35 (4.2)	307 (10.1)	55 (4.0)	307 (8.1)	10 (2.5)	299 (17.2)	9.6 (0.19)
Chinese Taipei	32 (3.6)	565 (4.7)	62 (3.8)	564 (3.2)	5 (1.8)	555 (9.4)	9.6 (0.13)
Slovenia	31 (2.3)	543 (3.3)	63 (2.5)	542 (3.1)	6 (1.1)	550 (5.7)	9.5 (0.08)
Jordan	28 (3.2)	463 (5.4)	51 (3.3)	451 (5.8)	21 (2.4)	425 (10.8)	8.9 (0.13)
Singapore	28 (2.3)	592 (8.6)	59 (2.7)	592 (5.4)	13 (1.8)	576 (11.5)	9.2 (0.09)
Sweden	24 (3.3)	519 (4.8)	60 (3.5)	509 (3.8)	16 (2.5)	505 (6.8)	9.0 (0.13)
Japan	22 (3.4)	559 (5.0)	65 (4.1)	557 (3.3)	13 (2.9)	557 (4.9)	9.0 (0.14)
Korea, Rep. of	13 (2.0)	567 (5.2)	63 (3.6)	559 (2.3)	24 (3.6)	558 (4.2)	8.3 (0.10)
International Avg.	47 (0.5)	481 (0.8)	45 (0.5)	474 (0.8)	8 (0.3)	473 (2.3)	

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

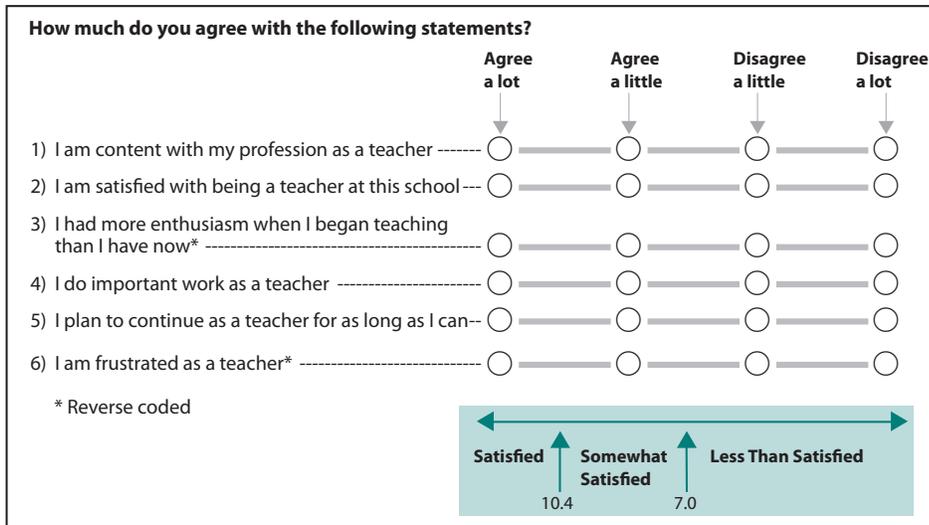
An "x" indicates data are available for less than 50% of students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 7.16: Teacher Career Satisfaction (Continued)**

Country	Satisfied		Somewhat Satisfied		Less Than Satisfied		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Ninth Grade Participants</b>							
Honduras	87 (3.0)	365 (3.7)	13 (3.0)	399 (15.6)	0 (0.0)	~ ~	12.2 (0.16)
South Africa	38 (3.8)	323 (9.3)	54 (3.7)	331 (6.2)	8 (1.7)	345 (17.5)	9.5 (0.12)
Botswana	13 (2.9)	422 (9.3)	64 (3.9)	401 (4.6)	23 (3.6)	399 (9.3)	8.4 (0.17)
<b>Benchmarking Participants</b>							
Ontario, Canada	62 (4.5)	525 (3.5)	37 (4.4)	516 (4.0)	1 (0.8)	~ ~	10.7 (0.15)
Abu Dhabi, UAE	61 (4.4)	460 (5.9)	33 (4.5)	456 (5.6)	7 (2.2)	485 (12.2)	10.6 (0.18)
Dubai, UAE	r 58 (4.4)	487 (5.9)	36 (4.4)	476 (7.2)	6 (1.3)	419 (18.6)	10.7 (0.19)
Alberta, Canada	53 (4.1)	550 (3.5)	38 (3.8)	544 (3.5)	9 (2.1)	532 (6.6)	10.2 (0.16)
Massachusetts, US	r 51 (7.3)	568 (9.6)	47 (7.5)	559 (13.3)	2 (1.7)	~ ~	10.2 (0.29)
Colorado, US	r 50 (6.5)	541 (7.0)	42 (6.3)	539 (10.4)	8 (3.5)	558 (11.7)	10.1 (0.27)
Indiana, US	r 48 (6.8)	539 (6.1)	46 (6.8)	529 (7.3)	6 (2.5)	537 (10.1)	10.1 (0.25)
Connecticut, US	r 47 (6.2)	535 (9.7)	44 (6.6)	533 (10.1)	8 (3.4)	522 (29.3)	9.9 (0.27)
Quebec, Canada	45 (4.1)	528 (4.2)	46 (4.2)	517 (4.2)	9 (2.4)	501 (11.7)	9.9 (0.15)
California, US	s 39 (5.2)	497 (6.5)	52 (5.2)	503 (9.3)	9 (3.1)	492 (16.2)	9.9 (0.23)
Minnesota, US	r 35 (5.8)	550 (14.2)	52 (6.8)	557 (6.3)	12 (4.8)	541 (10.3)	9.7 (0.27)
Alabama, US	r 33 (6.3)	487 (10.5)	59 (6.7)	481 (8.6)	8 (4.1)	485 (17.6)	9.5 (0.30)
North Carolina, US	s 30 (7.0)	531 (15.0)	43 (8.1)	539 (15.4)	27 (7.2)	501 (15.2)	8.9 (0.35)
Florida, US	x x	x x	x x	x x	x x	x x	x x

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011





# Chapter 8

## Classroom Instruction

Overall, students with positive attitudes toward science have higher achievement, but these attitudes deteriorate over time. Internationally, by the eighth grade, fewer students like learning science and feel confident in their abilities (compared to the fourth grade). In countries teaching science as separate subjects, students like learning chemistry and physics less than biology and earth science, and are less confident in their abilities in them.

Engaging instruction, good nutrition, and enough sleep were related to higher achievement. However, by the eighth grade, only one-quarter of the students reported being engaged in their science lessons, and nearly as many reported being not engaged. Also, in the majority of eighth grade classrooms, instruction was limited because students were suffering from lack of sleep.

This chapter considers the learning environment of the classroom itself, because classroom instruction is at the core of student learning. Previous chapters of this report have described how teaching effectiveness can be greatly influenced by students' home and school environments as well as by teachers' preparation. However, even though the curricular policies and school resources often set the tone for accomplishment, students' day-to-day classroom activities are likely to have a considerable direct impact on their science learning.

TIMSS routinely presents very powerful evidence showing that within countries students with more positive attitudes toward science have substantially higher achievement, and the results from TIMSS 2011 are consistent with previous assessments. In addition to being motivated to learn, students need the opportunity to learn. Thus, this chapter also provides information about the instructional time devoted to science and the approaches teachers use to engage students in learning. It is difficult, however, for teachers to engage students in learning if students do not have the prerequisite skills or are too sleep deprived or disruptive to pay attention. Finally, an effective classroom environment for science learning involves using a variety of instructional approaches, capitalizing on technology, and at the eighth grade, extending instruction with homework and regularly assessing student progress.

## Students' Attitudes Toward Science

Each successive TIMSS assessment has shown a strong positive relationship within countries between student attitudes toward science and their science achievement. Additionally, there is extensive research showing that students with more positive attitudes toward mathematics and science have higher average achievement in mathematics and science. For example, a recent meta-analysis of student attitudes toward school found that attitudes toward mathematics or science were related to mathematics and science achievement across 288 studies (Hattie, 2009). While positive attitudes and high achievement in science go hand in hand, it should be understood that the relationship is bidirectional, with attitudes and achievement mutually influencing each other. Students who are good at science also are more likely to enjoy learning science.

Much research about students' attitudes toward learning has studied the complex phenomenon of motivation. For example, students' motivation to learn can be affected by whether they find the subject enjoyable and place value on the subject. In addition, students' motivation can be affected by their self-confidence in learning the subject. TIMSS 2011 included scales about three

motivational constructs: intrinsic value (interest), utility value, and ability beliefs. Essentially, intrinsic motivation refers to doing an activity because it is interesting or enjoyable, and the Students Like Learning Science scale was developed to measure students' interest in and liking of learning science. In contrast, extrinsic motivation refers to doing something because it leads to a desirable outcome. There are many types of external motivation from teacher praise, to good grades, to being accepted to a good university, to having a successful career and daily life. In particular, the TIMSS 2011 Students Value Science scale addresses students' attitudes about the importance of the subject and usefulness of the subject, sometimes called attainment value and utility value (Wigfield & Eccles, 2000). Finally, motivation to learn includes having the feeling that you can succeed. The Student Confidence with Science scale assesses students' self-confidence or self-concept in their ability to learn science. A strong self-concept encourages students to engage with the instruction and show persistence, effort, and attentiveness.

### *Students Like Learning Science*

Exhibit 8.1 presents the fourth grade results for the TIMSS 2011 Students Like Learning Science scale. Students were scored according to the degree of their agreement with five statements such as “I enjoy learning science,” “Science is boring” (reverse coded), and “I learn many interesting things in science” (see second page of the exhibit for details). Students in the **Like Learning Science** category “agreed a lot” with three of the five statements and “agreed a little” with the other two, on average. In contrast, students who **Do Not Like Learning Science** “disagreed a little” with three of the statements and “agreed a little” with the other two, on average.

For each TIMSS 2011 participant, the percentage of students in each category is shown together with the students' average science achievement. The first page of the exhibit presents the results for countries participating at the fourth grade, and the average results across those countries. The second page of the exhibit presents the results for the sixth grade and benchmarking participants.

On average, more than half of the fourth grade students internationally **Like Learning Science**, substantially more than **Do Not Like Learning Science** (53% vs. 12%). The remaining fourth grade students (35%, on average) **Somewhat Like Learning Science**. Most important, however, on average, internationally, and in almost all TIMSS 2011 countries, including the sixth

## Exhibit 8.1: Students Like Learning Science

Reported by Students

Students were scored according to their degree of agreement with five statements on the *Students Like Learning Science* scale. Students who **Like Learning Science** had a score on the scale of at least 9.7, which corresponds to their “agreeing a lot” with three of the five statements and “agreeing a little” with the other two, on average. Students who **Do Not Like Learning Science** had a score no higher than 7.6, which corresponds to their “disagreeing a little” with three of the five statements and “agreeing a little” with the other two, on average. All other students **Somewhat Like Learning Science**.

Country	Like Learning Science		Somewhat Like Learning Science		Do Not Like Learning Science		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Turkey	73 (0.9)	486 (3.3)	24 (0.8)	410 (7.0)	3 (0.3)	393 (8.6)	10.9 (0.04)
Tunisia	72 (1.5)	376 (5.3)	24 (1.3)	278 (6.3)	4 (0.5)	262 (11.3)	11.0 (0.06)
Iran, Islamic Rep. of	68 (1.1)	473 (3.5)	27 (1.0)	412 (5.1)	5 (0.5)	415 (9.0)	10.7 (0.04)
Georgia	68 (1.1)	479 (3.1)	27 (0.9)	423 (5.6)	5 (0.5)	422 (10.6)	10.7 (0.04)
Portugal	66 (1.8)	533 (3.9)	31 (1.7)	502 (4.8)	4 (0.5)	489 (7.5)	10.5 (0.06)
Lithuania	63 (1.2)	524 (2.2)	29 (1.0)	502 (4.0)	8 (0.5)	498 (7.0)	10.4 (0.05)
Russian Federation	62 (1.2)	561 (3.6)	30 (0.9)	540 (4.1)	7 (0.5)	542 (5.6)	10.4 (0.05)
Kazakhstan	62 (1.3)	509 (5.1)	34 (1.3)	474 (6.1)	4 (0.4)	488 (13.4)	10.4 (0.06)
Armenia	61 (1.4)	433 (4.1)	30 (1.1)	396 (5.4)	9 (0.6)	380 (6.8)	10.5 (0.05)
Saudi Arabia	61 (1.5)	461 (4.9)	30 (1.1)	392 (7.9)	8 (0.8)	380 (10.5)	10.4 (0.06)
Romania	61 (1.4)	530 (5.6)	32 (1.2)	477 (7.5)	8 (0.6)	459 (16.1)	10.3 (0.06)
United Arab Emirates	60 (0.8)	462 (2.7)	31 (0.7)	383 (3.4)	8 (0.4)	377 (5.0)	10.4 (0.03)
Ireland	59 (1.5)	529 (3.2)	29 (1.0)	506 (4.4)	12 (1.0)	490 (9.1)	10.2 (0.07)
Chinese Taipei	58 (1.4)	564 (2.2)	30 (0.9)	537 (3.5)	11 (0.8)	533 (5.3)	10.1 (0.06)
Germany	58 (1.5)	538 (3.1)	30 (1.0)	524 (3.3)	12 (0.9)	517 (5.8)	10.1 (0.07)
Singapore	57 (0.7)	600 (3.4)	31 (0.6)	567 (4.3)	12 (0.5)	555 (5.4)	10.1 (0.03)
Poland	57 (0.9)	516 (2.9)	33 (0.9)	494 (3.1)	10 (0.5)	487 (6.0)	10.1 (0.04)
Kuwait	57 (1.4)	384 (5.1)	32 (1.1)	308 (5.2)	11 (0.9)	330 (10.7)	10.2 (0.06)
Norway	56 (1.7)	503 (2.5)	31 (1.4)	486 (3.7)	12 (0.9)	482 (4.9)	10.1 (0.07)
Thailand	56 (1.5)	498 (5.6)	38 (1.3)	444 (6.8)	6 (0.5)	420 (9.8)	10.1 (0.05)
United States	56 (0.8)	555 (2.3)	29 (0.5)	535 (3.3)	15 (0.6)	530 (3.3)	10.0 (0.04)
Oman	55 (1.1)	419 (4.1)	38 (0.9)	334 (6.1)	7 (0.4)	304 (9.5)	10.3 (0.04)
Australia	55 (1.0)	529 (2.8)	31 (0.7)	506 (3.9)	14 (0.7)	496 (5.2)	10.0 (0.05)
Malta	55 (0.8)	469 (2.8)	29 (0.8)	424 (3.9)	16 (0.6)	411 (3.7)	9.9 (0.04)
Croatia	55 (1.2)	522 (2.2)	30 (0.8)	507 (3.0)	15 (0.9)	514 (3.5)	10.0 (0.06)
Bahrain	55 (1.6)	484 (3.3)	33 (1.0)	422 (4.6)	12 (1.1)	412 (7.2)	10.1 (0.08)
New Zealand	55 (1.1)	512 (2.5)	32 (0.8)	486 (3.7)	13 (0.8)	468 (5.5)	10.0 (0.05)
Austria	53 (1.1)	540 (3.0)	33 (0.9)	524 (3.4)	14 (0.8)	521 (4.8)	9.9 (0.05)
Hong Kong SAR	52 (1.3)	551 (3.5)	35 (0.9)	523 (4.9)	14 (0.8)	507 (6.6)	9.9 (0.05)
Japan	52 (1.2)	566 (2.0)	40 (0.9)	554 (2.3)	9 (0.8)	538 (5.7)	9.9 (0.05)
Italy	51 (1.2)	532 (3.0)	36 (0.9)	519 (3.8)	12 (0.7)	515 (4.4)	9.9 (0.05)
Northern Ireland	51 (1.4)	533 (2.5)	36 (1.1)	509 (3.9)	13 (0.8)	483 (5.4)	9.8 (0.06)
Qatar	50 (1.8)	453 (5.2)	40 (1.5)	354 (5.5)	11 (0.8)	347 (12.6)	10.0 (0.07)
Slovak Republic	49 (1.2)	543 (3.5)	37 (0.9)	523 (4.6)	14 (0.8)	524 (5.5)	9.8 (0.05)
Serbia	48 (1.3)	525 (3.3)	41 (0.9)	507 (3.8)	11 (0.8)	511 (7.2)	9.8 (0.06)
Chile	48 (1.2)	501 (2.7)	39 (0.8)	462 (3.4)	13 (0.7)	471 (4.6)	9.8 (0.05)
Spain	48 (1.3)	519 (2.8)	36 (1.0)	491 (4.1)	16 (0.9)	502 (4.4)	9.7 (0.06)
Sweden	48 (1.5)	537 (3.1)	38 (1.1)	536 (3.3)	13 (0.8)	523 (4.7)	9.8 (0.06)
Hungary	48 (1.1)	554 (4.0)	36 (0.8)	519 (4.3)	16 (0.9)	519 (5.4)	9.7 (0.06)
Netherlands	45 (1.7)	536 (2.8)	36 (1.1)	529 (2.8)	19 (1.2)	524 (3.7)	9.6 (0.08)
Czech Republic	45 (1.3)	544 (2.8)	37 (1.0)	530 (3.5)	18 (0.9)	532 (4.0)	9.6 (0.06)
Denmark	44 (1.3)	533 (3.4)	36 (0.7)	526 (3.7)	19 (1.3)	527 (3.1)	9.5 (0.07)
Morocco	44 (1.8)	308 (5.9)	46 (1.4)	236 (5.2)	11 (0.9)	212 (9.0)	9.8 (0.07)
England	44 (1.5)	535 (4.1)	35 (1.1)	528 (4.1)	21 (1.1)	518 (3.9)	9.4 (0.07)
Belgium (Flemish)	42 (1.2)	516 (2.0)	35 (0.9)	508 (2.6)	23 (1.0)	498 (3.0)	9.3 (0.05)
Slovenia	41 (1.1)	529 (3.2)	38 (0.8)	515 (3.4)	21 (1.0)	516 (5.1)	9.3 (0.05)
Yemen	39 (2.1)	257 (8.2)	49 (1.9)	193 (6.7)	12 (1.4)	153 (12.3)	9.6 (0.08)
Korea, Rep. of	39 (0.9)	604 (3.1)	45 (0.9)	583 (2.0)	16 (0.7)	559 (3.6)	9.4 (0.04)
Finland	36 (1.2)	578 (3.2)	39 (1.0)	571 (3.2)	25 (1.1)	561 (3.4)	9.1 (0.06)
Azerbaijan	33 (1.5)	477 (6.2)	62 (1.3)	441 (5.6)	5 (0.6)	415 (14.3)	9.6 (0.06)
International Avg.	53 (0.2)	504 (0.5)	35 (0.1)	469 (0.7)	12 (0.1)	461 (1.1)	

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

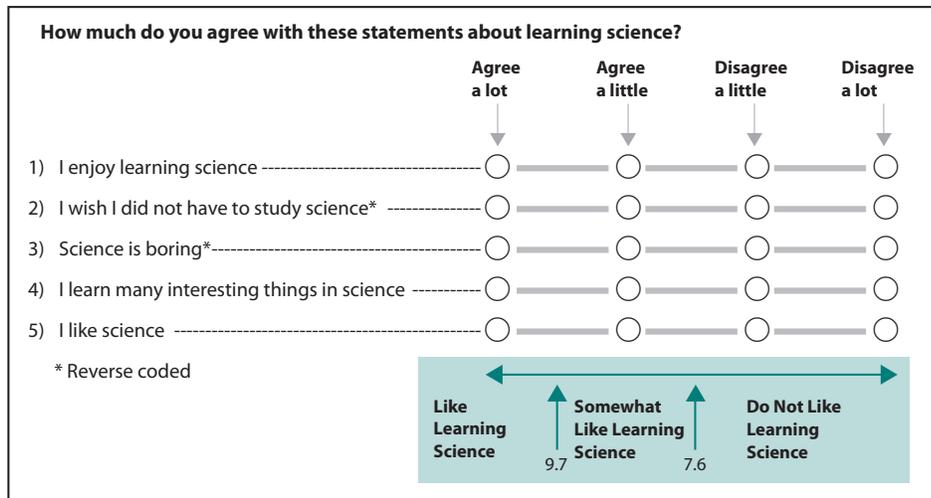
An “r” indicates data are available for at least 70% but less than 85% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 8.1: Students Like Learning Science (Continued)**

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Like Learning Science		Somewhat Like Learning Science		Do Not Like Learning Science		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Sixth Grade Participants</b>							
Botswana	53 (1.4)	436 (5.0)	37 (1.2)	306 (4.9)	10 (0.6)	249 (8.8)	10.0 (0.06)
Yemen	48 (1.7)	388 (6.7)	44 (1.5)	314 (7.1)	8 (0.7)	295 (13.8)	9.9 (0.07)
Honduras	41 (1.8)	464 (6.2)	54 (1.9)	412 (5.8)	5 (0.4)	412 (12.9)	9.8 (0.06)
<b>Benchmarking Participants</b>							
Dubai, UAE	66 (1.0)	492 (3.0)	27 (0.8)	420 (4.3)	7 (0.5)	400 (8.3)	10.6 (0.04)
North Carolina, US	64 (1.9)	547 (4.0)	26 (1.4)	527 (6.7)	10 (0.9)	520 (8.2)	10.4 (0.08)
Alberta, Canada	59 (1.6)	550 (2.5)	31 (1.2)	533 (4.1)	10 (0.7)	524 (6.5)	10.2 (0.07)
Abu Dhabi, UAE	58 (1.8)	448 (4.9)	33 (1.5)	364 (5.4)	9 (0.8)	373 (9.0)	10.3 (0.08)
Quebec, Canada	52 (1.4)	524 (3.0)	34 (1.0)	511 (3.7)	14 (1.0)	502 (4.8)	9.9 (0.06)
Florida, US	51 (1.7)	556 (4.2)	30 (1.2)	540 (4.1)	18 (1.0)	529 (5.4)	9.8 (0.07)
Ontario, Canada	48 (1.1)	537 (3.4)	35 (0.8)	525 (3.3)	16 (0.9)	510 (4.4)	9.7 (0.06)



grade and benchmarking participants, students who liked learning science had higher average science achievement than those who only somewhat or did not like learning science.

Exhibit 8.2 presents the corresponding results for the eighth grade on the Students Like Learning Science scale. Because 16 of the TIMSS countries teach science subjects separately (i.e., biology, chemistry, physics, and earth science) at the eighth grade rather than as a general or integrated subject, TIMSS asked students in these countries about their liking for the individual science subjects and the results were scaled separately for each subject. The first page of Exhibit 8.2 presents the results for general or integrated science for the eighth grade countries, and also for the ninth grade and benchmarking participants, as all of these teach science as a general or integrated subject. The second and third pages of the exhibit present the results for biology (second page) and chemistry, physics, and earth science (third page) in separate panels.

Looking first at general or integrated science and comparing to the fourth grade, substantially fewer eighth grade students reported positive attitudes toward learning science. At the eighth grade, about one-third (35%) of the students, internationally, on average, **Like Learning Science** (compared to 53% at the fourth grade), and about one-fifth (21%) **Do Not Like Learning Science**. Accompanying the decrease from the fourth to eighth grades in liking learning science is a widening achievement gap between students who like learning science (515, on average) and those who do not (450).

It is noticeable that some of the highest performing countries have the smallest percentages of students reporting positive attitudes toward learning science, such as Chinese Taipei, Japan, and Korea. The tendency of smaller percentages of students in some East Asian countries to report positive attitudes is consistent with previous TIMSS assessments. The relatively low percentages of students liking learning science may partially result from the high level of difficulty of the science being studied, and also these countries have a cultural tradition of serious attitudes toward learning.

Across countries teaching the sciences as separate subjects, the average percentages of students liking learning biology and earth science (36% and 33%, respectively) were similar to the percentage liking general or integrated science, but fewer students reported liking learning chemistry (25%) and physics (26%). In all four science subjects, the students who liked learning the subject had higher average achievement than those who only somewhat liked or did not like learning it.

## Exhibit 8.2: Students Like Learning Science

Reported by Students

The general/integrated science panel summarizes responses for countries where students are enrolled in science as a single subject. The remaining panels for biology, chemistry, physics, and earth science summarize responses for countries where students are taught science as separate subjects.

For general/integrated science, students were scored according to their degree of agreement with five statements on the *Students Like Learning Science* scale. Students who **Like Learning Science** had a score on the scale of at least 10.8, which corresponds to their “agreeing a lot” with three of the five statements and “agreeing a little” with the other two, on average. Students who **Do Not Like Learning Science** had a score on the scale no higher than 8.4, which corresponds to their “disagreeing a little” with three of the five statements and “agreeing a little” with the other two, on average. All other students **Somewhat Like Learning Science**. For biology, chemistry, physics, and earth science, a comparable procedure was used.

### Students Like Learning General/Integrated Science

General/Integrated Science	Like Learning Science		Somewhat Like Learning Science		Do Not Like Learning Science		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Country							
Tunisia	56 (1.2)	450 (2.6)	37 (1.0)	426 (2.8)	8 (0.5)	422 (5.7)	11.0 (0.04)
Iran, Islamic Rep. of	54 (1.2)	489 (4.2)	36 (0.9)	456 (4.1)	10 (0.7)	466 (6.4)	10.8 (0.05)
Turkey	49 (1.1)	509 (3.5)	40 (0.9)	462 (3.8)	11 (0.6)	453 (5.5)	10.6 (0.04)
Jordan	47 (1.2)	485 (3.4)	42 (0.9)	430 (4.2)	11 (0.6)	420 (6.5)	10.7 (0.05)
Oman	45 (0.9)	474 (2.5)	45 (0.8)	387 (3.9)	10 (0.4)	361 (5.2)	10.7 (0.03)
Saudi Arabia	45 (1.5)	460 (3.7)	37 (1.0)	421 (4.2)	18 (1.1)	413 (5.7)	10.4 (0.07)
Ghana	45 (1.5)	357 (4.9)	48 (1.2)	277 (5.6)	7 (0.5)	223 (10.9)	10.7 (0.05)
United Arab Emirates	43 (0.9)	496 (2.4)	40 (0.7)	447 (3.1)	17 (0.7)	433 (3.0)	10.3 (0.04)
Malaysia	42 (1.4)	457 (5.8)	44 (0.9)	418 (6.3)	13 (1.0)	364 (9.4)	10.4 (0.06)
Chile	40 (1.2)	475 (2.6)	43 (0.8)	455 (2.9)	17 (0.9)	451 (4.2)	10.2 (0.05)
Singapore	38 (0.8)	617 (5.2)	46 (0.7)	584 (4.2)	16 (0.5)	542 (5.4)	10.2 (0.03)
Palestinian Nat'l Auth.	38 (1.4)	459 (3.5)	46 (1.1)	405 (4.3)	16 (1.0)	385 (6.1)	10.3 (0.06)
Qatar	36 (1.4)	479 (5.0)	44 (1.2)	393 (3.9)	19 (0.9)	373 (6.7)	10.1 (0.06)
Thailand	34 (1.2)	473 (4.4)	56 (1.0)	443 (3.9)	10 (0.8)	431 (6.7)	10.1 (0.05)
Norway	33 (1.5)	519 (3.5)	44 (1.0)	492 (3.1)	23 (1.2)	466 (3.8)	9.9 (0.07)
England	32 (1.3)	562 (5.4)	45 (0.9)	532 (5.0)	23 (1.1)	500 (4.9)	9.9 (0.06)
Bahrain	32 (1.1)	493 (3.9)	45 (1.0)	445 (2.8)	23 (1.0)	422 (4.8)	9.9 (0.05)
Israel	29 (1.1)	547 (4.7)	37 (1.0)	507 (4.9)	34 (1.5)	501 (4.5)	9.4 (0.07)
United States	29 (0.7)	555 (3.1)	43 (0.7)	523 (2.6)	28 (0.7)	500 (3.0)	9.6 (0.04)
Hong Kong SAR	28 (1.2)	561 (4.1)	51 (0.9)	534 (3.3)	21 (1.1)	506 (4.9)	9.8 (0.06)
Italy	26 (1.0)	521 (3.1)	50 (1.0)	500 (3.2)	24 (0.9)	484 (4.1)	9.6 (0.05)
Australia	25 (1.3)	559 (6.1)	42 (1.0)	521 (4.8)	33 (1.3)	490 (4.9)	9.3 (0.07)
New Zealand	24 (1.0)	549 (5.2)	46 (0.7)	510 (4.7)	30 (1.3)	494 (5.3)	9.4 (0.06)
Chinese Taipei	17 (0.8)	618 (3.4)	43 (0.7)	571 (2.7)	40 (1.1)	534 (2.6)	9.0 (0.05)
Japan	15 (0.8)	595 (3.7)	47 (1.1)	566 (2.2)	38 (1.5)	531 (3.1)	9.0 (0.06)
Korea, Rep. of	11 (0.5)	623 (3.8)	43 (0.9)	576 (2.1)	46 (1.1)	531 (2.2)	8.7 (0.04)
International Avg.	35 (0.2)	515 (0.8)	44 (0.2)	472 (0.8)	21 (0.2)	450 (1.1)	

### Ninth Grade Participants

Botswana	57 (1.2)	443 (3.1)	34 (0.8)	369 (3.8)	9 (0.5)	330 (8.6)	11.0 (0.05)
South Africa	41 (1.1)	376 (3.0)	45 (0.8)	311 (4.5)	14 (0.6)	313 (6.4)	10.4 (0.04)
Honduras	39 (1.3)	385 (4.4)	49 (1.0)	359 (4.5)	11 (0.9)	370 (6.5)	10.4 (0.06)

### Benchmarking Participants

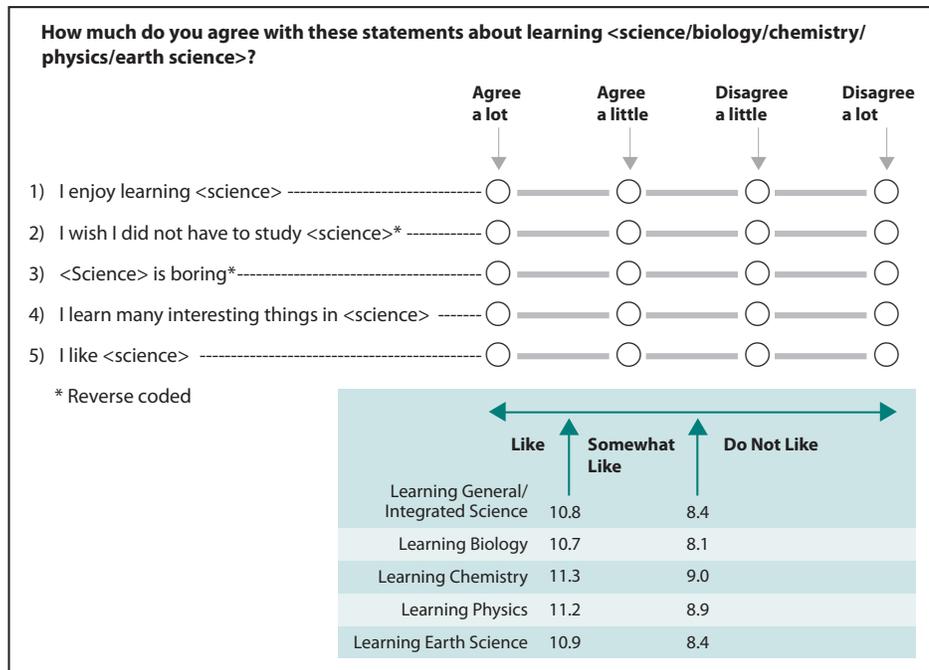
Dubai, UAE	49 (1.1)	511 (2.9)	37 (0.9)	468 (3.7)	14 (0.7)	446 (4.7)	10.6 (0.05)
Abu Dhabi, UAE	40 (1.3)	494 (4.6)	41 (1.0)	443 (4.7)	19 (1.3)	436 (5.3)	10.2 (0.07)
Massachusetts, US	37 (1.9)	589 (5.6)	41 (1.3)	565 (5.3)	22 (2.0)	536 (5.4)	10.0 (0.10)
Colorado, US	33 (1.7)	566 (5.7)	42 (1.4)	537 (4.6)	25 (1.4)	521 (5.6)	9.8 (0.07)
Alberta, Canada	30 (1.4)	566 (3.3)	44 (1.1)	543 (2.8)	25 (1.2)	528 (2.9)	9.7 (0.07)
Connecticut, US	30 (1.9)	563 (6.5)	41 (1.4)	527 (5.2)	29 (1.7)	516 (6.3)	9.6 (0.10)
Ontario, Canada	29 (1.1)	543 (3.8)	45 (0.8)	519 (3.0)	26 (1.1)	499 (3.1)	9.7 (0.05)
California, US	29 (1.3)	530 (5.2)	43 (1.3)	496 (4.8)	28 (1.5)	475 (5.9)	9.6 (0.07)
North Carolina, US	29 (1.3)	564 (7.1)	44 (1.1)	529 (7.4)	27 (1.7)	503 (6.9)	9.6 (0.09)
Minnesota, US	29 (2.0)	582 (5.0)	44 (1.3)	549 (4.4)	28 (1.8)	532 (5.7)	9.6 (0.10)
Alabama, US	28 (1.4)	508 (7.7)	44 (1.1)	485 (6.6)	28 (1.1)	470 (6.2)	9.6 (0.06)
Florida, US	28 (1.8)	567 (7.9)	42 (1.4)	532 (6.8)	30 (2.1)	502 (8.6)	9.5 (0.10)
Indiana, US	27 (1.8)	558 (6.3)	40 (1.3)	532 (5.6)	32 (1.8)	514 (4.9)	9.4 (0.10)
Quebec, Canada	24 (1.1)	547 (3.6)	48 (0.9)	522 (2.7)	29 (1.2)	496 (3.6)	9.5 (0.06)

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

A dash (-) indicates comparable data are not available.

An "r" indicates data are available for at least 70% but less than 85% of the students.



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Separate Science Panels

Students Like Learning Biology

Biology	Like Learning Biology		Somewhat Like Learning Biology		Do Not Like Learning Biology		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Ukraine	56 (1.4)	507 (4.1)	37 (1.2)	495 (4.2)	8 (0.7)	501 (7.6)	10.9 (0.06)
Georgia	56 (1.3)	441 (2.9)	34 (1.1)	409 (3.5)	10 (0.8)	406 (7.0)	10.8 (0.06)
Armenia	53 (1.4)	451 (3.3)	35 (1.0)	426 (4.4)	12 (0.8)	434 (5.3)	10.7 (0.07)
Syrian Arab Republic	51 (1.3)	446 (3.8)	42 (1.2)	413 (4.0)	7 (0.5)	400 (7.2)	10.8 (0.05)
Morocco	51 (0.9)	400 (2.0)	41 (0.7)	357 (2.7)	8 (0.4)	354 (6.4)	10.8 (0.04)
Kazakhstan	46 (1.4)	505 (4.1)	50 (1.4)	480 (4.7)	4 (0.4)	496 (8.5)	10.6 (0.05)
Romania	36 (1.5)	484 (3.9)	45 (1.0)	459 (4.0)	19 (1.0)	454 (5.6)	10.0 (0.07)
Russian Federation	36 (0.9)	546 (4.5)	50 (0.8)	540 (3.4)	14 (0.9)	546 (5.0)	10.1 (0.05)
Lithuania	34 (1.3)	525 (3.1)	45 (1.1)	511 (3.2)	21 (1.1)	508 (3.9)	9.8 (0.06)
Lebanon	32 (1.3)	445 (5.7)	50 (1.0)	391 (5.6)	18 (1.0)	379 (6.1)	9.9 (0.06)
Macedonia, Rep. of	30 (1.2)	458 (5.3)	55 (1.1)	387 (5.4)	15 (1.1)	423 (10.2)	9.9 (0.06)
Hungary	28 (1.2)	536 (3.0)	43 (0.9)	514 (4.3)	29 (1.4)	525 (3.6)	9.5 (0.07)
Indonesia	24 (1.2)	414 (6.5)	71 (1.1)	405 (4.3)	5 (0.5)	385 (11.9)	9.8 (0.04)
Sweden	19 (0.9)	538 (4.0)	54 (0.9)	515 (2.8)	27 (1.1)	493 (3.6)	9.2 (0.05)
Finland	15 (0.7)	574 (4.5)	47 (1.0)	557 (2.7)	38 (1.3)	543 (2.7)	8.8 (0.05)
Slovenia	13 (0.8)	543 (4.4)	43 (1.2)	544 (2.9)	44 (1.5)	543 (3.7)	8.6 (0.06)
International Avg.	36 (0.3)	488 (1.1)	46 (0.3)	463 (1.0)	17 (0.2)	462 (1.7)	

**Exhibit 8.2: Students Like Learning Science (Continued)**

*Students Like Learning Chemistry*

Chemistry	Like Learning Chemistry		Somewhat Like Learning Chemistry		Do Not Like Learning Chemistry		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Kazakhstan	40 (1.5)	514 (4.6)	52 (1.4)	478 (4.7)	8 (0.6)	473 (6.7)	11.0 (0.05)
Morocco	39 (0.8)	403 (2.3)	47 (0.6)	361 (3.1)	13 (0.5)	365 (4.3)	10.9 (0.03)
Ukraine	35 (1.5)	521 (4.5)	40 (1.1)	495 (3.7)	25 (1.2)	489 (5.3)	10.4 (0.07)
Russian Federation	31 (0.9)	561 (4.1)	44 (0.8)	538 (4.0)	25 (1.0)	530 (3.4)	10.4 (0.05)
Lebanon	31 (1.3)	447 (5.1)	52 (1.1)	390 (5.2)	18 (1.0)	386 (7.2)	10.5 (0.06)
Armenia	28 (1.3)	464 (4.2)	39 (0.8)	430 (3.7)	32 (1.4)	435 (4.0)	10.0 (0.08)
Syrian Arab Republic	28 (1.2)	451 (4.7)	54 (1.0)	421 (4.2)	18 (0.9)	418 (4.7)	10.4 (0.05)
Lithuania	25 (1.1)	539 (3.2)	41 (0.8)	510 (3.2)	34 (1.3)	503 (3.3)	9.9 (0.06)
Macedonia, Rep. of	23 (1.2)	451 (6.0)	46 (1.2)	395 (5.8)	31 (1.6)	415 (6.2)	9.9 (0.07)
Romania	20 (1.2)	503 (4.7)	42 (1.1)	459 (3.6)	37 (1.8)	457 (4.1)	9.7 (0.08)
Slovenia	16 (0.8)	579 (4.2)	39 (1.2)	547 (3.2)	45 (1.6)	529 (3.2)	9.3 (0.06)
Hungary	16 (0.8)	548 (4.8)	35 (1.0)	515 (3.7)	49 (1.4)	521 (3.4)	9.2 (0.06)
Sweden	15 (0.9)	546 (5.2)	47 (0.9)	517 (3.1)	38 (1.2)	496 (2.8)	9.5 (0.05)
Finland	13 (0.9)	594 (4.4)	35 (1.2)	562 (2.9)	52 (1.7)	540 (2.7)	9.1 (0.07)
Indonesia	9 (0.7)	390 (8.6)	72 (1.2)	399 (4.7)	19 (1.4)	405 (7.0)	9.9 (0.04)
Georgia	--	--	--	--	--	--	--
International Avg.	25 (0.3)	501 (1.3)	46 (0.3)	468 (1.0)	30 (0.3)	464 (1.2)	

*Students Like Learning Physics*

Physics	Like Learning Physics		Somewhat Like Learning Physics		Do Not Like Learning Physics		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Armenia	44 (1.6)	465 (3.5)	40 (1.2)	424 (4.2)	16 (0.9)	419 (5.9)	10.9 (0.07)
Morocco	42 (0.8)	404 (2.4)	47 (0.7)	362 (2.9)	11 (0.4)	370 (3.3)	11.0 (0.03)
Georgia	42 (1.4)	447 (4.2)	40 (1.2)	418 (3.3)	18 (1.1)	402 (6.4)	10.7 (0.06)
Ukraine	40 (1.6)	523 (4.2)	42 (1.2)	491 (3.9)	19 (1.2)	484 (4.8)	10.6 (0.07)
Kazakhstan	39 (1.7)	512 (5.2)	52 (1.4)	478 (4.3)	9 (0.8)	486 (8.6)	10.8 (0.06)
Russian Federation	34 (1.0)	562 (4.0)	48 (0.7)	536 (3.2)	18 (0.9)	523 (4.3)	10.5 (0.05)
Syrian Arab Republic	29 (1.0)	453 (4.4)	55 (0.9)	421 (4.0)	16 (0.7)	419 (4.8)	10.4 (0.04)
Lebanon	27 (1.3)	446 (5.9)	52 (1.2)	391 (5.3)	22 (1.1)	399 (6.1)	10.2 (0.06)
Macedonia, Rep. of	25 (1.2)	456 (5.5)	49 (1.1)	393 (5.5)	26 (1.3)	413 (7.0)	10.0 (0.06)
Hungary	20 (0.8)	555 (3.9)	39 (0.8)	519 (4.2)	41 (1.2)	514 (3.2)	9.4 (0.05)
Lithuania	19 (1.0)	536 (4.6)	41 (0.9)	512 (3.0)	40 (1.3)	508 (3.0)	9.4 (0.06)
Romania	17 (1.1)	499 (5.1)	45 (1.1)	461 (4.5)	38 (1.5)	461 (3.7)	9.5 (0.06)
Sweden	13 (0.7)	559 (5.0)	46 (0.9)	518 (3.1)	41 (1.1)	499 (2.8)	9.3 (0.04)
Indonesia	12 (0.9)	409 (8.3)	75 (0.8)	408 (4.9)	13 (1.0)	415 (5.2)	9.9 (0.04)
Finland	9 (0.7)	602 (5.0)	32 (1.0)	559 (3.2)	58 (1.3)	544 (2.7)	8.7 (0.06)
Slovenia	7 (0.6)	586 (6.6)	28 (1.0)	550 (4.1)	65 (1.1)	536 (2.8)	8.4 (0.04)
International Avg.	26 (0.3)	501 (1.3)	46 (0.3)	465 (1.0)	28 (0.3)	462 (1.2)	

*Students Like Learning Earth Science*

Earth Science	Like Learning Earth Science		Somewhat Like Learning Earth Science		Do Not Like Learning Earth Science		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Georgia	50 (1.2)	446 (3.3)	40 (1.0)	411 (3.8)	10 (0.7)	397 (6.1)	10.8 (0.05)
Armenia	50 (1.5)	456 (3.3)	37 (1.0)	424 (4.0)	13 (0.8)	429 (6.5)	10.7 (0.07)
Morocco	47 (0.8)	395 (2.1)	44 (0.7)	362 (3.2)	9 (0.4)	374 (3.5)	10.8 (0.03)
Kazakhstan	43 (1.6)	505 (4.6)	50 (1.3)	481 (4.5)	6 (0.7)	493 (10.0)	10.6 (0.06)
Ukraine	42 (1.6)	511 (4.4)	44 (1.2)	497 (4.2)	14 (1.1)	493 (5.5)	10.4 (0.07)
Macedonia, Rep. of	38 (1.4)	445 (4.9)	47 (1.1)	387 (5.6)	15 (1.0)	418 (9.8)	10.3 (0.06)
Romania	36 (1.4)	489 (3.7)	44 (1.0)	459 (4.9)	20 (1.3)	446 (5.5)	10.1 (0.07)
Syrian Arab Republic	35 (1.5)	450 (4.7)	52 (1.2)	418 (4.0)	12 (0.9)	401 (6.7)	10.3 (0.05)
Lithuania	35 (1.3)	531 (3.1)	45 (0.9)	507 (2.8)	21 (1.1)	506 (4.3)	10.0 (0.07)
Russian Federation	29 (1.1)	550 (3.9)	50 (0.8)	540 (3.6)	20 (1.1)	542 (4.3)	9.9 (0.06)
Sweden	21 (0.8)	529 (3.9)	54 (0.8)	513 (3.0)	25 (1.0)	500 (3.9)	9.5 (0.04)
Hungary	20 (1.2)	527 (5.4)	39 (0.9)	516 (3.9)	41 (1.7)	529 (3.0)	9.0 (0.08)
Finland	18 (0.9)	576 (4.3)	47 (0.8)	558 (2.6)	35 (1.2)	535 (2.6)	9.2 (0.05)
Slovenia	14 (0.8)	557 (4.5)	45 (1.2)	545 (3.0)	41 (1.5)	537 (3.4)	8.8 (0.07)
Indonesia	12 (1.0)	395 (8.7)	76 (0.9)	406 (4.2)	12 (0.8)	405 (6.4)	9.5 (0.04)
Lebanon	--	--	--	--	--	--	--
International Avg.	33 (0.3)	491 (1.2)	48 (0.3)	468 (1.0)	20 (0.3)	467 (1.5)	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

### *Students Value Science*

Exhibit 8.3 presents the results for the TIMSS 2011 Students Value Science scale, which only was given at the eighth grade. The scale itself addresses six different aspects of valuing science:

- ◆ I think learning science will help me in my daily life;
- ◆ I need science to learn other school subjects;
- ◆ I need to do well in science to get into the university of my choice;
- ◆ I need to do well in science to get the job I want;
- ◆ I would like a job that involves using science; and
- ◆ It is important to do well in science.

Students in countries teaching the sciences as separate subjects were asked about each of the four science subjects and the results were scaled separately. On each scale, students with a score corresponding to “agreeing a lot” with three of the statements and “agreeing a little” with the other three, on average, were considered to **Value** science. In comparison, students in the **Do Not Value** science category “disagreed a little” with three of the statements and “agreed a little” with the other three, on average. The first page of Exhibit 8.3 presents the results for general or integrated science for the eighth grade countries, and also for the ninth grade and benchmarking participants. The second and third pages of the exhibit present the results for biology (second page) and chemistry, physics, and earth science (third page) in separate panels.

Internationally, on average, eighth grade students in general or integrated science countries placed a high value on science. Forty-one percent were in the **Value** category and another 33 percent were in the **Somewhat Value** category, on average. However, about one-fourth (26%) were in the **Do Not Value** category. Across the eighth grade, ninth grade, and benchmarking participants, students who said they valued science typically had higher achievement than students who only valued it somewhat, and those students, in turn, had higher achievement than students who did not value science.

Students in countries teaching the sciences as separate subjects do not seem to value the individual science subjects in the same way as students in general science countries value science. Across the four subjects, only about one-fourth (25–29%) of the students reported that they value the science subjects, about one-third (33–36%) reported that they somewhat value the subjects, and about two-fifths (36–42%) reported that they did not value them. This

### Exhibit 8.3: Students Value Science

*Reported by Students*

The general/integrated science panel summarizes responses for countries where students are enrolled in science as a single subject. The remaining panels for biology, chemistry, physics, and earth science summarize responses for countries where students are taught science as separate subjects.

For general/integrated science, students were scored according to their degree of agreement with six statements on the *Students Value Science* scale. Students who **Value** science had a score on the scale of at least 10.5, which corresponds to their “agreeing a lot” with three of the six statements and “agreeing a little” with the other three, on average. Students who **Do Not Value** science had a score no higher than 8.6, which corresponds to their “disagreeing a little” with three of the six statements and “agreeing a little” with the other three, on average. All other students **Somewhat Value** science. For biology, chemistry, physics, and earth science, a comparable procedure was used.

*Students Value General/Integrated Science*

General/Integrated Science	Value		Somewhat Value		Do Not Value		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Country							
Ghana	80 (1.0)	323 (5.1)	16 (0.8)	266 (7.2)	4 (0.4)	224 (10.5)	11.6 (0.04)
Oman	69 (0.7)	441 (3.0)	24 (0.6)	393 (5.0)	7 (0.4)	361 (6.2)	11.2 (0.03)
Jordan	66 (1.0)	468 (3.1)	25 (0.8)	437 (5.6)	8 (0.5)	403 (7.9)	11.1 (0.04)
Tunisia	62 (0.9)	441 (2.7)	27 (0.7)	436 (2.9)	12 (0.6)	438 (5.0)	10.9 (0.04)
Palestinian Nat'l Auth.	62 (1.3)	437 (3.1)	27 (0.9)	406 (4.4)	11 (0.7)	379 (7.3)	10.9 (0.05)
Saudi Arabia	53 (1.2)	446 (3.9)	32 (0.8)	433 (4.4)	15 (0.8)	419 (6.2)	10.5 (0.05)
United Arab Emirates	51 (0.7)	474 (2.8)	30 (0.5)	459 (3.1)	18 (0.5)	453 (2.8)	10.4 (0.03)
Qatar	51 (1.3)	447 (4.0)	30 (0.9)	403 (4.7)	19 (1.0)	381 (8.2)	10.4 (0.06)
Iran, Islamic Rep. of	51 (1.0)	478 (4.7)	33 (0.8)	469 (4.2)	16 (0.7)	476 (5.1)	10.5 (0.04)
Thailand	49 (1.3)	466 (4.1)	43 (1.0)	441 (4.0)	8 (0.5)	424 (5.8)	10.5 (0.04)
Malaysia	49 (1.6)	453 (5.7)	34 (0.9)	419 (6.4)	17 (1.1)	370 (9.2)	10.3 (0.07)
Bahrain	49 (1.0)	473 (2.6)	31 (0.8)	447 (3.2)	21 (0.8)	430 (5.0)	10.3 (0.05)
England	41 (1.3)	547 (5.9)	37 (0.9)	530 (4.7)	22 (0.9)	516 (5.9)	10.1 (0.05)
Singapore	41 (0.8)	616 (4.6)	43 (0.7)	583 (4.3)	17 (0.6)	546 (5.9)	10.2 (0.03)
Turkey	40 (0.8)	500 (4.2)	36 (0.6)	476 (3.8)	23 (0.8)	469 (4.7)	10.0 (0.04)
Chile	39 (0.8)	466 (2.8)	36 (0.7)	458 (2.8)	25 (0.8)	462 (3.5)	9.9 (0.03)
Israel	37 (1.2)	531 (4.9)	30 (0.8)	516 (4.7)	32 (1.0)	503 (4.2)	9.7 (0.06)
United States	36 (0.7)	544 (3.0)	34 (0.5)	525 (2.7)	29 (0.6)	506 (2.9)	9.7 (0.03)
New Zealand	26 (0.8)	531 (5.3)	33 (0.8)	515 (5.2)	41 (1.2)	504 (4.4)	9.2 (0.05)
Hong Kong SAR	26 (1.0)	559 (4.1)	43 (0.8)	535 (3.8)	32 (1.1)	518 (4.0)	9.5 (0.04)
Australia	25 (1.3)	557 (6.4)	31 (0.8)	525 (5.5)	44 (1.3)	496 (3.8)	9.1 (0.07)
Norway	24 (0.9)	506 (4.1)	38 (1.0)	499 (3.7)	38 (1.1)	484 (2.6)	9.3 (0.04)
Korea, Rep. of	14 (0.6)	607 (4.1)	40 (0.9)	574 (2.3)	46 (1.0)	535 (2.2)	8.8 (0.03)
Italy	13 (0.6)	532 (5.7)	36 (0.9)	505 (2.8)	50 (0.8)	490 (3.1)	8.9 (0.03)
Chinese Taipei	12 (0.7)	612 (4.2)	30 (0.7)	586 (2.8)	58 (1.1)	543 (2.2)	8.5 (0.05)
Japan	10 (0.7)	595 (4.9)	34 (1.0)	574 (2.7)	56 (1.1)	540 (2.7)	8.5 (0.04)
International Avg.	41 (0.2)	502 (0.8)	33 (0.2)	477 (0.8)	26 (0.2)	457 (1.1)	

**Ninth Grade Participants**

Botswana	75 (0.8)	429 (3.0)	19 (0.6)	356 (4.8)	7 (0.4)	306 (9.0)	11.4 (0.03)
South Africa	57 (1.0)	344 (3.5)	26 (0.6)	319 (4.7)	16 (0.7)	346 (6.8)	10.7 (0.05)
Honduras	--	--	--	--	--	--	--

**Benchmarking Participants**

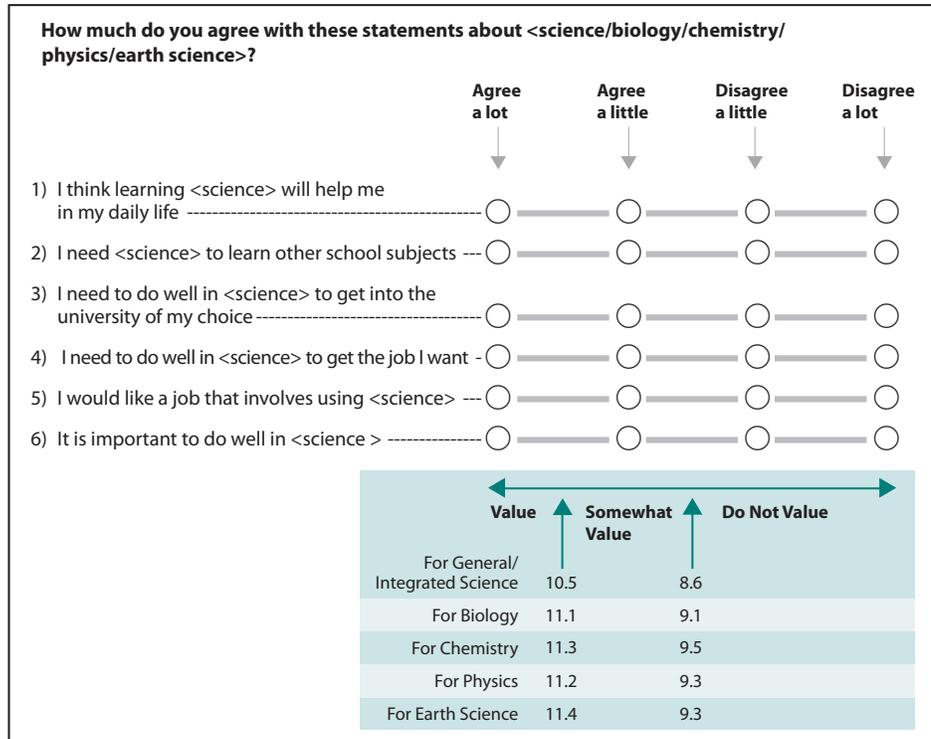
Dubai, UAE	52 (1.0)	494 (3.3)	29 (0.8)	479 (3.7)	19 (0.7)	476 (3.3)	10.4 (0.04)
Abu Dhabi, UAE	50 (1.1)	472 (4.6)	31 (0.8)	453 (5.1)	18 (0.9)	450 (5.2)	10.4 (0.05)
North Carolina, US	40 (1.5)	554 (6.5)	33 (1.2)	525 (7.8)	27 (1.1)	511 (6.2)	9.9 (0.06)
Alabama, US	39 (1.3)	490 (7.2)	34 (0.9)	491 (8.0)	27 (1.3)	476 (4.5)	9.9 (0.06)
Alberta, Canada	38 (1.0)	562 (3.2)	36 (0.9)	542 (2.6)	26 (1.0)	531 (3.1)	9.9 (0.05)
Minnesota, US	38 (1.7)	575 (4.7)	36 (1.1)	550 (5.0)	25 (1.5)	530 (5.3)	9.9 (0.07)
Indiana, US	37 (1.3)	552 (5.2)	35 (1.0)	533 (5.5)	28 (1.3)	510 (5.1)	9.8 (0.07)
Colorado, US	37 (1.4)	557 (5.6)	36 (1.0)	539 (6.0)	27 (1.2)	528 (5.0)	9.8 (0.06)
Florida, US	35 (1.8)	554 (7.7)	38 (1.4)	531 (8.3)	28 (1.7)	509 (7.7)	9.8 (0.08)
Massachusetts, US	34 (1.4)	587 (5.9)	36 (1.1)	567 (5.3)	30 (1.5)	546 (6.4)	9.7 (0.07)
Ontario, Canada	34 (1.1)	540 (3.3)	35 (0.9)	518 (3.4)	30 (0.9)	503 (3.4)	9.7 (0.05)
Connecticut, US	34 (1.3)	551 (6.1)	36 (0.8)	536 (4.6)	30 (1.2)	518 (5.6)	9.7 (0.07)
California, US	32 (1.3)	512 (5.5)	37 (1.2)	503 (5.7)	31 (1.1)	486 (4.8)	9.6 (0.05)
Quebec, Canada	27 (1.1)	539 (3.1)	39 (0.8)	525 (3.1)	34 (1.1)	502 (2.8)	9.5 (0.05)

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

A dash (–) indicates comparable data are not available.

An “r” indicates data are available for at least 70% but less than 85% of the students.



Separate Science Panels

Students Value Biology

Biology	Value		Somewhat Value		Do Not Value		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Country							
Morocco	60 (0.8)	376 (2.4)	29 (0.6)	378 (3.6)	11 (0.5)	393 (4.3)	11.4 (0.03)
Syrian Arab Republic	55 (1.1)	431 (4.1)	33 (0.9)	427 (4.7)	13 (0.7)	420 (7.1)	11.3 (0.04)
Lebanon	40 (1.3)	415 (5.2)	37 (1.0)	400 (6.3)	23 (1.1)	402 (6.7)	10.6 (0.06)
Macedonia, Rep. of	39 (1.4)	384 (5.5)	33 (0.9)	418 (5.5)	28 (1.3)	448 (7.1)	10.5 (0.07)
Kazakhstan	38 (1.5)	482 (4.2)	40 (1.1)	488 (4.9)	22 (1.5)	516 (4.9)	10.6 (0.07)
Georgia	32 (1.4)	412 (4.6)	34 (0.9)	432 (3.3)	34 (1.2)	437 (3.5)	10.1 (0.06)
Ukraine	32 (1.3)	495 (5.0)	36 (1.0)	499 (4.7)	32 (1.3)	512 (3.9)	10.1 (0.06)
Armenia	26 (0.9)	425 (4.8)	32 (0.9)	433 (3.7)	42 (1.0)	454 (3.4)	9.8 (0.05)
Lithuania	25 (1.0)	514 (3.6)	37 (0.9)	511 (3.6)	37 (1.2)	520 (3.0)	9.9 (0.05)
Indonesia	24 (1.3)	405 (7.8)	62 (1.0)	404 (4.3)	14 (0.9)	418 (5.2)	10.3 (0.05)
Russian Federation	23 (0.8)	534 (5.2)	30 (0.8)	535 (3.9)	47 (1.2)	553 (3.4)	9.6 (0.05)
Romania	20 (0.8)	459 (5.0)	31 (0.9)	463 (4.6)	49 (1.1)	473 (4.1)	9.4 (0.05)
Hungary	17 (0.7)	520 (6.0)	29 (0.9)	515 (3.9)	54 (1.2)	529 (2.8)	9.2 (0.05)
Slovenia	13 (0.7)	549 (5.1)	38 (0.8)	544 (3.5)	49 (1.1)	542 (2.8)	9.3 (0.04)
Sweden	13 (0.5)	526 (5.0)	38 (0.9)	518 (3.1)	49 (0.9)	507 (2.6)	9.4 (0.03)
Finland	6 (0.4)	577 (7.2)	26 (0.9)	564 (3.5)	68 (1.0)	549 (2.5)	8.6 (0.04)
International Avg.	29 (0.3)	469 (1.3)	35 (0.2)	471 (1.1)	36 (0.3)	480 (1.1)	

**Exhibit 8.3: Students Value Science (Continued)**

*Students Value Chemistry*

Chemistry	Value		Somewhat Value		Do Not Value		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Morocco	56 (0.7)	378 (2.6)	29 (0.5)	375 (3.4)	15 (0.6)	390 (3.5)	11.4 (0.03)
Syrian Arab Republic	48 (1.3)	430 (4.1)	33 (0.9)	426 (4.5)	19 (0.9)	433 (5.7)	11.1 (0.05)
Kazakhstan	39 (1.4)	487 (4.6)	40 (1.2)	489 (5.1)	20 (1.2)	507 (5.1)	10.9 (0.05)
Lebanon	36 (1.1)	411 (5.3)	37 (1.0)	400 (6.0)	27 (1.2)	412 (6.5)	10.7 (0.05)
Macedonia, Rep. of	33 (1.2)	386 (5.9)	29 (1.0)	409 (6.2)	38 (1.4)	442 (6.0)	10.2 (0.07)
Ukraine	26 (1.1)	498 (4.6)	34 (0.8)	501 (4.9)	40 (1.4)	506 (3.3)	10.0 (0.06)
Lithuania	25 (0.9)	519 (3.8)	34 (0.8)	513 (3.5)	41 (1.1)	513 (2.8)	10.0 (0.05)
Russian Federation	22 (1.0)	544 (4.1)	29 (0.6)	539 (4.3)	49 (0.9)	545 (3.4)	9.9 (0.05)
Armenia	20 (0.7)	428 (5.2)	23 (0.8)	427 (5.0)	57 (1.1)	449 (3.0)	9.4 (0.05)
Indonesia	17 (1.0)	392 (6.6)	55 (1.3)	397 (5.0)	28 (1.3)	411 (6.2)	10.2 (0.04)
Romania	16 (0.7)	462 (5.5)	26 (0.9)	464 (4.7)	57 (1.2)	471 (3.6)	9.3 (0.06)
Slovenia	15 (0.8)	566 (3.6)	37 (1.0)	549 (3.9)	48 (1.1)	533 (2.8)	9.7 (0.04)
Hungary	14 (0.6)	518 (6.9)	24 (0.7)	517 (5.1)	62 (0.9)	528 (2.6)	9.1 (0.04)
Sweden	11 (0.6)	518 (6.4)	33 (0.9)	520 (3.8)	56 (1.0)	510 (2.6)	9.5 (0.03)
Finland	7 (0.5)	584 (5.9)	26 (1.0)	570 (3.2)	67 (1.1)	545 (2.4)	8.9 (0.04)
Georgia	--	--	--	--	--	--	--
International Avg.	26 (0.2)	475 (1.3)	33 (0.2)	473 (1.2)	42 (0.3)	479 (1.1)	

*Students Value Physics*

Physics	Value		Somewhat Value		Do Not Value		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Morocco	60 (0.7)	379 (2.3)	26 (0.5)	378 (3.3)	14 (0.5)	393 (3.8)	11.4 (0.03)
Syrian Arab Republic	47 (1.2)	429 (4.3)	33 (1.0)	425 (4.2)	20 (0.9)	437 (5.1)	11.0 (0.05)
Kazakhstan	42 (1.4)	491 (5.0)	40 (1.0)	486 (5.2)	18 (1.1)	506 (4.9)	10.9 (0.06)
Lebanon	37 (1.4)	415 (5.4)	36 (1.2)	400 (6.3)	27 (1.3)	408 (6.7)	10.5 (0.06)
Macedonia, Rep. of	36 (1.3)	390 (6.1)	29 (0.8)	415 (5.7)	35 (1.4)	436 (6.5)	10.2 (0.07)
Georgia	34 (1.2)	422 (4.4)	32 (0.9)	426 (3.7)	33 (1.0)	436 (3.3)	10.2 (0.05)
Ukraine	29 (1.2)	508 (4.8)	35 (1.1)	503 (4.4)	36 (1.5)	498 (3.2)	10.0 (0.06)
Russian Federation	27 (1.2)	553 (4.5)	32 (0.8)	544 (3.6)	41 (1.2)	535 (3.3)	10.0 (0.05)
Armenia	27 (1.0)	440 (4.7)	28 (0.9)	434 (4.2)	45 (1.2)	447 (3.6)	9.9 (0.05)
Lithuania	23 (0.9)	521 (4.2)	35 (1.0)	513 (3.3)	41 (1.1)	513 (2.6)	9.8 (0.05)
Indonesia	20 (1.4)	397 (9.1)	58 (1.0)	409 (4.5)	22 (1.3)	424 (4.6)	10.2 (0.05)
Hungary	17 (0.5)	539 (4.9)	27 (0.8)	521 (5.1)	56 (0.9)	521 (2.5)	9.2 (0.04)
Romania	16 (0.9)	460 (5.4)	26 (1.0)	472 (6.1)	58 (1.4)	468 (3.4)	9.1 (0.06)
Slovenia	13 (0.6)	564 (4.5)	36 (0.9)	551 (3.4)	51 (0.9)	533 (2.9)	9.3 (0.04)
Sweden	13 (0.5)	528 (5.5)	35 (0.9)	522 (3.5)	52 (0.9)	508 (2.6)	9.4 (0.03)
Finland	7 (0.6)	581 (6.2)	24 (0.9)	570 (3.4)	69 (1.0)	546 (2.5)	8.6 (0.05)
International Avg.	28 (0.3)	476 (1.3)	33 (0.2)	473 (1.1)	39 (0.3)	476 (1.0)	

*Students Value Earth Science*

Earth Science	Value		Somewhat Value		Do Not Value		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Morocco	58 (0.7)	373 (2.3)	28 (0.5)	378 (2.9)	14 (0.5)	404 (3.4)	11.6 (0.03)
Syrian Arab Republic	48 (1.3)	425 (4.3)	32 (0.9)	427 (4.8)	20 (1.2)	436 (6.4)	11.1 (0.06)
Kazakhstan	35 (1.2)	482 (4.5)	43 (0.9)	487 (4.7)	22 (1.3)	516 (5.6)	10.7 (0.06)
Macedonia, Rep. of	35 (1.4)	379 (5.5)	35 (1.0)	417 (5.3)	30 (1.4)	449 (6.4)	10.5 (0.07)
Georgia	32 (1.2)	414 (4.8)	35 (0.9)	426 (4.0)	33 (1.3)	443 (3.6)	10.3 (0.06)
Lithuania	26 (0.8)	509 (3.7)	39 (0.9)	516 (2.9)	35 (1.0)	517 (3.3)	10.1 (0.05)
Ukraine	24 (1.2)	492 (5.5)	39 (1.0)	505 (4.4)	38 (1.5)	506 (3.9)	10.0 (0.06)
Armenia	20 (0.9)	423 (5.0)	32 (0.9)	432 (4.1)	48 (1.2)	453 (3.3)	9.7 (0.05)
Romania	19 (1.0)	448 (4.6)	33 (1.0)	468 (4.7)	48 (1.4)	474 (4.1)	9.6 (0.06)
Indonesia	17 (1.2)	390 (8.1)	58 (1.2)	402 (4.5)	25 (1.4)	422 (4.3)	10.2 (0.05)
Sweden	15 (0.6)	508 (4.8)	43 (0.9)	519 (3.1)	42 (1.0)	509 (3.1)	9.8 (0.03)
Russian Federation	14 (0.7)	525 (5.0)	29 (0.9)	542 (4.0)	57 (1.3)	548 (3.4)	9.3 (0.06)
Slovenia	13 (0.7)	545 (5.1)	40 (0.9)	549 (3.8)	47 (1.0)	539 (2.9)	9.5 (0.04)
Hungary	11 (0.6)	506 (7.2)	26 (0.8)	514 (4.4)	62 (1.2)	531 (2.5)	9.0 (0.05)
Finland	6 (0.5)	568 (7.6)	30 (0.9)	565 (2.9)	64 (1.0)	547 (2.4)	8.9 (0.04)
Lebanon	--	--	--	--	--	--	--
International Avg.	25 (0.3)	466 (1.4)	36 (0.2)	476 (1.1)	39 (0.3)	486 (1.1)	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

may be partly due to the nature of the questions making up the Students Value Science scale, several of which may be more suited to a general subject such as reading, mathematics, or science than to the more specific biology, chemistry, physics, and earth science. For example, students may indeed value science very highly and yet not agree that they “need biology to learn other school subjects” (question 2 on the scale), or that they “need to do well in earth science to get the job I want” (question 4 on the scale). As a result, the Students Value Science scale may underestimate the extent to which students in separate science countries actually value science, and inflate the percentage of students in the **Do Not Value** category. This may somewhat explain the absence of relationship with science achievement in chemistry and physics and the anomalous finding of higher average science achievement among students who **Do Not Value** biology and earth science compared to those who do value these subjects.

### *Students Confident in Science*

Exhibit 8.4 presents the fourth grade results for the TIMSS 2011 Students Confident in Science scale, which includes six statements such as “Science is harder for me than for many of my classmates” (reverse coded) and “My teacher tells me I am good at science” (see second page of exhibit for all six statements). **Confident** students “agreed a lot” with three of the six statements and “agreed a little” to the other three, on average. Students **Not Confident** in science “disagreed a little” with three of the statements and “agreed a little” with the other three, on average.

Internationally, on average, 43 percent of the fourth grade students expressed confidence in their science ability. Average science achievement was highest for the **Confident** fourth grade students and lowest (by 68 points) for the students lacking confidence (21% across countries). Similar to the results for “liking” to learn science at the eighth grade, students in some of the highest performing countries expressed the least confidence. For the sixth grade participants, somewhat fewer students expressed confidence (28–39%) and somewhat more expressed a lack of confidence (23–30%).

As shown in Exhibit 8.5 (second page), the TIMSS 2011 Student Confidence with Science scale for the eighth grade included nine statements, five of which also were included in the fourth grade scale. As with the other attitudinal scales, students in countries teaching the sciences as separate subjects were asked about each of the four science subjects and the results were scaled separately. On average internationally, only 20 percent of the eighth grade

students in general or integrated science countries expressed confidence in their science ability, with 49 percent **Somewhat Confident** and 31 percent **Not Confident**. The average achievement gap was large—86 points—between the **Confident** students and those **Not Confident**. To at least some extent, the eighth grade results for general or integrated science held constant across the ninth grade and benchmarking participants.

The eighth grade students in separate science countries were similar to students in general or integrated countries in their confidence with biology and earth science (21–19% confident, respectively), but less confident with chemistry and physics (14% confident for each). In all four science subjects there was a strong positive relationship between student confidence and average science achievement.

## Exhibit 8.4: Students Confident in Science

Reported by Students

Students were scored according to their degree of agreement with six statements on the *Students Confident in Science* scale. Students **Confident** in science had a score on the scale of at least 10.1, which corresponds to their “agreeing a lot” with three of the six statements and “agreeing a little” with the other three, on average. Students who were **Not Confident** had a score no higher than 8.3, which corresponds to their “disagreeing a little” with three of the six statements and “agreeing a little” with the other three, on average. All other students were **Somewhat Confident** in science.

Country	Confident		Somewhat Confident		Not Confident		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Croatia	62 (0.9)	529 (2.0)	25 (0.8)	505 (3.1)	13 (0.7)	479 (3.9)	10.9 (0.05)
Iran, Islamic Rep. of	61 (1.0)	479 (3.5)	27 (0.8)	423 (5.1)	11 (0.6)	393 (6.5)	10.9 (0.05)
Austria	59 (1.0)	549 (2.9)	28 (0.9)	522 (3.0)	13 (0.7)	478 (5.2)	10.7 (0.04)
Turkey	57 (1.0)	498 (3.3)	30 (0.7)	437 (4.7)	13 (0.7)	389 (6.8)	10.6 (0.05)
Saudi Arabia	56 (1.5)	463 (5.0)	28 (1.0)	409 (6.6)	16 (1.0)	370 (10.0)	10.7 (0.07)
Norway	55 (1.3)	507 (2.1)	33 (1.1)	486 (4.0)	11 (0.7)	466 (4.8)	10.5 (0.05)
Germany	53 (1.1)	548 (3.0)	33 (0.9)	524 (3.5)	13 (0.8)	483 (4.5)	10.4 (0.05)
Georgia	53 (1.2)	488 (3.2)	28 (1.0)	443 (5.0)	19 (0.9)	412 (5.7)	10.5 (0.06)
Oman	52 (0.9)	426 (4.5)	29 (0.7)	344 (5.1)	19 (0.6)	303 (6.5)	10.5 (0.05)
Romania	52 (1.3)	544 (4.5)	29 (1.0)	491 (7.5)	19 (1.2)	435 (10.1)	10.4 (0.06)
Kazakhstan	52 (1.5)	509 (5.2)	33 (1.3)	485 (6.2)	15 (0.9)	479 (7.7)	10.4 (0.07)
United Arab Emirates	51 (0.8)	463 (2.8)	30 (0.6)	411 (3.6)	18 (0.5)	368 (3.6)	10.4 (0.03)
Tunisia	51 (1.4)	380 (6.2)	35 (1.2)	329 (6.4)	14 (0.8)	278 (10.5)	10.3 (0.07)
Serbia	51 (1.4)	536 (3.1)	35 (1.1)	512 (4.0)	14 (1.0)	456 (7.4)	10.4 (0.06)
Kuwait	50 (1.2)	388 (5.5)	31 (0.8)	338 (5.9)	19 (0.9)	285 (7.2)	10.4 (0.05)
Hungary	50 (1.0)	568 (3.4)	30 (0.8)	520 (4.1)	21 (0.9)	483 (5.1)	10.3 (0.05)
Sweden	49 (1.2)	547 (3.0)	40 (1.1)	530 (3.3)	11 (0.7)	500 (5.5)	10.2 (0.05)
Russian Federation	48 (1.2)	570 (3.9)	32 (0.8)	548 (4.2)	20 (0.8)	521 (4.1)	10.2 (0.05)
United States	48 (0.8)	567 (2.0)	32 (0.6)	538 (3.2)	20 (0.6)	507 (3.0)	10.1 (0.03)
Azerbaijan	47 (1.8)	482 (5.6)	32 (1.3)	435 (6.0)	20 (1.0)	409 (6.2)	10.2 (0.07)
Ireland	47 (1.5)	533 (3.6)	36 (1.1)	516 (3.7)	17 (1.0)	481 (7.0)	10.1 (0.06)
Malta	47 (0.9)	478 (2.4)	29 (0.8)	435 (3.0)	24 (0.7)	400 (4.0)	10.1 (0.04)
Poland	46 (0.9)	528 (2.5)	35 (0.7)	502 (3.1)	19 (0.7)	460 (5.2)	10.1 (0.04)
Slovenia	46 (1.0)	543 (2.5)	37 (0.8)	515 (3.4)	17 (0.7)	475 (4.8)	10.1 (0.05)
Bahrain	46 (1.5)	488 (3.5)	33 (1.1)	448 (3.6)	21 (1.0)	396 (5.7)	10.2 (0.07)
Armenia	46 (1.2)	440 (4.0)	30 (0.8)	409 (5.8)	25 (1.0)	386 (5.1)	10.2 (0.06)
Qatar	45 (1.3)	453 (5.3)	31 (0.9)	378 (4.8)	24 (1.2)	333 (7.4)	10.2 (0.05)
Lithuania	45 (1.0)	534 (2.5)	37 (1.0)	511 (2.9)	18 (0.8)	478 (4.1)	10.0 (0.04)
Slovak Republic	44 (1.1)	556 (3.2)	35 (0.9)	529 (4.7)	20 (0.8)	488 (4.9)	10.0 (0.05)
Chinese Taipei	44 (1.3)	573 (2.4)	35 (0.8)	550 (3.2)	21 (1.0)	512 (4.4)	10.1 (0.06)
Australia	42 (1.0)	535 (3.2)	36 (0.9)	516 (3.4)	22 (0.9)	484 (4.4)	9.9 (0.04)
Spain	41 (1.2)	532 (2.4)	33 (1.0)	499 (4.0)	26 (1.1)	477 (4.0)	9.8 (0.05)
Portugal	41 (1.7)	548 (4.2)	44 (1.4)	514 (3.7)	15 (1.1)	474 (5.6)	10.0 (0.06)
Netherlands	39 (1.5)	545 (2.9)	44 (1.0)	529 (2.4)	17 (0.9)	507 (4.0)	9.8 (0.05)
Italy	39 (1.0)	540 (2.8)	44 (0.8)	524 (3.0)	17 (0.8)	496 (4.5)	9.9 (0.04)
Czech Republic	38 (1.2)	556 (3.0)	38 (1.1)	538 (3.1)	24 (1.0)	505 (4.2)	9.7 (0.06)
Finland	38 (1.1)	587 (3.3)	43 (0.9)	571 (2.6)	19 (0.8)	540 (4.6)	9.7 (0.04)
Northern Ireland	37 (1.4)	537 (2.9)	40 (1.0)	520 (3.0)	23 (1.1)	482 (4.4)	9.7 (0.05)
Belgium (Flemish)	37 (1.0)	525 (2.4)	42 (0.9)	510 (2.2)	22 (0.8)	478 (3.0)	9.7 (0.04)
Denmark	36 (1.0)	540 (3.1)	44 (0.9)	529 (2.8)	20 (0.9)	509 (4.9)	9.7 (0.04)
England	33 (1.3)	549 (4.5)	38 (1.1)	530 (3.8)	29 (1.1)	506 (3.4)	9.5 (0.05)
Yemen	30 (1.9)	269 (7.4)	41 (1.3)	204 (7.7)	29 (1.7)	171 (8.4)	9.6 (0.07)
Chile	30 (0.9)	520 (3.5)	37 (0.7)	481 (2.7)	33 (0.9)	449 (3.0)	9.4 (0.04)
New Zealand	28 (1.2)	530 (3.4)	40 (1.0)	504 (3.5)	32 (1.0)	463 (3.6)	9.3 (0.05)
Morocco	27 (1.4)	317 (5.3)	43 (1.0)	257 (5.7)	31 (1.6)	231 (6.0)	9.4 (0.06)
Singapore	26 (0.6)	620 (3.6)	36 (0.6)	592 (3.6)	37 (0.7)	552 (4.0)	9.1 (0.03)
Hong Kong SAR	25 (0.9)	560 (4.6)	36 (0.9)	539 (3.8)	39 (1.3)	516 (4.8)	9.1 (0.05)
Thailand	19 (1.0)	500 (5.9)	49 (1.2)	471 (6.2)	32 (1.3)	458 (6.9)	9.1 (0.04)
Japan	17 (0.8)	581 (3.1)	48 (0.9)	564 (2.2)	34 (1.0)	541 (3.2)	8.9 (0.03)
Korea, Rep. of	15 (0.7)	623 (3.8)	45 (0.8)	598 (2.1)	40 (1.0)	562 (2.3)	8.8 (0.03)
International Avg.	43 (0.2)	514 (0.5)	36 (0.1)	480 (0.6)	21 (0.1)	446 (0.8)	

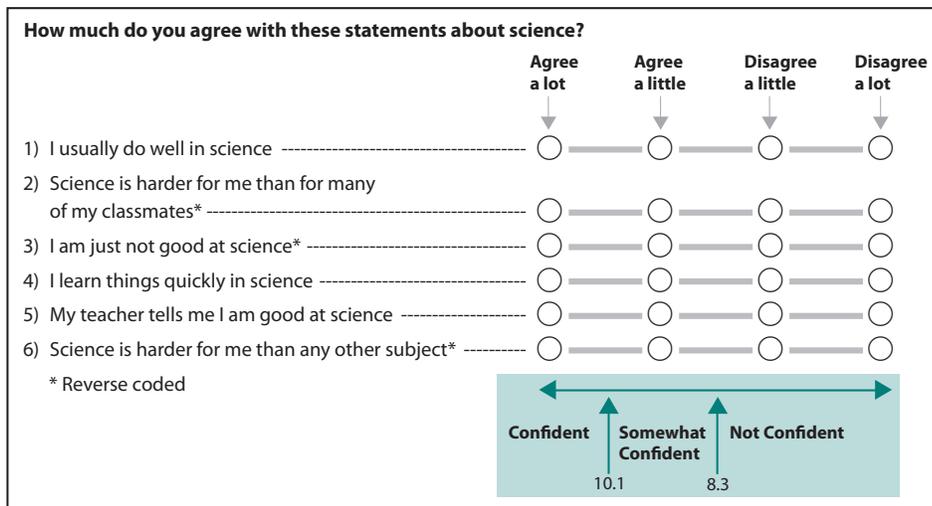
Centerpoint of scale set at 10.

(.) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

An “r” indicates data are available for at least 70% but less than 85% of the students.

**Exhibit 8.4: Students Confident in Science (Continued)**

Country	Confident		Somewhat Confident		Not Confident		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Sixth Grade Participants</b>							
Yemen	39 (1.9)	389 (7.5)	38 (1.2)	335 (6.9)	23 (1.6)	298 (9.2)	10.0 (0.08)
Botswana	32 (1.3)	448 (6.2)	41 (0.9)	348 (5.6)	27 (1.0)	308 (6.6)	9.6 (0.05)
Honduras	28 (1.7)	474 (8.0)	42 (1.2)	429 (5.2)	30 (1.3)	402 (5.9)	9.5 (0.07)
<b>Benchmarking Participants</b>							
North Carolina, US	55 (1.5)	556 (4.5)	30 (1.4)	531 (5.5)	16 (1.2)	498 (6.5)	10.4 (0.06)
Dubai, UAE	53 (0.9)	494 (3.1)	30 (0.9)	452 (3.4)	16 (0.6)	400 (5.6)	10.4 (0.04)
Alberta, Canada	53 (1.3)	557 (2.6)	34 (1.0)	533 (3.0)	14 (0.7)	506 (5.9)	10.4 (0.06)
Abu Dhabi, UAE	50 (1.7)	449 (4.9)	31 (1.1)	393 (6.8)	19 (1.1)	354 (6.0)	10.3 (0.07)
Quebec, Canada	47 (1.3)	528 (2.9)	38 (1.0)	512 (3.2)	15 (0.9)	491 (4.5)	10.1 (0.05)
Florida, US	47 (1.6)	565 (4.5)	30 (1.5)	540 (4.2)	23 (1.3)	517 (4.5)	10.1 (0.07)
Ontario, Canada	41 (1.0)	548 (3.2)	38 (0.9)	525 (3.6)	21 (1.1)	497 (4.7)	9.9 (0.05)



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

## Exhibit 8.5: Students Confident in Science

Reported by Students

The general/integrated science panel summarizes responses for countries where students are enrolled in science as a single subject. The remaining panels for biology, chemistry, physics, and earth science summarize responses for countries where students are taught science as separate subjects.

For general/integrated science, students were scored according to their degree of agreement with nine statements on the *Students Confident in Science* scale. Students **Confident** in science had a score on the scale of at least 11.5, which corresponds to their "agreeing a lot" with five of the nine statements and "agreeing a little" with the other four, on average. Students who were **Not Confident** had a score no higher than 9.0, which corresponds to their "disagreeing a little" with five of the nine statements and "agreeing a little" with the other four, on average. All other students were **Somewhat Confident** in science. For biology, chemistry, physics, and earth science, a comparable procedure was used.

### Students Confident in General/Integrated Science

General/Integrated Science Country	Confident		Somewhat Confident		Not Confident		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Tunisia	37 (1.1)	464 (2.9)	51 (0.9)	427 (2.4)	11 (0.6)	414 (3.9)	11.1 (0.05)
Iran, Islamic Rep. of	33 (1.0)	509 (4.5)	50 (0.7)	463 (4.0)	17 (0.8)	443 (4.7)	10.8 (0.05)
Israel	33 (1.2)	568 (4.0)	43 (1.0)	501 (4.6)	24 (1.1)	477 (4.8)	10.6 (0.07)
Oman	29 (0.9)	487 (2.9)	57 (0.8)	407 (3.3)	14 (0.4)	360 (5.2)	10.7 (0.04)
Jordan	29 (1.0)	507 (3.4)	56 (0.8)	440 (4.0)	15 (0.7)	407 (6.5)	10.7 (0.04)
Saudi Arabia	29 (1.2)	481 (4.0)	54 (1.0)	426 (3.8)	17 (1.0)	401 (6.0)	10.6 (0.06)
United Arab Emirates	29 (0.7)	512 (2.7)	52 (0.5)	454 (2.8)	19 (0.7)	428 (3.1)	10.6 (0.04)
Qatar	28 (1.6)	496 (5.4)	51 (1.4)	404 (3.5)	22 (0.9)	368 (6.2)	10.5 (0.07)
Ghana	27 (1.1)	372 (5.1)	56 (0.8)	295 (5.1)	16 (0.8)	256 (8.8)	10.6 (0.05)
United States	26 (0.7)	565 (3.3)	47 (0.5)	524 (2.6)	27 (0.7)	492 (3.0)	10.3 (0.04)
Turkey	25 (1.0)	549 (5.8)	48 (0.9)	474 (3.4)	26 (0.9)	441 (3.9)	10.3 (0.05)
Palestinian Nat'l Auth.	23 (1.1)	480 (3.6)	55 (1.0)	414 (3.9)	22 (1.0)	379 (5.7)	10.4 (0.05)
Norway	23 (1.0)	535 (3.6)	55 (0.9)	494 (3.0)	22 (1.1)	456 (3.8)	10.4 (0.05)
England	23 (1.2)	579 (5.2)	52 (1.2)	529 (5.4)	25 (1.2)	503 (5.0)	10.2 (0.06)
Bahrain	23 (0.9)	511 (4.1)	52 (0.9)	450 (2.6)	25 (0.9)	418 (4.2)	10.2 (0.05)
Chile	18 (0.7)	498 (3.0)	55 (1.0)	459 (2.8)	27 (1.3)	444 (3.5)	10.0 (0.05)
Australia	16 (1.1)	575 (6.5)	49 (1.1)	527 (4.8)	35 (1.4)	486 (4.6)	9.8 (0.06)
Singapore	14 (0.5)	630 (5.9)	48 (0.7)	600 (4.8)	37 (0.8)	562 (4.2)	9.6 (0.03)
New Zealand	14 (0.9)	570 (5.8)	46 (0.9)	519 (5.3)	40 (1.2)	490 (4.6)	9.6 (0.05)
Italy	13 (0.8)	540 (3.8)	61 (1.0)	505 (2.7)	26 (1.1)	473 (4.2)	9.9 (0.04)
Hong Kong SAR	8 (0.6)	579 (4.9)	47 (1.1)	544 (4.1)	45 (1.3)	520 (3.4)	9.2 (0.04)
Chinese Taipei	6 (0.4)	648 (4.9)	27 (0.9)	599 (3.1)	67 (1.0)	543 (2.3)	8.3 (0.05)
Thailand	5 (0.4)	498 (7.8)	58 (1.3)	451 (4.3)	37 (1.5)	448 (4.2)	9.3 (0.04)
Korea, Rep. of	4 (0.3)	652 (4.6)	33 (0.8)	603 (2.1)	63 (0.9)	532 (1.9)	8.7 (0.03)
Malaysia	4 (0.4)	511 (9.0)	45 (1.1)	437 (6.2)	51 (1.3)	411 (6.5)	9.1 (0.04)
Japan	3 (0.3)	631 (7.7)	28 (0.9)	591 (2.6)	69 (1.1)	540 (2.6)	8.4 (0.04)
International Avg.	20 (0.2)	536 (1.0)	49 (0.2)	482 (0.8)	31 (0.2)	450 (0.9)	

### Ninth Grade Participants

South Africa	17 (0.6)	399 (4.1)	59 (0.6)	326 (3.5)	24 (0.7)	323 (5.6)	10.1 (0.03)
Honduras	16 (0.9)	404 (5.3)	60 (1.0)	368 (4.4)	24 (1.3)	353 (4.2)	10.0 (0.05)
Botswana	15 (0.7)	485 (4.3)	54 (0.9)	401 (3.7)	31 (1.1)	381 (4.7)	9.9 (0.04)

### Benchmarking Participants

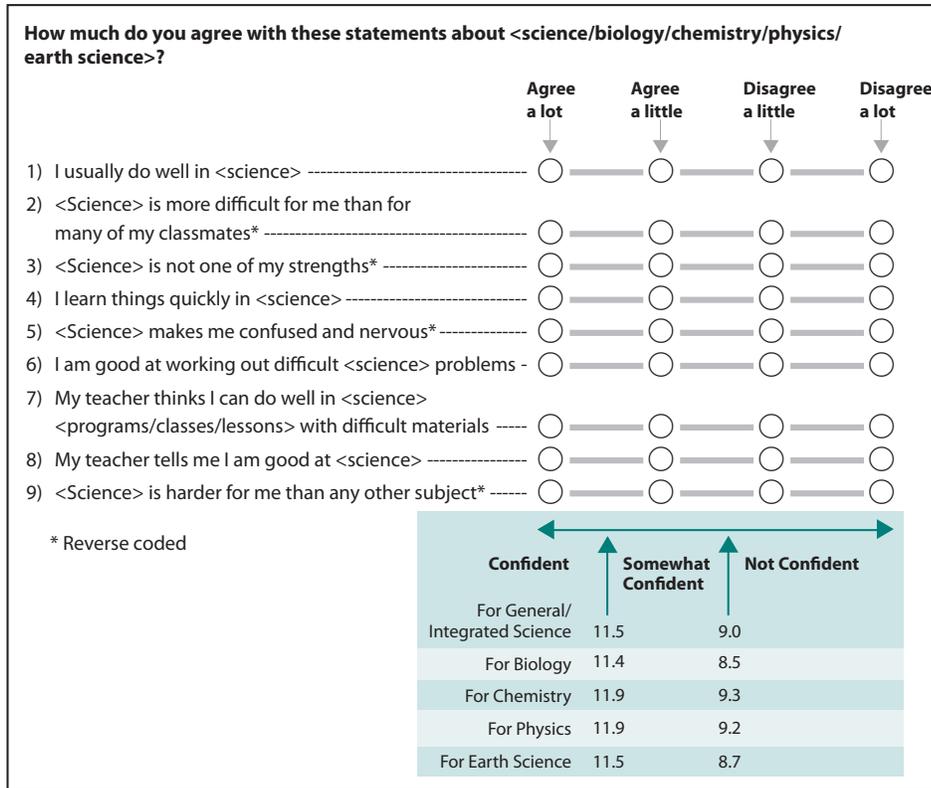
Massachusetts, US	33 (2.1)	604 (6.4)	46 (1.2)	561 (5.0)	21 (1.9)	526 (4.4)	10.7 (0.12)
Dubai, UAE	32 (1.1)	528 (3.5)	50 (0.9)	474 (3.6)	18 (0.7)	446 (4.4)	10.7 (0.05)
Connecticut, US	28 (1.9)	576 (6.7)	44 (1.3)	531 (5.1)	28 (1.7)	501 (5.2)	10.4 (0.10)
North Carolina, US	28 (1.6)	575 (7.4)	46 (1.2)	532 (7.0)	27 (1.8)	490 (5.1)	10.3 (0.11)
Abu Dhabi, UAE	27 (1.1)	509 (5.4)	53 (0.9)	450 (4.5)	20 (1.1)	429 (5.1)	10.5 (0.05)
Indiana, US	27 (1.4)	570 (5.4)	46 (1.0)	532 (4.9)	27 (1.8)	500 (5.0)	10.4 (0.09)
Minnesota, US	27 (2.0)	595 (4.4)	45 (1.2)	553 (3.9)	27 (1.7)	515 (5.3)	10.3 (0.10)
California, US	27 (1.5)	544 (4.3)	47 (1.1)	496 (4.5)	27 (1.8)	464 (5.6)	10.4 (0.09)
Colorado, US	26 (1.4)	579 (5.5)	49 (1.1)	539 (5.4)	25 (1.7)	511 (5.0)	10.4 (0.08)
Florida, US	24 (1.8)	570 (7.9)	47 (1.6)	535 (7.6)	29 (2.4)	499 (8.3)	10.2 (0.11)
Alabama, US	24 (1.4)	517 (8.3)	47 (1.4)	488 (6.0)	29 (2.0)	462 (6.7)	10.2 (0.09)
Ontario, Canada	22 (0.9)	560 (3.7)	49 (1.0)	521 (2.9)	30 (1.1)	492 (3.4)	10.1 (0.05)
Alberta, Canada	21 (1.0)	588 (2.9)	53 (0.9)	543 (2.9)	26 (1.2)	519 (3.0)	10.2 (0.06)
Quebec, Canada	19 (1.0)	550 (3.7)	60 (0.8)	521 (2.7)	21 (1.0)	491 (3.7)	10.2 (0.05)

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students.



Separate Science Panels

Students Confident in Biology

Biology Country	Confident		Somewhat Confident		Not Confident		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Georgia	32 (1.0)	472 (3.2)	48 (0.9)	417 (3.3)	20 (0.9)	380 (4.6)	10.6 (0.06)
Syrian Arab Republic	31 (1.3)	458 (4.6)	58 (1.1)	418 (3.5)	11 (0.8)	398 (5.5)	10.7 (0.06)
Kazakhstan	27 (1.4)	516 (4.7)	61 (1.2)	486 (4.7)	11 (0.8)	469 (6.7)	10.5 (0.07)
Macedonia, Rep. of	27 (1.0)	478 (4.8)	54 (1.0)	392 (5.7)	19 (1.0)	381 (7.0)	10.3 (0.05)
Russian Federation	23 (0.9)	565 (4.2)	57 (0.9)	543 (3.3)	20 (0.8)	519 (3.9)	10.1 (0.05)
Hungary	22 (1.1)	563 (3.7)	52 (0.9)	518 (3.3)	25 (1.2)	499 (4.9)	10.0 (0.07)
Ukraine	22 (1.1)	533 (5.0)	58 (1.0)	501 (3.5)	20 (1.0)	472 (5.5)	10.1 (0.06)
Morocco	22 (0.7)	424 (2.6)	59 (0.7)	370 (2.7)	19 (0.6)	353 (3.2)	10.1 (0.03)
Romania	21 (1.1)	504 (3.6)	55 (0.9)	466 (3.7)	25 (1.2)	439 (6.1)	9.9 (0.06)
Lebanon	21 (1.1)	467 (6.4)	56 (1.1)	400 (5.5)	23 (1.2)	368 (5.8)	10.0 (0.06)
Lithuania	19 (0.8)	547 (4.0)	58 (0.9)	513 (2.7)	23 (1.1)	492 (4.4)	9.9 (0.05)
Armenia	16 (0.8)	486 (3.9)	55 (1.0)	438 (3.4)	29 (1.2)	419 (4.4)	9.6 (0.05)
Slovenia	15 (0.8)	572 (3.9)	61 (0.9)	547 (2.9)	24 (1.1)	517 (4.5)	9.7 (0.05)
Sweden	14 (0.7)	558 (4.8)	66 (0.9)	517 (2.5)	20 (0.9)	474 (3.3)	9.8 (0.04)
Finland	14 (0.8)	592 (3.9)	59 (1.0)	557 (2.5)	27 (1.1)	530 (3.4)	9.6 (0.05)
Indonesia	5 (0.5)	412 (10.7)	67 (1.4)	403 (5.1)	29 (1.6)	413 (4.5)	9.2 (0.04)
International Avg.	21 (0.2)	509 (1.2)	58 (0.2)	468 (0.9)	22 (0.3)	445 (1.2)	

**Exhibit 8.5: Students Confident in Science (Continued)**

*Students Confident in Chemistry*

Chemistry	Confident		Somewhat Confident		Not Confident		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Lebanon	21 (1.3)	462 (6.5)	57 (1.1)	399 (5.0)	22 (1.1)	376 (6.9)	10.6 (0.06)
Kazakhstan	21 (1.2)	523 (5.4)	55 (1.0)	487 (4.5)	24 (1.1)	478 (5.6)	10.7 (0.06)
Morocco	17 (0.6)	427 (2.9)	59 (0.6)	371 (2.7)	23 (0.6)	361 (3.3)	10.4 (0.03)
Syrian Arab Republic	17 (0.9)	462 (5.0)	60 (0.9)	424 (4.1)	23 (0.8)	419 (4.6)	10.4 (0.05)
Slovenia	16 (0.7)	595 (3.7)	49 (0.8)	550 (3.1)	35 (1.2)	513 (3.2)	10.1 (0.05)
Macedonia, Rep. of	15 (0.8)	493 (6.6)	51 (1.1)	403 (5.1)	34 (1.3)	396 (5.9)	10.1 (0.06)
Russian Federation	14 (0.8)	583 (4.8)	44 (1.1)	548 (4.1)	42 (1.3)	525 (3.3)	9.9 (0.05)
Hungary	14 (0.7)	572 (4.9)	40 (1.2)	521 (3.6)	46 (1.4)	511 (3.5)	9.7 (0.06)
Lithuania	13 (0.8)	562 (3.7)	44 (1.0)	517 (3.3)	43 (1.3)	498 (3.3)	9.8 (0.06)
Ukraine	13 (0.8)	552 (5.1)	42 (0.9)	506 (3.7)	45 (1.2)	485 (4.0)	9.8 (0.06)
Sweden	12 (0.7)	563 (5.1)	61 (1.0)	518 (2.8)	27 (1.2)	482 (3.3)	10.2 (0.04)
Finland	12 (0.7)	608 (4.2)	41 (1.2)	566 (2.7)	47 (1.6)	531 (2.9)	9.6 (0.07)
Romania	12 (0.8)	525 (5.7)	42 (1.2)	470 (4.4)	46 (1.6)	449 (3.6)	9.7 (0.06)
Armenia	9 (0.6)	504 (4.7)	42 (1.0)	444 (3.9)	50 (1.3)	428 (3.6)	9.4 (0.05)
Indonesia	2 (0.4)	~ ~	53 (1.7)	389 (5.3)	44 (1.9)	415 (5.0)	9.5 (0.04)
Georgia	--	--	--	--	--	--	--
International Avg.	14 (0.2)	531 (1.3)	49 (0.3)	474 (1.0)	37 (0.3)	458 (1.1)	

*Students Confident in Physics*

Physics	Confident		Somewhat Confident		Not Confident		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Georgia	20 (1.0)	479 (4.6)	46 (0.9)	428 (4.0)	34 (1.1)	398 (3.5)	10.3 (0.05)
Kazakhstan	20 (1.2)	520 (6.2)	55 (1.1)	488 (4.6)	25 (1.3)	480 (4.9)	10.5 (0.07)
Morocco	19 (0.7)	425 (3.0)	59 (0.7)	372 (2.5)	22 (0.7)	364 (3.2)	10.5 (0.03)
Syrian Arab Republic	18 (0.8)	465 (4.8)	63 (0.8)	423 (3.9)	19 (0.7)	418 (5.0)	10.5 (0.04)
Lebanon	18 (1.1)	463 (7.5)	55 (1.2)	403 (5.5)	27 (1.3)	379 (5.7)	10.4 (0.07)
Hungary	18 (0.8)	580 (3.7)	43 (0.9)	524 (3.9)	39 (1.0)	498 (3.1)	10.1 (0.06)
Russian Federation	17 (0.7)	584 (4.1)	51 (1.2)	545 (3.5)	32 (1.3)	517 (3.9)	10.3 (0.05)
Macedonia, Rep. of	17 (0.9)	492 (5.9)	53 (1.0)	398 (5.2)	31 (1.2)	400 (6.2)	10.2 (0.06)
Armenia	15 (0.7)	502 (4.4)	51 (0.9)	442 (3.4)	35 (1.1)	414 (3.8)	10.1 (0.05)
Ukraine	13 (1.0)	557 (6.5)	50 (1.2)	505 (3.6)	37 (1.5)	480 (3.8)	9.9 (0.07)
Sweden	11 (0.7)	569 (4.8)	62 (0.8)	520 (2.6)	26 (0.8)	480 (3.3)	10.1 (0.04)
Lithuania	9 (0.6)	563 (4.4)	41 (1.2)	519 (3.1)	50 (1.4)	502 (2.9)	9.4 (0.06)
Finland	9 (0.7)	609 (4.9)	39 (1.3)	569 (2.9)	52 (1.5)	535 (2.7)	9.3 (0.07)
Slovenia	9 (0.5)	614 (4.8)	40 (1.1)	559 (3.4)	52 (1.2)	521 (3.0)	9.3 (0.04)
Romania	8 (0.6)	520 (6.1)	45 (1.1)	471 (4.3)	47 (1.3)	455 (3.8)	9.5 (0.05)
Indonesia	3 (0.6)	392 (13.2)	57 (1.7)	401 (5.9)	40 (2.0)	423 (3.9)	9.6 (0.05)
International Avg.	14 (0.2)	521 (1.5)	51 (0.3)	473 (1.0)	35 (0.3)	454 (1.0)	

*Students Confident in Earth Science*

Earth Science	Confident		Somewhat Confident		Not Confident		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Macedonia, Rep. of	30 (1.1)	479 (5.4)	54 (0.9)	393 (6.0)	16 (0.8)	367 (6.4)	10.6 (0.06)
Kazakhstan	28 (1.5)	518 (4.7)	59 (1.2)	485 (4.7)	13 (0.9)	470 (5.7)	10.7 (0.07)
Georgia	26 (1.1)	482 (3.7)	50 (1.0)	420 (3.4)	24 (1.0)	385 (4.0)	10.3 (0.06)
Russian Federation	23 (0.9)	563 (3.3)	56 (0.9)	545 (3.2)	22 (1.0)	516 (4.8)	10.2 (0.05)
Syrian Arab Republic	22 (1.1)	460 (6.0)	62 (1.0)	421 (3.9)	16 (0.9)	411 (5.4)	10.2 (0.06)
Lithuania	21 (0.9)	550 (3.1)	52 (1.0)	513 (3.0)	27 (1.1)	490 (3.5)	10.0 (0.06)
Romania	21 (1.1)	509 (3.4)	53 (1.0)	467 (4.2)	26 (1.2)	434 (4.5)	10.0 (0.07)
Morocco	20 (0.5)	420 (2.8)	61 (0.6)	370 (2.4)	19 (0.5)	362 (3.1)	10.1 (0.03)
Hungary	19 (1.0)	555 (4.2)	48 (1.0)	521 (3.8)	33 (1.3)	509 (3.7)	9.8 (0.07)
Sweden	18 (0.9)	542 (4.4)	66 (0.9)	515 (2.7)	15 (0.7)	472 (5.0)	10.2 (0.04)
Slovenia	16 (0.7)	576 (4.4)	58 (1.1)	549 (2.8)	26 (1.3)	513 (3.7)	9.8 (0.05)
Armenia	16 (0.8)	489 (4.0)	57 (1.0)	440 (3.4)	27 (1.1)	415 (4.4)	9.7 (0.05)
Finland	15 (0.9)	590 (4.1)	58 (0.9)	558 (2.5)	28 (1.2)	525 (2.5)	9.7 (0.06)
Ukraine	15 (1.0)	546 (5.2)	56 (1.0)	504 (3.6)	29 (1.3)	477 (4.1)	9.7 (0.06)
Indonesia	3 (0.4)	389 (12.6)	60 (1.6)	398 (5.4)	37 (1.8)	419 (3.8)	9.1 (0.04)
Lebanon	--	--	--	--	--	--	--
International Avg.	19 (0.2)	511 (1.4)	57 (0.3)	473 (1.0)	24 (0.3)	451 (1.1)	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

## Instructional Time

### *Instructional Time Spent on Science*

It is difficult to examine the effect of instructional time on student achievement, because a wide variety of factors influence the productivity of instruction hours—most importantly, the quality of the curriculum and instructional approaches (and all of the variables influencing them). In addition, the relationship between instructional time and student achievement is highly dependent on the effectiveness of the educational system. If an education system essentially is ineffective, increasing the amount of instruction time will have diminishing returns. Also, most countries implement levels of instructional time across their systems so that any variation is unintended and rarely related to achievement.

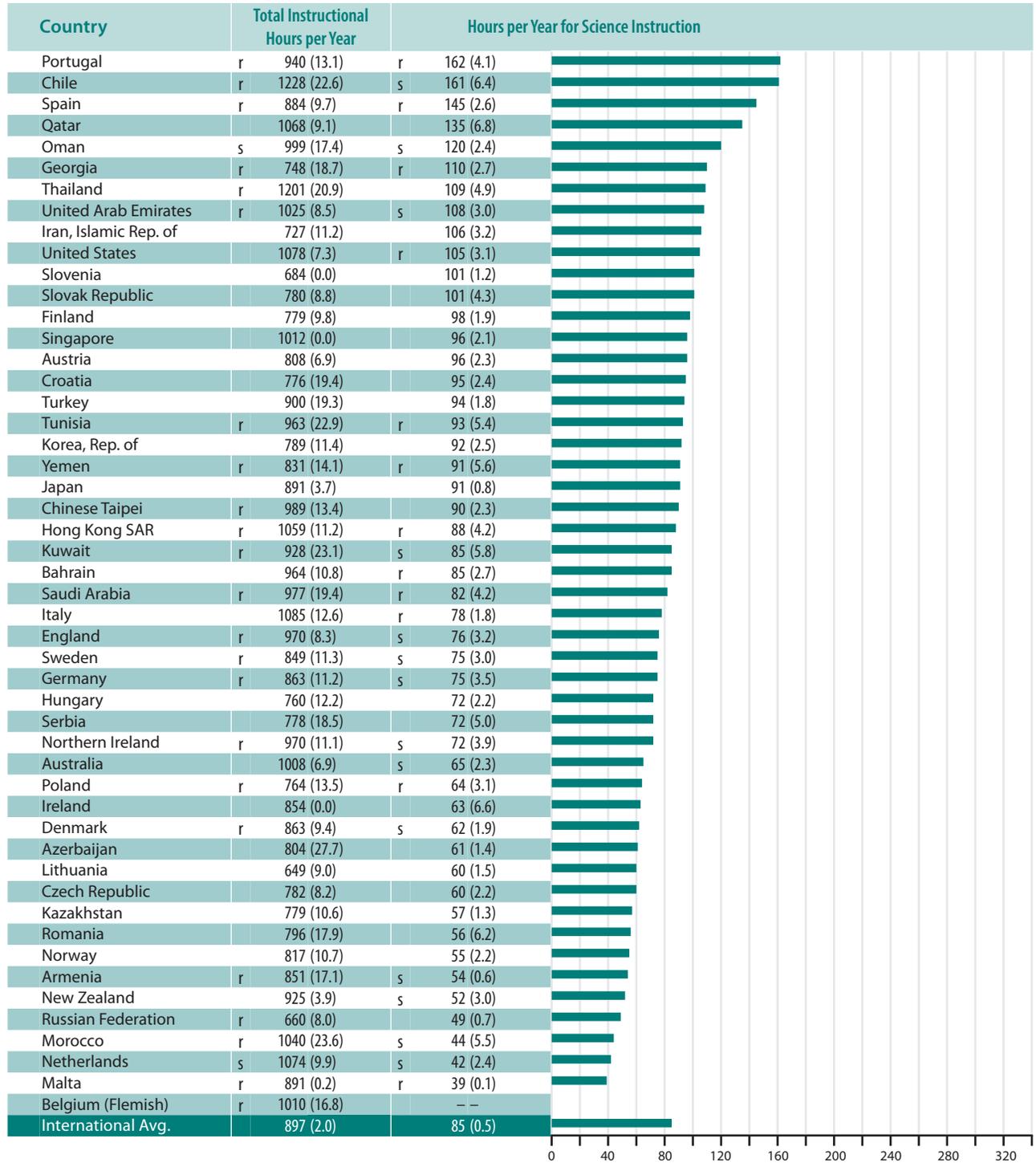
Despite the difficulties in studying its effects, instructional time remains a crucial resource in considering students' opportunity to learn. If everything else about schooling was equal and of high quality, more instructional time should result in increased student learning. For example, a recent study published by the London School of Economics used data from PISA 2006 and from 10- and 13-year-olds in Israel to compare achievement estimates for the same students across curriculum subjects, and found that instructional time has a positive and significant effect on achievement (Lavy, 2010).

Exhibits 8.6 and 8.7 present principals' and teachers' reports about the instructional hours per year spent on science instruction, respectively, at the fourth and eighth grades. The results for the time spent on science instruction were based on a series of calculations. As explained on the second page of the exhibits, principals provided the number of school days per year and the number of instructional hours per day. This information was combined to provide the yearly total number of instructional hours in each country shown in the first column of the exhibit. There was substantial variation across countries, but the fourth grade students in the TIMSS 2011 countries averaged about 900 hours per year of instruction, while those in the eighth grade averaged about 1,000 hours.

Teachers reported the weekly amount of instruction in science. This information was combined with the data provided by principals to estimate yearly amounts of instructional time in science for each TIMSS 2011 participant (second column in the exhibits). On average, the fourth grade countries reported devoting 85 hours per year to science instruction, although the amount of instructional time varied widely across the fourth grade, sixth grade, and benchmarking participants, from a low of 39 to a high of 162 hours.

**Exhibit 8.6: Instructional Time Spent on Science**

Reported by Principals and Teachers



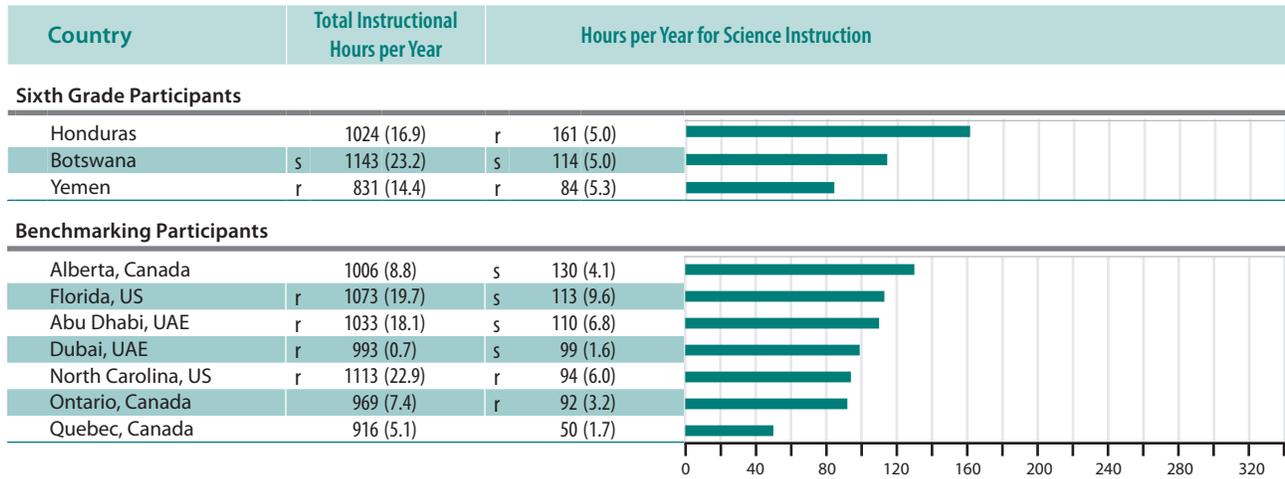
SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

A dash (–) indicates comparable data not available.

An “r” indicates data are available for at least 70% but less than 85% of the students. An “s” indicates data are available for at least 50% but less than 70% of the students.

**Exhibit 8.6: Instructional Time Spent on Science (Continued)**

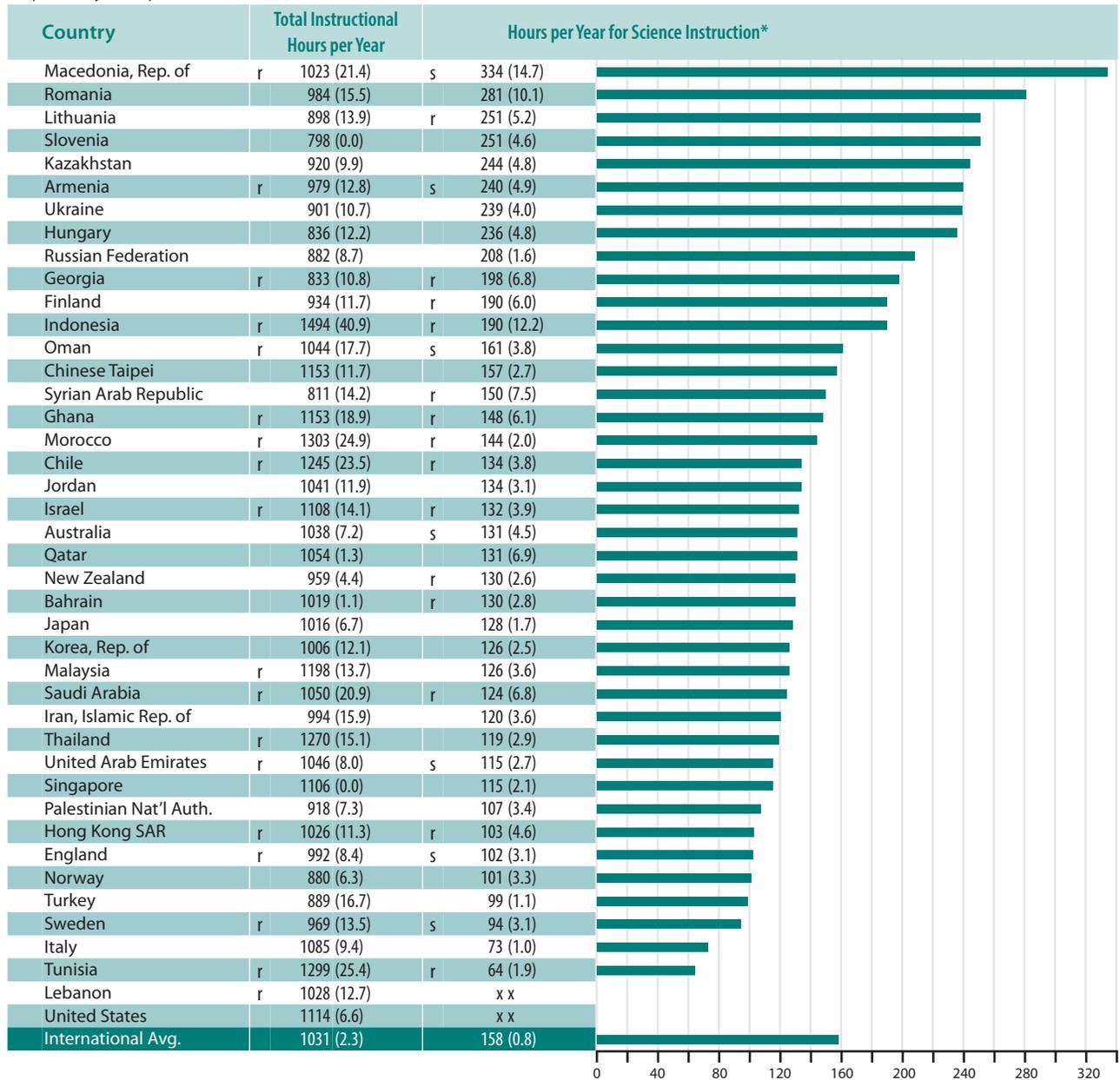


SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

<b>Total Instructional Hours per Year</b>	=	Principal Reports of School Days per Year	X	Principal Reports of Instructional Hours per Day
<b>Hours per Year for Science Instruction</b>	=	Teacher Reports of Weekly Science Instructional Hours	X	Principal Reports of School Days per Year
		Principal Reports of School Days per Week		

## Exhibit 8.7: Instructional Time Spent on Science

Reported by Principals and Teachers



\* For countries teaching science as separate subjects, total hours across subjects.

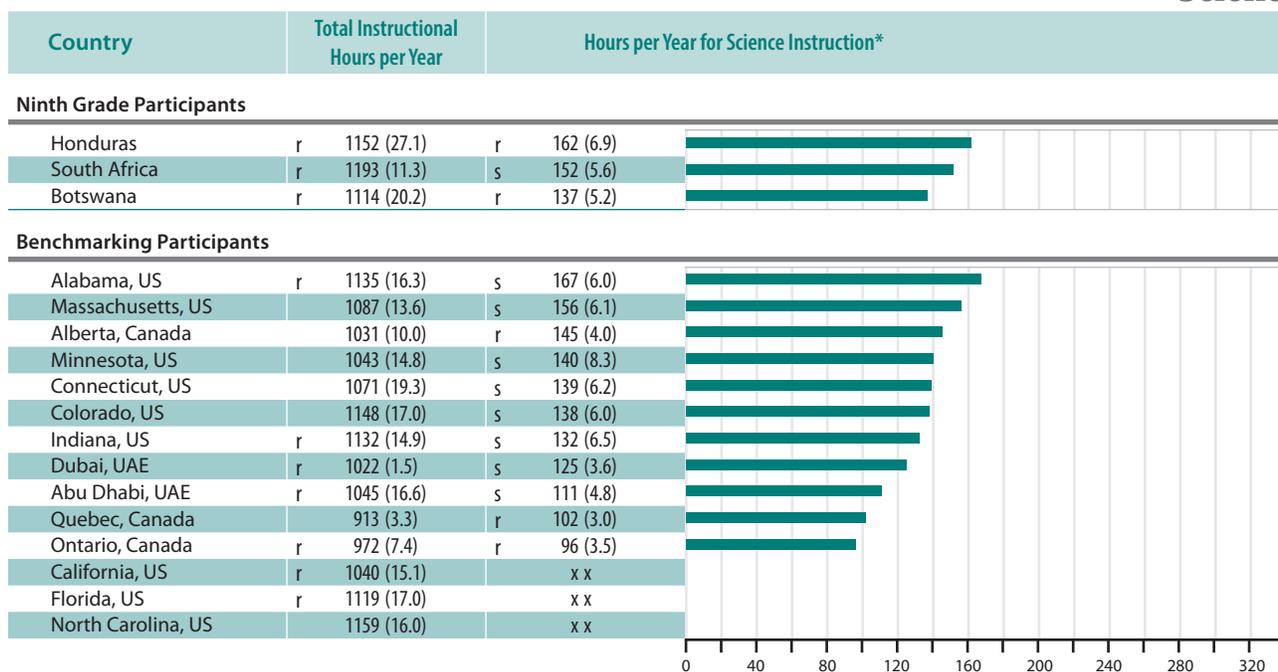
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

A dash (-) indicates comparable data not available.

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

An "x" indicates data are available for less than 50% of students.

**Exhibit 8.7: Instructional Time Spent on Science (Continued)**



SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**For Countries Teaching Science as Separate Subjects**

Country	Hours per Year for Instruction				
	All Science Subjects	Biology	Chemistry	Physics	Earth Science
Macedonia, Rep. of	s 334 (14.7)	s 86 (6.1)	s 84 (4.5)	s 85 (6.3)	s 80 (4.2)
Romania	281 (10.1)	50 (4.1)	83 (4.6)	77 (2.8)	71 (2.2)
Lithuania	r 251 (5.2)	r 44 (1.7)	r 70 (2.5)	67 (2.4)	70 (2.8)
Slovenia	251 (4.6)	60 (2.2)	69 (1.7)	64 (2.0)	58 (1.4)
Kazakhstan	244 (4.8)	57 (1.6)	70 (1.6)	60 (1.5)	56 (1.5)
Armenia	s 240 (4.9)	s 60 (2.0)	s 59 (1.2)	s 63 (2.2)	s 58 (1.4)
Ukraine	239 (4.0)	62 (1.2)	65 (2.9)	61 (0.9)	51 (1.4)
Hungary	236 (4.8)	62 (2.2)	59 (2.2)	56 (2.1)	60 (2.9)
Russian Federation	208 (1.6)	51 (0.6)	52 (0.7)	53 (1.0)	52 (0.6)
Georgia	r 198 (6.8)	r 71 (4.8)	--	r 64 (2.4)	s 63 (2.9)
Finland	r 190 (6.0)	r 43 (2.0)	55 (2.1)	51 (1.7)	r 42 (2.2)
Indonesia	r 190 (12.2)	r 61 (5.5)	r 37 (2.5)	r 56 (5.0)	r 37 (2.5)
Syrian Arab Republic	r 150 (7.5)	r 53 (2.4)	r 40 (3.0)	r 40 (3.0)	r 18 (0.8)
Morocco	r 144 (2.0)	s 36 (0.6)	r 36 (0.6)	r 36 (0.6)	s 36 (0.6)
Lebanon	x x	x x	x x	x x	--
International Avg.	225 (1.9)	57 (0.8)	56 (0.7)	59 (0.8)	54 (0.6)

<b>Total Instructional Hours per Year</b>	=	Principal Reports of School Days per Year	x	Principal Reports of Instructional Hours per Day
<b>Hours per Year for Science Instruction</b>	=	Teacher Reports of Weekly Science Instructional Hours	x	Principal Reports of School Days per Year
		Principal Reports of School Days per Week		

Instructional time for science was much greater at the eighth grade, with the eighth grade countries devoting an average of 158 hours to science instruction, and there was greater variability across countries, from 64 to 334 hours. The large increase in science instructional time compared to the fourth grade was mainly the result of the greater attention given to science instruction in the separate science countries. For these countries, the number of hours reported for each of biology, chemistry, physics, and earth science is shown on the second page of Exhibit 8.7. The separate science countries devote 54 to 59 hours per year, on average, to each science subject, for an overall average of 225 hours of science instruction per year.

It should be noted that the variation across countries in science instructional time at both the fourth and eighth grades (including the sixth and ninth grades, respectively, and the benchmarking participants) is due to countries spending different amounts of time on total schooling, and allocating different amounts of the total time to science instruction, and in different ways. Finally, it should be understood that providing time for instruction is a necessary but not sufficient condition for student learning; the time allocated for instruction is a resource that needs to be used effectively, and efficiently.

### *Students Taught the TIMSS Science Topics*

The science content and topic areas assessed in TIMSS 2011 are elaborated in the Science Framework, with each topic area for the fourth and eighth grades presented as comprehensive lists of objectives. Developed collaboratively by the participating countries, the TIMSS topics do not represent the “least common denominator” but rather a forward-looking conception of science teaching and learning.

Exhibit 8.8 presents teachers’ reports about the TIMSS science topics that actually had been taught to students in fourth grade classrooms either prior to or during the year of the assessment. The exhibit shows, for each TIMSS participant, the percentage of students whose teachers reported that the students had been taught each of the topics, averaged across all science topics and across all topics within each science content domain. The topics are shown on the second page of the exhibit. At the fourth grade, teachers were asked about a total of 20 topics: six in life science, eight in physical science, and six in earth science.

At the fourth grade, according to their teachers, 64 percent of students, on average, had been taught the TIMSS science topics overall. There was considerable variation across countries, from 93 percent in Kuwait to 38 percent in Japan. On average, the percentage of students taught various topics was

highest for life science (75%), next highest for earth science (63%), and lowest for physical science (57%). However, including the fourth grade, sixth grade, and the benchmarking participants, there was considerable variation from topic to topic and from participant to participant.

Exhibit 8.9 presents teachers' reports about the TIMSS science topics that actually had been taught to students in eighth grade science classrooms either prior to or during the year of the assessment. The exhibit shows, for each participant, the percentage of students whose teachers reported that the students had been taught each of the topics, averaged across all science topics and across all topics within each science content domain. The topics are shown on the second page of the exhibit. At the eighth grade, teachers were asked about a total of 20 topics: seven in biology, four in chemistry, five in physics, and four in earth science.

At the eighth grade, on average, 72 percent of students had been taught the science topics overall. Teachers' reports about the degree of implementation ranged from 98 percent in Macedonia to 39 percent in Norway. Chemistry had the greatest degree of coverage, with 81 percent of students having been taught the chemistry topics at the eighth grade, followed by physics, with 75 percent of students taught the topics. The coverage for biology and earth science was similar, with 68 percent of the students being taught the topics in each of those two content areas. It should be emphasized that there was considerable variation across participants in relative coverage of the topics in the content domains.

National Research Coordinators were asked to indicate whether each of the TIMSS 2011 science topics was included in their countries' intended curriculum through the fourth or eighth grade, and if so, whether the topics were intended to be taught to "all or almost all students" or "only the more able students." The results for the fourth and eighth grades are summarized in Exhibits 8.10 and 8.11. On average, across countries, the majority of the assessment topics were intended for all students—14 out of 20 at the fourth grade, and 17 out of 20 at the eighth grade.

At the fourth grade, the results varied topic by topic and country by country. However, of the six life science topics, on average, five were included in the curriculum for all students and one was not included; of the eight physical science topics, five were included and two were not; and of the six earth science topics, four were included and two were not. At the eighth grade, there was also considerable variation across countries, but with most of the topics in each content domain included in the curriculum for all students. On average across the eighth grade students, six of the seven biology topics, three of the four

**Exhibit 8.8: Percentage of Students Taught the TIMSS Science Topics\***
*Reported by Teachers*

Country		All Science (20 Topics)		Life Science (6 Topics)		Physical Science (8 Topics)		Earth Science (6 Topics)
Armenia	r	69 (1.9)	s	73 (2.2)	s	56 (2.7)	s	81 (2.0)
Australia	r	58 (1.8)	r	69 (2.0)	s	47 (2.6)	s	62 (2.3)
Austria		71 (1.1)		83 (1.1)		58 (1.9)		76 (1.3)
Azerbaijan		77 (1.5)		80 (2.0)		69 (1.9)		86 (1.7)
Bahrain		76 (1.8)		80 (1.9)		75 (2.4)		75 (2.7)
Belgium (Flemish)		41 (1.2)		57 (1.9)		27 (1.5)		44 (1.6)
Chile	r	69 (1.2)	r	87 (1.3)	r	48 (2.6)	r	78 (1.7)
Chinese Taipei		58 (1.6)		69 (2.1)		61 (2.0)		43 (2.1)
Croatia		56 (1.1)		81 (1.4)		36 (1.6)		59 (1.3)
Czech Republic		59 (1.2)		85 (1.3)		37 (1.6)		62 (2.1)
Denmark	s	55 (1.4)	s	63 (2.4)	s	48 (1.9)	s	58 (2.2)
England	r	71 (1.7)	r	72 (2.4)	r	78 (1.8)	r	62 (2.9)
Finland		55 (1.2)		73 (1.6)		43 (1.8)		53 (1.6)
Georgia		70 (1.5)		85 (1.5)		46 (2.3)		86 (1.6)
Germany		59 (1.2)		73 (1.5)		52 (2.0)		53 (1.5)
Hong Kong SAR		56 (1.9)		72 (2.4)		48 (2.3)		51 (2.1)
Hungary		67 (1.2)		91 (1.1)		49 (1.9)		67 (1.7)
Iran, Islamic Rep. of		70 (1.3)		69 (2.2)		73 (1.3)		66 (1.4)
Ireland		71 (1.4)		73 (1.8)		68 (2.0)		72 (1.8)
Italy		57 (1.1)		69 (1.5)		44 (1.7)		64 (1.6)
Japan		38 (1.5)		34 (2.0)		42 (1.8)		36 (1.7)
Kazakhstan		--		--		--		--
Korea, Rep. of		50 (1.9)		56 (2.3)		44 (2.4)		52 (2.2)
Kuwait		93 (0.8)		96 (0.7)		93 (1.2)		91 (1.4)
Lithuania		79 (1.4)		98 (0.4)		64 (2.1)		81 (2.0)
Malta		58 (0.0)		67 (0.0)		57 (0.1)		53 (0.1)
Morocco	r	50 (1.6)	r	72 (1.6)	r	45 (1.9)	r	34 (2.2)
Netherlands	r	47 (2.0)	s	60 (2.0)	s	32 (2.5)	s	54 (3.4)
New Zealand		54 (1.7)		66 (2.0)		44 (2.2)		56 (1.9)
Northern Ireland	r	61 (2.1)	r	74 (2.3)	r	57 (2.8)	r	53 (3.0)
Norway		56 (1.4)		67 (1.9)		34 (2.0)		75 (2.0)
Oman		70 (1.0)		87 (1.0)		73 (1.1)		49 (1.6)
Poland		66 (1.2)		83 (1.3)		41 (2.1)		82 (1.0)
Portugal		85 (1.7)		96 (1.0)		75 (3.3)		88 (1.0)
Qatar		64 (1.6)		77 (2.4)		58 (2.1)		60 (1.8)
Romania		92 (0.9)		95 (1.1)		93 (1.3)		88 (1.0)
Russian Federation		--		--		--		--
Saudi Arabia		81 (1.3)		82 (1.6)		88 (1.5)		70 (1.9)
Serbia		85 (1.1)		88 (1.3)		92 (1.5)		74 (1.5)
Singapore		41 (0.8)		47 (1.3)		59 (0.9)		12 (1.1)
Slovak Republic		87 (0.8)		96 (0.7)		83 (1.3)		85 (1.1)
Slovenia		64 (1.4)		71 (1.5)		69 (2.0)		52 (2.0)
Spain		72 (1.3)		89 (1.2)		56 (2.4)		76 (1.8)
Sweden	r	53 (1.6)	r	59 (2.7)	r	34 (1.9)	s	73 (2.4)
Thailand		66 (2.3)		79 (2.0)		54 (3.1)		68 (2.9)
Tunisia		46 (1.2)		75 (1.7)		42 (1.5)		23 (1.7)
Turkey		75 (1.2)		69 (1.9)		88 (0.9)		66 (2.0)
United Arab Emirates		65 (1.0)		64 (1.1)		62 (1.3)		69 (1.3)
United States	r	72 (1.0)	r	73 (1.2)	r	67 (1.4)	r	77 (1.3)
Yemen		54 (1.9)		65 (2.1)		54 (2.3)		43 (2.5)
International Avg.		64 (0.2)		75 (0.2)		57 (0.3)		63 (0.3)

\* Percentage mostly taught before or in the assessment year averaged across topics.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

A dash (-) indicates comparable data are not available.

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 8.8: Percentage of Students Taught the TIMSS Science Topics\* (Continued)**

Country	All Science (20 Topics)	Life Science (6 Topics)	Physical Science (8 Topics)	Earth Science (6 Topics)
<b>Sixth Grade Participants</b>				
Botswana	86 (1.3)	90 (1.4)	91 (1.4)	76 (2.3)
Honduras	78 (1.3)	98 (0.5)	54 (2.9)	90 (1.5)
Yemen	71 (1.7)	79 (2.0)	74 (2.0)	58 (2.8)
<b>Benchmarking Participants</b>				
Alberta, Canada	r 48 (1.6)	r 60 (2.4)	r 46 (2.3)	r 40 (2.4)
Ontario, Canada	52 (1.5)	67 (2.1)	r 46 (2.3)	r 44 (2.0)
Quebec, Canada	52 (1.9)	59 (2.4)	43 (2.4)	58 (2.3)
Abu Dhabi, UAE	65 (1.7)	61 (2.1)	66 (2.3)	66 (2.2)
Dubai, UAE	r 63 (1.2)	r 66 (1.4)	r 59 (1.3)	r 66 (2.3)
Florida, US	s 79 (1.7)	s 74 (3.2)	s 77 (3.0)	s 86 (2.6)
North Carolina, US	r 66 (1.9)	r 76 (2.7)	r 56 (2.8)	r 71 (3.4)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**TIMSS 2011 Science Topics**

**A. Life Science**

- 1) Major body structures and their functions in humans and other organisms (plants and animals)
- 2) Life cycles and reproduction in plants and animals
- 3) Physical features, behavior, and survival of organisms living in different environments
- 4) Relationships in a given community (e.g., simple food chains, predator-prey relationships)
- 5) Changes in environments (effects of human activity, pollution and its prevention)
- 6) Human health (e.g., transmission/prevention of communicable diseases, signs of health/illness, diet, exercise)

**B. Physical Science**

- 1) States of matter (solids, liquids, gases) and differences in their physical properties (shape, volume), including changes in state of matter by heating and cooling
- 2) Classification of objects/materials based on physical properties (e.g., weight/mass, volume, magnetic attraction)
- 3) Forming and separating mixtures
- 4) Familiar changes in materials (e.g., decaying, burning, rusting, cooking)
- 5) Common energy sources/forms and their practical uses (e.g., the Sun, electricity, water, wind)
- 6) Light (e.g., sources, behavior)
- 7) Electrical circuits and properties of magnets
- 8) Forces that cause objects to move (e.g., gravity, push/pull forces)

**C. Earth Science**

- 1) Water on Earth (location, types, and movement) and air (composition, proof of its existence, uses)
- 2) Common features of Earth's landscape (e.g., mountains, plains, rivers, deserts) and relationship to human use (e.g., farming, irrigation, land development)
- 3) Weather conditions from day to day or over the seasons
- 4) Fossils of animals and plants (age, location, formation)
- 5) Earth's solar system (planets, Sun, moon)
- 6) Day, night, and shadows due to Earth's rotation and its relationship to the Sun

**Exhibit 8.9: Percentage of Students Taught the TIMSS Science Topics\***
*Reported by Teachers*

Country	All Science (20 Topics)	Biology (7 Topics)	Chemistry (4 Topics)	Physics (5 Topics)	Earth Science (4 Topics)
Armenia	93 (0.6)	89 (1.0)	97 (1.0)	96 (0.9)	r 90 (1.8)
Australia	s 58 (1.1)	s 47 (1.6)	s 66 (2.3)	s 63 (1.8)	s 61 (3.0)
Bahrain	85 (0.8)	81 (1.2)	90 (0.8)	81 (1.2)	89 (1.2)
Chile	78 (1.2)	83 (1.5)	73 (1.8)	76 (2.0)	76 (3.0)
Chinese Taipei	68 (0.9)	92 (1.9)	98 (1.0)	59 (1.5)	5 (1.5)
England	r 87 (1.3)	r 86 (1.5)	r 91 (1.7)	r 89 (1.9)	r 83 (2.0)
Finland	59 (1.0)	35 (1.5)	91 (1.4)	60 (1.9)	67 (2.6)
Georgia	64 (0.7)	63 (1.6)	--	40 (0.7)	97 (0.8)
Ghana	68 (1.5)	73 (1.7)	76 (1.6)	71 (2.4)	49 (2.7)
Hong Kong SAR	56 (1.3)	54 (1.9)	61 (1.9)	76 (1.6)	32 (3.0)
Hungary	83 (0.8)	75 (1.7)	98 (0.6)	86 (0.9)	75 (1.8)
Indonesia	67 (1.6)	73 (2.2)	r 82 (3.2)	79 (1.3)	r 27 (3.8)
Iran, Islamic Rep. of	91 (0.6)	82 (1.2)	98 (0.6)	98 (0.5)	91 (1.0)
Israel	74 (1.0)	70 (1.4)	94 (1.1)	80 (1.0)	s 53 (2.8)
Italy	77 (1.1)	81 (1.1)	82 (2.1)	71 (1.6)	71 (2.3)
Japan	57 (0.7)	35 (1.1)	86 (1.3)	76 (1.4)	41 (1.3)
Jordan	89 (0.9)	89 (1.1)	91 (1.3)	87 (1.3)	90 (1.3)
Kazakhstan	--	--	--	--	--
Korea, Rep. of	54 (0.9)	38 (1.3)	42 (1.4)	79 (1.5)	64 (1.4)
Lebanon	r 80 (1.3)	r 71 (2.0)	92 (1.5)	84 (2.0)	--
Lithuania	72 (1.0)	69 (1.9)	65 (1.4)	65 (2.0)	91 (1.1)
Macedonia, Rep. of	r 98 (0.3)	r 97 (0.6)	r 100 (0.2)	99 (0.6)	r 95 (1.0)
Malaysia	63 (1.0)	61 (1.4)	80 (1.5)	72 (1.2)	38 (2.0)
Morocco	57 (0.7)	56 (1.2)	r 59 (1.7)	55 (1.6)	s 62 (1.7)
New Zealand	48 (1.3)	40 (1.7)	62 (2.2)	58 (1.5)	38 (2.8)
Norway	39 (1.0)	29 (1.5)	55 (2.4)	28 (1.4)	55 (3.2)
Oman	77 (0.8)	73 (1.0)	78 (1.2)	77 (1.3)	84 (1.6)
Palestinian Nat'l Auth.	86 (1.0)	80 (1.5)	95 (0.8)	83 (1.5)	89 (1.4)
Qatar	79 (1.9)	75 (2.2)	86 (2.4)	78 (2.7)	82 (1.6)
Romania	95 (0.4)	90 (1.1)	98 (0.7)	99 (0.4)	97 (0.8)
Russian Federation	--	--	--	--	--
Saudi Arabia	88 (1.0)	86 (1.3)	91 (1.8)	85 (1.6)	92 (1.5)
Singapore	65 (1.1)	63 (1.4)	80 (1.5)	83 (1.1)	r 31 (2.4)
Slovenia	63 (0.8)	61 (1.5)	56 (1.1)	57 (1.6)	81 (1.9)
Sweden	r 67 (1.3)	r 58 (1.5)	r 74 (1.7)	r 73 (2.1)	x x
Syrian Arab Republic	66 (1.8)	63 (2.4)	r 85 (1.9)	r 66 (2.3)	r 54 (4.0)
Thailand	74 (1.4)	69 (2.1)	92 (1.5)	67 (1.9)	72 (2.9)
Tunisia	40 (1.4)	46 (1.6)	--	--	29 (2.2)
Turkey	89 (0.6)	93 (0.7)	99 (0.3)	97 (0.5)	63 (2.1)
Ukraine	70 (0.8)	46 (1.9)	73 (0.9)	79 (0.7)	96 (1.1)
United Arab Emirates	72 (1.0)	r 63 (1.3)	r 77 (1.5)	r 74 (1.4)	r 82 (1.2)
United States	s 84 (0.8)	s 88 (1.1)	s 79 (1.5)	s 77 (1.6)	s 92 (1.1)
International Avg.	72 (0.2)	68 (0.2)	81 (0.3)	75 (0.2)	68 (0.3)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

\* Percentage mostly taught before or in the assessment year averaged across topics.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

A dash (–) indicates comparable data are not available.

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

An "x" indicates data are available for less than 50% of students.

**Exhibit 8.9: Percentage of Students Taught the TIMSS Science Topics\* (Continued)**

Country	All Science (20 Topics)	Biology (7 Topics)	Chemistry (4 Topics)	Physics (5 Topics)	Earth Science (4 Topics)
<b>Ninth Grade Participants</b>					
Botswana	54 (1.2)	68 (1.7)	35 (1.9)	72 (1.3)	28 (2.5)
Honduras	70 (1.6)	80 (2.2)	70 (2.8)	55 (2.8)	71 (2.5)
South Africa	76 (1.3)	78 (1.5)	82 (1.8)	72 (1.8)	72 (3.0)
<b>Benchmarking Participants</b>					
Alberta, Canada	63 (1.0)	63 (1.6)	38 (1.8)	72 (1.7)	74 (1.8)
Ontario, Canada	r 71 (1.5)	r 76 (1.6)	r 52 (2.9)	r 74 (2.0)	r 79 (2.8)
Quebec, Canada	67 (1.1)	r 59 (1.8)	r 76 (2.2)	51 (1.9)	89 (1.6)
Abu Dhabi, UAE	72 (1.7)	r 62 (2.6)	r 76 (2.6)	r 77 (2.4)	r 80 (2.4)
Dubai, UAE	r 72 (2.0)	s 65 (2.6)	r 76 (1.8)	s 73 (1.8)	s 79 (2.9)
Alabama, US	s 86 (1.9)	s 87 (3.9)	s 88 (3.4)	s 78 (3.0)	s 93 (2.5)
California, US	s 86 (2.3)	s 90 (3.7)	s 93 (1.4)	s 75 (2.4)	s 85 (3.5)
Colorado, US	s 88 (2.1)	s 93 (2.1)	s 83 (5.1)	s 79 (3.2)	s 97 (1.5)
Connecticut, US	s 85 (1.4)	s 89 (1.6)	s 82 (3.0)	s 77 (3.1)	s 91 (2.3)
Florida, US	x x	x x	x x	x x	x x
Indiana, US	s 80 (2.1)	s 80 (3.1)	s 69 (4.6)	s 82 (3.4)	s 91 (3.3)
Massachusetts, US	s 82 (1.9)	s 89 (2.1)	s 71 (4.5)	s 72 (3.4)	s 94 (2.0)
Minnesota, US	r 79 (3.1)	r 87 (3.8)	r 67 (5.5)	r 63 (5.1)	r 96 (1.2)
North Carolina, US	s 89 (1.9)	s 89 (2.6)	s 88 (4.0)	s 84 (3.4)	s 96 (1.6)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**TIMSS 2011 Science Topics**

**A. Biology**

- 1) Major organs and organ systems in humans and other organisms (structure/function, life processes that maintain stable bodily conditions)
- 2) Cells and their functions, including respiration and photosynthesis as cellular processes
- 3) Reproduction (sexual and asexual) and heredity (passing on of traits, inherited versus acquired/learned characteristics)
- 4) Role of variation and adaptation in survival/extinction of species in a changing environment
- 5) Interdependence of populations of organisms in an ecosystem (e.g., energy flow, food webs, competition, predation) and the impact of changes in the physical environment on populations (e.g., climate, water supply)
- 6) Reasons for increase in world's human population (e.g., advances in medicine, sanitation), and the effects of population growth on the environment
- 7) Human health (causes of infectious diseases, methods of infection, prevention, immunity) and the importance of diet and exercise in maintaining health

**B. Chemistry**

- 1) Classification, composition, and particulate structure of matter (elements, compounds, mixtures, molecules, atoms, protons, neutrons, electrons)
- 2) Solutions (solvent, solute, concentration/dilution, effect of temperature on solubility)
- 3) Properties and uses of common acids and bases
- 4) Chemical change (transformation of reactants, evidence of chemical change, conservation of matter, common oxidation reactions - combustion, rusting, tarnishing)

**C. Physics**

- 1) Physical states and changes in matter (explanations of properties in terms of movement and distance between particles; phase change, thermal expansion, and changes in volume and/or pressure)
- 2) Energy forms, transformations, heat, and temperature
- 3) Basic properties/behaviors of light (reflection, refraction, light and color, simple ray diagrams) and sound (transmission through media, loudness, pitch, amplitude, frequency, relative speed of light and sound)
- 4) Electric circuits (flow of current; types of circuits - parallel/series; current/voltage relationship) and properties and uses of permanent magnets and electromagnets
- 5) Forces and motion (types of forces, basic description of motion, effects of density and pressure)

**D. Earth Science**

- 1) Earth's structure and physical features (Earth's crust, mantle and core; composition and relative distribution of water, and composition of air)
- 2) Earth's processes, cycles, and history (rock cycle; water cycle; weather patterns; major geological events; formation of fossils and fossil fuels)
- 3) Earth's resources, their use, and conservation (e.g., renewable/nonrenewable resources, human use of land/soil, water resources)
- 4) Earth in the solar system and the universe (phenomena on Earth - day/night, tides, phases of moon, eclipses, seasons; physical features of Earth compared to other bodies; the Sun as a star)

**Exhibit 8.10: Number of TIMSS Science Topics Intended to Be Taught by the End of Fourth Grade**

Reported by National Research Coordinators

Country	All Science (20 Topics)			Life Science (6 Topics)			Physical Science (8 Topics)			Earth Science (6 Topics)		
	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 4	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 4	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 4	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 4
Armenia	14	0	6	5	0	1	4	0	4	5	0	1
Australia	15	1	4	5	0	1	5	1	2	5	0	1
Austria	16	0	4	6	0	0	7	0	1	3	0	3
Azerbaijan	4	8	8	2	3	1	0	2	6	2	3	1
Bahrain	20	0	0	6	0	0	8	0	0	6	0	0
Belgium (Flemish)	16	4	0	6	0	0	6	2	0	4	2	0
Chile	6	0	14	2	0	4	2	0	6	2	0	4
Chinese Taipei	11	0	9	4	0	2	5	0	3	2	0	4
Croatia	18	0	2	6	0	0	6	0	2	6	0	0
Czech Republic	12	0	8	6	0	0	3	0	5	3	0	3
Denmark	14	0	6	6	0	0	3	0	5	5	0	1
England	16	0	4	6	0	0	7	0	1	3	0	3
Finland	11	0	9	3	0	3	4	0	4	4	0	2
Georgia	14	2	4	5	0	1	3	2	3	6	0	0
Germany	16	0	4	5	0	1	7	0	1	4	0	2
Hong Kong SAR	17	0	3	6	0	0	7	0	1	4	0	2
Hungary	12	0	8	6	0	0	5	0	3	1	0	5
Iran, Islamic Rep. of	20	0	0	6	0	0	8	0	0	6	0	0
Ireland	18	0	2	6	0	0	8	0	0	4	0	2
Italy	12	0	8	5	0	1	3	0	5	4	0	2
Japan	13	0	7	2	0	4	6	0	2	5	0	1
Kazakhstan	16	0	4	6	0	0	4	0	4	6	0	0
Korea, Rep. of	8	2	10	2	0	4	3	2	3	3	0	3
Kuwait	20	0	0	6	0	0	8	0	0	6	0	0
Lithuania	16	2	2	6	0	0	5	2	1	5	0	1
Malta	12	0	8	3	0	3	6	0	2	3	0	3
Morocco	19	0	1	6	0	0	8	0	0	5	0	1
* Netherlands												
New Zealand	12	8	0	3	3	0	5	3	0	4	2	0
Northern Ireland	20	0	0	6	0	0	8	0	0	6	0	0
Norway	12	0	8	4	0	2	4	0	4	4	0	2
Oman	20	0	0	6	0	0	8	0	0	6	0	0
Poland	8	0	12	3	0	3	2	0	6	3	0	3
Portugal	15	0	5	5	0	1	5	0	3	5	0	1
Qatar	12	6	2	5	1	0	4	4	0	3	1	2
Romania	19	0	1	6	0	0	8	0	0	5	0	1
Russian Federation	12	0	8	4	0	2	2	0	6	6	0	0
Saudi Arabia	19	0	1	6	0	0	8	0	0	5	0	1
Serbia	18	0	2	6	0	0	8	0	0	4	0	2
Singapore	6	0	14	3	0	3	3	0	5	0	0	6
Slovak Republic	17	0	3	6	0	0	6	0	2	5	0	1
Slovenia	15	0	5	4	0	2	7	0	1	4	0	2
Spain	7	0	13	2	0	4	3	0	5	2	0	4
Sweden	19	0	1	6	0	0	8	0	0	5	0	1
Thailand	14	0	6	3	0	3	5	0	3	6	0	0
Tunisia	5	0	15	2	0	4	3	0	5	0	0	6
Turkey	19	0	1	5	0	1	8	0	0	6	0	0
United Arab Emirates	20	0	0	6	0	0	8	0	0	6	0	0
United States	15	0	5	3	0	3	8	0	0	4	0	2
Yemen	18	0	2	6	0	0	7	0	1	5	0	1
International Avg.	14	1	5	5	0	1	5	0	2	4	0	2

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

\* No grade-specific science curriculum prescribed.  
Because of rounding some results may appear inconsistent.

**Exhibit 8.10: Number of TIMSS Science Topics Intended to Be Taught by the End of Fourth Grade (Continued)**

Country	All Science (20 Topics)			Life Science (6 Topics)			Physical Science (8 Topics)			Earth Science (6 Topics)		
	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 4	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 4	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 4	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 4
<b>Sixth Grade Participants</b>												
Botswana	6	0	14	2	0	4	3	0	5	1	0	5
Honduras	16	0	4	6	0	0	6	0	2	4	0	2
<b>Benchmarking Participants</b>												
Alberta, Canada	13	0	7	5	0	1	6	0	2	2	0	4
Ontario, Canada	13	0	7	5	0	1	6	0	2	2	0	4
Quebec, Canada	9	2	9	2	1	3	4	1	3	3	0	3
Abu Dhabi, UAE	19	0	1	6	0	0	8	0	0	5	0	1
Dubai, UAE	20	0	0	6	0	0	8	0	0	6	0	0
Florida, US	12	0	8	3	0	3	5	0	3	4	0	2
North Carolina, US	12	0	8	3	0	3	6	0	2	3	0	3

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 8.11: Number of TIMSS Science Topics Intended to Be Taught by the End of Eighth Grade**

Reported by National Research Coordinators

Country	All Science (20 Topics)			Biology (7 Topics)			Chemistry (4 Topics)		
	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 8	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 8	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 8
Armenia	20	0	0	7	0	0	4	0	0
Australia	18	1	1	6	0	1	3	1	0
Bahrain	20	0	0	7	0	0	4	0	0
Chile	17	0	3	7	0	0	2	0	2
Chinese Taipei	19	0	1	6	0	1	4	0	0
England	19	0	1	6	0	1	4	0	0
Finland	15	0	5	3	0	4	4	0	0
Georgia	9	4	7	4	3	0	0	0	4
Ghana	20	0	0	7	0	0	4	0	0
Hong Kong SAR	18	0	2	7	0	0	2	0	2
Hungary	19	0	1	7	0	0	4	0	0
Indonesia	19	0	1	7	0	0	3	0	1
Iran, Islamic Rep. of	20	0	0	7	0	0	4	0	0
Israel	16	2	2	5	1	1	3	1	0
Italy	17	2	1	5	2	0	4	0	0
Japan	17	0	3	5	0	2	4	0	0
Jordan	20	0	0	7	0	0	4	0	0
Kazakhstan	20	0	0	7	0	0	4	0	0
Korea, Rep. of	13	5	2	2	3	2	3	1	0
Lebanon	9	2	9	0	0	7	2	0	2
Lithuania	16	0	4	7	0	0	3	0	1
Macedonia, Rep. of	20	0	0	7	0	0	4	0	0
Malaysia	15	0	5	4	0	3	3	0	1
Morocco	6	0	14	1	0	6	2	0	2
New Zealand	16	4	0	6	1	0	3	1	0
Norway	12	0	8	3	0	4	2	0	2
Oman	20	0	0	7	0	0	4	0	0
Palestinian Nat'l Auth.	20	0	0	7	0	0	4	0	0
Qatar	8	0	12	3	0	4	0	0	4
Romania	20	0	0	7	0	0	4	0	0
Russian Federation	20	0	0	7	0	0	4	0	0
Saudi Arabia	19	0	1	6	0	1	4	0	0
Singapore	14	0	6	4	0	3	4	0	0
Slovenia	15	0	5	5	0	2	2	0	2
Sweden	20	0	0	7	0	0	4	0	0
Syrian Arab Republic	20	0	0	7	0	0	4	0	0
Thailand	20	0	0	7	0	0	4	0	0
Tunisia	9	0	11	5	0	2	2	0	2
Turkey	20	0	0	7	0	0	4	0	0
Ukraine	12	5	3	0	5	2	3	0	1
United Arab Emirates	20	0	0	7	0	0	4	0	0
United States	16	0	4	6	0	1	2	0	2
International Avg.	17	1	3	6	0	1	3	0	1

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Because of rounding some results may appear inconsistent.

**Exhibit 8.11: Number of TIMSS Science Topics Intended to Be Taught by the End of Eighth Grade (Continued)**

Country	Physics (5 Topics)			Earth Science (4 Topics)		
	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 8	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 8
Armenia	5	0	0	4	0	0
Australia	5	0	0	4	0	0
Bahrain	5	0	0	4	0	0
Chile	4	0	1	4	0	0
Chinese Taipei	5	0	0	4	0	0
England	5	0	0	4	0	0
Finland	4	0	1	4	0	0
Georgia	2	0	3	3	1	0
Ghana	5	0	0	4	0	0
Hong Kong SAR	5	0	0	4	0	0
Hungary	5	0	0	3	0	1
Indonesia	5	0	0	4	0	0
Iran, Islamic Rep. of	5	0	0	4	0	0
Israel	4	0	1	4	0	0
Italy	4	0	1	4	0	0
Japan	4	0	1	4	0	0
Jordan	5	0	0	4	0	0
Kazakhstan	5	0	0	4	0	0
Korea, Rep. of	5	0	0	3	1	0
Lebanon	5	0	0	2	2	0
Lithuania	2	0	3	4	0	0
Macedonia, Rep. of	5	0	0	4	0	0
Malaysia	5	0	0	3	0	1
Morocco	0	0	5	3	0	1
New Zealand	3	2	0	4	0	0
Norway	4	0	1	3	0	1
Oman	5	0	0	4	0	0
Palestinian Nat'l Auth.	5	0	0	4	0	0
Qatar	4	0	1	1	0	3
Romania	5	0	0	4	0	0
Russian Federation	5	0	0	4	0	0
Saudi Arabia	5	0	0	4	0	0
Singapore	4	0	1	2	0	2
Slovenia	4	0	1	4	0	0
Sweden	5	0	0	4	0	0
Syrian Arab Republic	5	0	0	4	0	0
Thailand	5	0	0	4	0	0
Tunisia	2	0	3	0	0	4
Turkey	5	0	0	4	0	0
Ukraine	5	0	0	4	0	0
United Arab Emirates	5	0	0	4	0	0
United States	4	0	1	4	0	0
International Avg.	4	0	1	4	0	0

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 8.11: Number of TIMSS Science Topics Intended to Be Taught by the End of Eighth Grade (Continued)**

Country	All Science (20 Topics)			Biology (7 Topics)			Chemistry (4 Topics)		
	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 8	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 8	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 8
<b>Ninth Grade Participants</b>									
Botswana	10	0	10	6	0	1	1	0	3
Honduras	20	0	0	7	0	0	4	0	0
South Africa	20	0	0	7	0	0	4	0	0
<b>Benchmarking Participants</b>									
Alberta, Canada	15	0	5	5	0	2	1	0	3
Ontario, Canada	18	0	2	7	0	0	3	0	1
Quebec, Canada	10	1	9	3	1	3	3	0	1
Abu Dhabi, UAE	19	0	1	7	0	0	3	0	1
Dubai, UAE	20	0	0	7	0	0	4	0	0
Alabama, US	18	0	2	5	0	2	4	0	0
California, US	16	0	4	5	0	2	2	0	2
Colorado, US	18	0	2	6	0	1	3	0	1
Connecticut, US	20	0	0	7	0	0	4	0	0
Florida, US	18	0	2	5	0	2	4	0	0
Indiana, US	16	0	4	5	0	2	2	0	2
Massachusetts, US	16	0	4	5	0	2	2	0	2
Minnesota, US	13	0	7	4	0	3	2	0	2
North Carolina, US	15	0	5	7	0	0	1	0	3

Country	Physics (5 topics)			Earth Science (4 topics)		
	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 8	Topics Taught to All or Almost All Students	Topics Taught to Only the More Able Students (Top Track)	Not Included in the Curriculum Through Grade 8
<b>Ninth Grade Participants</b>						
Botswana	2	0	3	1	0	3
Honduras	5	0	0	4	0	0
South Africa	5	0	0	4	0	0
<b>Benchmarking Participants</b>						
Alberta, Canada	5	0	0	4	0	0
Ontario, Canada	5	0	0	3	0	1
Quebec, Canada	0	0	5	4	0	0
Abu Dhabi, UAE	5	0	0	4	0	0
Dubai, UAE	5	0	0	4	0	0
Alabama, US	5	0	0	4	0	0
California, US	5	0	0	4	0	0
Colorado, US	5	0	0	4	0	0
Connecticut, US	5	0	0	4	0	0
Florida, US	5	0	0	4	0	0
Indiana, US	5	0	0	4	0	0
Massachusetts, US	5	0	0	4	0	0
Minnesota, US	5	0	0	2	0	2
North Carolina, US	4	0	1	3	0	1

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

chemistry topics, four of the five physics topics, and all four of the earth science topics were included in the curriculum for all students. However, there were a number of countries where none of the topics in a content area were included in the eighth grade science curriculum for all students, including Lebanon and the Ukraine (no biology), Georgia and Qatar (no chemistry), Morocco and Québec, Canada (no physics), and Tunisia (no earth science).

### *Collaborate to Improve Teaching*

Part of creating a school learning environment focused on academic success involves a staff that collaborates on curricular activities. For example, a study including a comprehensive theoretical review and a meta-analysis of studies about professional communities indicated a small but positive effect of professional communities on student achievement (Lomos, Roelande, & Bosker, 2011). Because teacher collaboration with colleagues is important in building a professional community, TIMSS 2011 included the Collaborate to Improve Teaching scale. Although the idea of teacher collegiality and collaboration can involve a variety of theoretical perspectives and terms, the TIMSS 2011 scale was designed to focus on the idea of collaboration for the purpose of improving teaching. Therefore, the scale was based on how often teachers interacted with other teachers regarding each of five areas:

- ◆ Discuss how to teach a particular topic;
- ◆ Collaborate in planning and preparing instructional materials;
- ◆ Share what I have learned about my teaching experiences;
- ◆ Visit another classroom to learn more about teaching; and
- ◆ Work together to try out new ideas.

Students were scored according to their teachers responses, with **Very Collaborative** teachers having interactions with other teachers at least “one to three times per week” in each of three of the five areas and “two or three times per month” in each of the other two, on average.

Exhibit 8.12 presents the results for the fourth grade. In general, most science teachers of fourth grade students reported a high degree of collaboration with other teachers with the goal of improving teaching and learning. Internationally, on average, about one-third of the fourth grade students (35%) had **Very Collaborative** teachers. Another 53 percent of students, on average, had teachers that reported being **Collaborative** (e.g., interacting two or three times a month for all areas). Few fourth grade students (12%, on average) had

## Exhibit 8.12: Collaborate to Improve Teaching

Reported by Teachers

Students were scored according to their teachers' responses to how often they interacted with other teachers in each of five teaching areas on the *Collaborate to Improve Teaching* scale. Students with **Very Collaborative** teachers had a score on the scale of at least 11.0, which corresponds to their teachers having interactions with other teachers at least "one to three times per week" in each of three of the five areas and "two or three times per month" in each of the other two, on average. Students with **Somewhat Collaborative** teachers had a score no higher than 7.3, which corresponds to their teachers interacting with other teachers "never or almost never" in each of three of the five areas and "two or three times per month" in each of the other two, on average. All other students had **Collaborative** teachers.

Country	Very Collaborative		Collaborative		Somewhat Collaborative		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Slovenia	73 (3.5)	521 (3.0)	25 (3.4)	518 (4.5)	2 (0.8)	~ ~	11.8 (0.14)
Kuwait	69 (3.6)	350 (5.5)	27 (3.5)	343 (9.3)	3 (1.4)	311 (15.3)	11.3 (0.15)
Romania	68 (3.8)	503 (7.2)	31 (3.9)	507 (8.2)	1 (0.6)	~ ~	11.4 (0.12)
Kazakhstan	59 (3.9)	490 (5.6)	41 (4.0)	503 (9.5)	0 (0.3)	~ ~	11.1 (0.08)
Armenia	57 (3.8)	420 (4.6)	42 (3.9)	412 (5.6)	1 (0.9)	~ ~	11.1 (0.11)
Serbia	52 (4.0)	522 (3.8)	46 (4.0)	508 (4.5)	2 (0.9)	~ ~	10.8 (0.13)
Oman	52 (3.3)	384 (4.2)	47 (3.4)	371 (6.6)	1 (0.6)	~ ~	10.8 (0.07)
Slovak Republic	50 (3.4)	532 (4.9)	48 (3.5)	534 (4.4)	2 (0.9)	~ ~	10.7 (0.09)
Korea, Rep. of	49 (3.7)	592 (2.7)	48 (3.6)	582 (2.6)	3 (1.5)	570 (10.3)	10.6 (0.15)
United States	r 49 (2.8)	547 (2.9)	40 (2.7)	546 (3.8)	11 (1.7)	535 (6.8)	10.4 (0.14)
Azerbaijan	47 (4.1)	439 (8.4)	49 (4.3)	440 (7.4)	4 (1.9)	410 (42.0)	10.6 (0.13)
Portugal	45 (4.8)	521 (7.0)	50 (4.9)	522 (4.2)	5 (1.4)	525 (8.0)	10.6 (0.18)
Turkey	44 (3.3)	461 (7.8)	46 (2.9)	462 (6.5)	9 (1.8)	468 (8.6)	10.2 (0.12)
Australia	r 43 (3.4)	520 (5.4)	44 (3.9)	520 (5.4)	13 (2.8)	515 (8.5)	10.3 (0.15)
Hungary	43 (4.2)	532 (6.6)	54 (4.1)	536 (5.4)	3 (1.1)	528 (12.6)	10.5 (0.12)
United Arab Emirates	43 (2.7)	437 (4.4)	51 (2.6)	426 (3.9)	6 (1.3)	416 (11.2)	10.4 (0.09)
England	42 (3.7)	523 (5.8)	47 (3.9)	534 (4.4)	11 (2.0)	537 (13.8)	10.3 (0.14)
New Zealand	41 (3.1)	496 (5.0)	54 (2.9)	500 (3.5)	5 (1.3)	476 (12.8)	10.4 (0.11)
Croatia	41 (3.8)	519 (3.0)	57 (3.8)	515 (2.6)	2 (0.9)	~ ~	10.5 (0.11)
Lithuania	40 (3.4)	516 (3.9)	55 (3.5)	514 (4.1)	5 (1.5)	511 (10.1)	10.4 (0.11)
Chile	39 (4.2)	487 (5.2)	40 (4.4)	478 (5.2)	22 (3.5)	471 (9.5)	9.7 (0.19)
Thailand	38 (3.5)	473 (8.2)	57 (3.8)	473 (7.6)	5 (1.7)	462 (15.7)	10.5 (0.15)
Spain	38 (3.8)	514 (3.6)	51 (3.8)	502 (4.2)	11 (2.3)	493 (6.1)	9.9 (0.17)
Qatar	35 (4.1)	391 (11.6)	62 (4.1)	395 (6.4)	3 (1.3)	409 (38.3)	10.3 (0.18)
Sweden	r 35 (4.6)	535 (4.5)	51 (4.6)	533 (4.0)	14 (3.5)	542 (4.9)	9.8 (0.23)
Norway	34 (4.0)	497 (3.0)	55 (4.1)	493 (3.4)	11 (3.1)	491 (7.9)	9.9 (0.17)
Georgia	33 (3.1)	449 (7.4)	62 (3.4)	460 (4.0)	5 (1.5)	431 (26.7)	10.3 (0.11)
Poland	32 (3.0)	500 (3.6)	66 (3.1)	508 (3.2)	2 (0.9)	~ ~	10.3 (0.08)
Japan	32 (3.8)	563 (2.8)	55 (4.2)	559 (2.4)	13 (2.8)	543 (5.2)	9.8 (0.13)
Russian Federation	31 (3.9)	550 (6.7)	67 (4.0)	553 (3.6)	1 (0.8)	~ ~	10.3 (0.08)
Iran, Islamic Rep. of	31 (3.0)	449 (7.6)	60 (2.9)	452 (4.9)	9 (2.0)	473 (12.3)	10.0 (0.14)
Singapore	31 (2.5)	581 (5.9)	61 (2.8)	584 (4.3)	9 (1.4)	580 (14.4)	9.9 (0.10)
Bahrain	29 (4.9)	464 (7.1)	58 (5.1)	448 (4.8)	13 (2.8)	436 (13.2)	9.7 (0.16)
Italy	27 (3.1)	527 (6.1)	58 (3.5)	524 (3.6)	15 (2.5)	522 (6.8)	9.4 (0.13)
Chinese Taipei	27 (3.6)	556 (4.5)	56 (4.0)	552 (3.1)	18 (3.0)	547 (5.1)	9.4 (0.17)
Germany	25 (2.9)	522 (4.8)	59 (3.6)	529 (3.5)	16 (2.6)	537 (5.6)	9.5 (0.12)
Finland	25 (2.7)	571 (4.6)	62 (2.6)	571 (2.9)	13 (1.8)	565 (6.2)	9.6 (0.13)
Northern Ireland	r 22 (4.1)	515 (5.7)	54 (4.9)	519 (4.1)	24 (3.7)	514 (7.0)	9.3 (0.22)
Belgium (Flemish)	20 (2.5)	508 (3.4)	62 (3.5)	508 (2.5)	18 (2.8)	513 (5.2)	9.3 (0.14)
Austria	19 (3.1)	521 (7.5)	55 (3.8)	532 (3.2)	26 (3.0)	540 (4.2)	9.0 (0.15)
Saudi Arabia	18 (3.2)	429 (11.4)	59 (4.2)	439 (6.5)	24 (3.2)	414 (10.2)	9.1 (0.14)
Netherlands	r 18 (3.9)	532 (6.1)	57 (4.6)	531 (3.4)	26 (4.5)	527 (4.3)	9.0 (0.19)
Hong Kong SAR	16 (3.6)	536 (7.0)	74 (3.7)	534 (4.9)	10 (2.5)	538 (8.6)	9.4 (0.14)
Morocco	16 (2.4)	261 (11.5)	43 (3.7)	270 (8.1)	41 (3.4)	260 (8.3)	8.1 (0.19)
Ireland	16 (2.6)	522 (9.7)	59 (3.6)	512 (3.8)	25 (3.1)	525 (5.6)	8.8 (0.14)
Czech Republic	15 (2.5)	529 (4.9)	70 (3.6)	540 (3.0)	15 (3.0)	529 (5.2)	9.2 (0.14)
Yemen	14 (3.0)	196 (16.5)	60 (4.2)	221 (8.4)	25 (3.7)	187 (13.8)	8.8 (0.16)
Denmark	14 (2.7)	537 (5.2)	67 (3.5)	530 (3.4)	19 (3.0)	526 (5.9)	9.3 (0.13)
Malta	14 (0.1)	461 (3.5)	45 (0.1)	447 (2.5)	41 (0.1)	441 (2.4)	8.1 (0.01)
Tunisia	13 (2.3)	350 (17.1)	57 (3.9)	347 (7.4)	31 (3.6)	340 (9.8)	8.5 (0.17)
International Avg.	35 (0.5)	487 (1.0)	53 (0.5)	487 (0.7)	12 (0.3)	479 (2.1)	

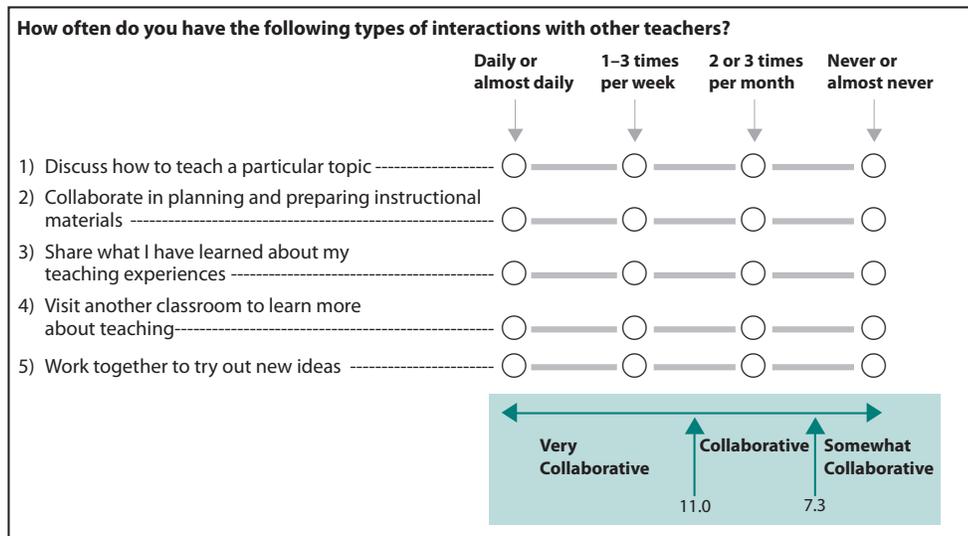
SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Centerpoint of scale set at 10.  
 ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.  
 A tilde (~) indicates insufficient data to report achievement.  
 An "r" indicates data are available for at least 70% but less than 85% of the students.

**Exhibit 8.12: Collaborate to Improve Teaching (Continued)**

Country	Very Collaborative		Collaborative		Somewhat Collaborative		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Sixth Grade Participants</b>							
Botswana	56 (4.3)	362 (6.4)	37 (4.2)	380 (11.5)	7 (2.3)	384 (51.4)	10.9 (0.19)
Honduras	35 (4.8)	425 (14.9)	51 (4.6)	434 (5.7)	14 (2.4)	443 (10.4)	9.9 (0.23)
Yemen	17 (3.0)	326 (16.0)	61 (3.5)	359 (8.5)	22 (3.5)	324 (15.1)	8.9 (0.16)
<b>Benchmarking Participants</b>							
North Carolina, US	62 (7.2)	535 (6.6)	34 (6.6)	542 (6.9)	4 (2.1)	536 (10.5)	11.1 (0.26)
Dubai, UAE	62 (4.0)	470 (6.0)	37 (4.0)	463 (9.0)	2 (0.3)	~ ~	11.0 (0.09)
Florida, US	52 (4.9)	546 (5.6)	44 (4.8)	543 (6.6)	5 (2.3)	539 (29.0)	10.9 (0.21)
Abu Dhabi, UAE	40 (4.4)	413 (8.3)	54 (4.5)	415 (7.9)	6 (1.8)	404 (6.2)	10.4 (0.14)
Alberta, Canada	33 (4.1)	542 (4.5)	53 (4.9)	540 (4.3)	14 (3.2)	546 (5.6)	9.8 (0.19)
Ontario, Canada	27 (3.5)	528 (4.3)	57 (4.0)	526 (4.0)	17 (2.9)	533 (5.5)	9.8 (0.18)
Quebec, Canada	20 (3.9)	514 (6.1)	58 (4.8)	516 (3.4)	22 (3.6)	519 (5.3)	9.1 (0.18)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



## Exhibit 8.13: Collaborate to Improve Teaching

Reported by Teachers

Students were scored according to their teachers' responses to how often they interacted with other teachers in each of five teaching areas on the *Collaborate to Improve Teaching* scale. Students with **Very Collaborative** teachers had a score on the scale of at least 11.4, which corresponds to their teachers having interactions with other teachers at least "one to three times per week" in each of three of the five areas and "two or three times per month" in each of the other two, on average. Students with **Somewhat Collaborative** teachers had a score no higher than 7.5, which corresponds to their teachers interacting with other teachers "never or almost never" in each of three of the five areas and "two or three times per month" in each of the other two, on average. All other students had **Collaborative** teachers.

Country	Very Collaborative		Collaborative		Somewhat Collaborative		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Qatar	53 (4.2)	401 (8.3)	40 (4.4)	439 (11.2)	6 (1.2)	433 (14.7)	11.2 (0.11)
Israel	51 (3.3)	514 (5.6)	46 (3.3)	520 (6.5)	3 (1.1)	510 (40.2)	11.0 (0.12)
Bahrain	47 (2.6)	456 (3.4)	44 (2.1)	451 (2.8)	9 (1.7)	450 (14.0)	10.7 (0.13)
Kazakhstan	46 (2.8)	479 (5.3)	53 (2.8)	500 (4.9)	1 (0.2)	~ ~	11.1 (0.07)
Oman	46 (3.2)	429 (5.3)	48 (3.1)	412 (5.4)	6 (1.7)	417 (14.1)	10.9 (0.11)
Indonesia	45 (4.1)	399 (8.3)	50 (4.3)	410 (5.4)	5 (1.8)	412 (12.7)	10.7 (0.12)
Armenia	44 (2.9)	437 (4.2)	54 (2.8)	440 (4.2)	2 (0.5)	~ ~	11.1 (0.08)
Romania	41 (2.6)	465 (3.8)	55 (2.5)	466 (4.5)	4 (0.9)	456 (8.8)	10.8 (0.09)
Thailand	39 (3.8)	460 (8.6)	51 (3.5)	447 (4.5)	10 (2.4)	434 (14.2)	10.5 (0.17)
United Arab Emirates	38 (2.2)	463 (4.0)	56 (2.1)	458 (3.4)	6 (0.8)	485 (12.1)	10.6 (0.08)
United States	r 38 (2.4)	528 (4.3)	47 (2.2)	529 (4.8)	16 (1.9)	516 (9.1)	10.2 (0.12)
Australia	s 37 (3.6)	520 (7.1)	52 (3.4)	530 (6.8)	11 (2.2)	518 (13.8)	10.4 (0.16)
Ghana	37 (4.0)	298 (7.8)	52 (3.8)	316 (9.1)	12 (2.5)	283 (16.2)	10.5 (0.18)
Macedonia, Rep. of	34 (2.4)	405 (7.0)	61 (2.5)	413 (6.7)	5 (0.9)	412 (14.2)	10.5 (0.09)
Lebanon	34 (3.3)	417 (7.9)	60 (3.5)	402 (6.4)	6 (1.3)	381 (15.4)	10.4 (0.12)
Palestinian Nat'l Auth.	33 (4.1)	415 (6.3)	61 (4.0)	424 (4.9)	6 (1.9)	412 (17.2)	10.4 (0.14)
Malaysia	32 (3.8)	424 (9.8)	64 (3.8)	430 (8.2)	4 (1.5)	378 (30.8)	10.5 (0.11)
Georgia	31 (2.1)	416 (4.0)	67 (2.0)	422 (3.5)	3 (0.7)	419 (8.5)	10.5 (0.08)
Turkey	31 (3.1)	485 (8.5)	53 (3.6)	482 (4.6)	16 (2.7)	485 (9.0)	9.9 (0.14)
New Zealand	30 (2.8)	518 (8.4)	58 (3.9)	512 (6.4)	12 (2.7)	486 (10.9)	10.0 (0.11)
England	r 27 (3.4)	521 (12.6)	57 (3.0)	536 (5.7)	16 (2.6)	535 (8.2)	9.9 (0.16)
Sweden	r 26 (3.5)	508 (5.7)	50 (3.3)	515 (3.7)	24 (3.0)	504 (4.9)	9.6 (0.15)
Ukraine	26 (2.6)	498 (5.2)	70 (2.5)	502 (3.9)	4 (1.3)	496 (10.6)	10.4 (0.09)
Jordan	25 (3.3)	460 (7.8)	66 (3.8)	448 (5.4)	10 (2.5)	428 (18.8)	10.0 (0.13)
Slovenia	23 (1.9)	541 (3.3)	63 (2.1)	544 (2.9)	15 (1.6)	543 (4.3)	9.9 (0.08)
Singapore	22 (2.3)	585 (10.8)	66 (2.7)	595 (5.6)	11 (1.8)	573 (11.8)	9.9 (0.09)
Norway	22 (3.3)	501 (6.7)	60 (4.3)	493 (3.4)	18 (3.7)	490 (4.9)	9.7 (0.16)
Chile	21 (3.2)	470 (6.6)	44 (4.2)	459 (4.6)	35 (3.5)	457 (5.7)	9.0 (0.18)
Saudi Arabia	21 (3.4)	443 (7.3)	64 (4.1)	436 (4.9)	16 (3.1)	428 (12.3)	9.7 (0.16)
Hungary	20 (2.3)	506 (6.9)	65 (2.4)	526 (3.2)	15 (1.8)	531 (5.4)	9.8 (0.09)
Tunisia	19 (3.1)	436 (4.4)	63 (3.8)	440 (3.2)	18 (2.7)	437 (5.4)	9.4 (0.14)
Syrian Arab Republic	18 (2.3)	416 (6.2)	60 (3.6)	427 (5.1)	22 (3.4)	431 (9.2)	9.4 (0.15)
Korea, Rep. of	18 (2.7)	566 (5.0)	66 (3.7)	559 (2.3)	16 (2.9)	559 (4.3)	9.6 (0.13)
Lithuania	18 (1.7)	517 (5.1)	67 (2.0)	513 (2.6)	15 (1.5)	516 (6.0)	9.5 (0.08)
Japan	17 (3.3)	557 (6.8)	61 (4.0)	558 (3.1)	22 (3.2)	558 (5.6)	9.2 (0.16)
Finland	15 (1.8)	557 (3.9)	59 (2.2)	552 (2.6)	26 (2.2)	551 (3.7)	9.2 (0.11)
Russian Federation	15 (1.6)	543 (6.8)	81 (1.6)	542 (3.3)	4 (0.8)	545 (7.0)	10.1 (0.06)
Chinese Taipei	15 (3.1)	568 (8.9)	58 (4.3)	563 (3.8)	28 (4.0)	563 (4.7)	9.0 (0.17)
Italy	13 (2.8)	504 (9.8)	56 (3.7)	504 (4.0)	30 (3.5)	498 (4.5)	8.8 (0.18)
Hong Kong SAR	13 (3.3)	520 (10.8)	73 (4.4)	537 (4.9)	14 (2.8)	536 (10.7)	9.4 (0.14)
Iran, Islamic Rep. of	13 (2.5)	482 (9.5)	69 (3.2)	477 (4.5)	18 (2.7)	459 (10.5)	9.3 (0.12)
Morocco	13 (1.3)	384 (5.8)	47 (2.5)	377 (2.9)	40 (2.4)	374 (3.1)	8.4 (0.11)
International Avg.	29 (0.5)	476 (1.1)	58 (0.5)	479 (0.8)	13 (0.4)	472 (2.1)	

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

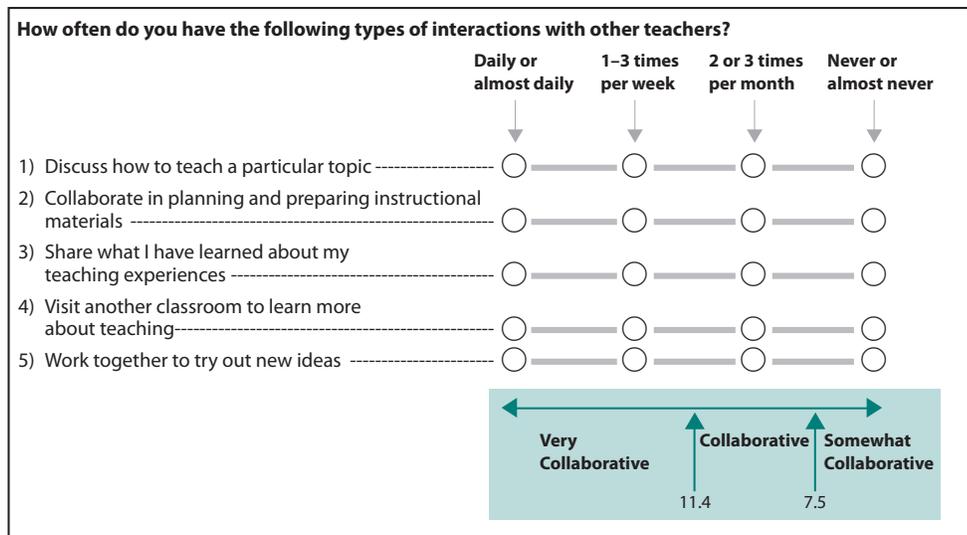
An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

An "x" indicates data are available for less than 50% of students.

**Exhibit 8.13: Collaborate to Improve Teaching (Continued)**

Country	Very Collaborative		Collaborative		Somewhat Collaborative		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Ninth Grade Participants</b>							
Botswana	44 (4.2)	406 (5.3)	48 (4.2)	405 (5.8)	8 (2.4)	390 (13.9)	10.8 (0.17)
South Africa	37 (3.8)	324 (7.5)	51 (3.9)	332 (7.4)	13 (2.4)	334 (14.3)	10.4 (0.15)
Honduras	21 (3.9)	364 (7.4)	52 (4.6)	376 (7.0)	27 (3.7)	360 (6.6)	9.2 (0.19)
<b>Benchmarking Participants</b>							
North Carolina, US	s 63 (7.0)	530 (12.8)	19 (5.7)	540 (13.1)	17 (6.3)	498 (20.4)	10.7 (0.33)
Dubai, UAE	r 46 (3.0)	481 (5.2)	49 (3.0)	477 (4.3)	5 (0.7)	495 (26.3)	10.9 (0.09)
Abu Dhabi, UAE	40 (4.4)	461 (7.1)	54 (4.2)	455 (5.7)	6 (1.7)	501 (21.3)	10.5 (0.15)
Colorado, US	40 (6.2)	534 (9.1)	44 (5.9)	542 (9.7)	16 (5.1)	556 (15.1)	10.2 (0.30)
Ontario, Canada	35 (3.7)	522 (3.5)	47 (4.1)	522 (4.2)	17 (3.2)	520 (5.8)	10.2 (0.20)
California, US	s 34 (5.3)	487 (8.1)	56 (5.3)	513 (7.8)	10 (3.4)	468 (13.4)	10.2 (0.23)
Connecticut, US	r 34 (6.4)	556 (6.6)	42 (5.5)	529 (13.1)	25 (5.7)	508 (16.3)	9.6 (0.37)
Indiana, US	r 31 (6.2)	525 (7.1)	42 (7.2)	539 (9.3)	27 (5.7)	539 (7.4)	9.5 (0.26)
Massachusetts, US	r 26 (7.3)	569 (18.7)	56 (7.6)	562 (9.5)	18 (5.3)	558 (21.9)	9.7 (0.34)
Alberta, Canada	26 (2.8)	543 (4.4)	46 (3.5)	549 (3.7)	28 (3.3)	544 (3.9)	9.5 (0.16)
Alabama, US	r 26 (5.7)	490 (9.6)	62 (7.0)	481 (8.8)	13 (4.6)	482 (16.9)	9.7 (0.26)
Minnesota, US	r 23 (5.6)	539 (19.4)	48 (7.8)	564 (7.4)	28 (7.5)	546 (8.1)	9.2 (0.36)
Quebec, Canada	14 (2.7)	524 (7.8)	62 (3.7)	518 (3.8)	24 (3.5)	525 (6.1)	9.1 (0.17)
Florida, US	x x	x x	x x	x x	x x	x x	x x

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



science teachers that were only **Somewhat Collaborative** (e.g., never or almost never interacting in three of the five areas).

Looking across the countries at the fourth and sixth grades as well as the benchmarking participants, it is clear that there are differences from country to country. However, primarily these differences were between the percentages of students with **Very Collaborative** and **Collaborative** teachers, although they had the same achievement (487), on average.

Exhibit 8.13 presents the teacher collaboration results for the eighth grade. The science teachers of eighth grade students reported a degree of collaboration with other teachers comparable to their colleagues at the fourth grade. Nearly one-third of the eighth grade students (29%) had **Very Collaborative** teachers and another 58 percent had **Collaborative** teachers, with 13 percent having only **Somewhat Collaborative** teachers. Just like at the fourth grade, eighth grade students had essentially the same average science achievement whether their teachers were **Very Collaborative** or **Collaborative** (476 and 479, respectively). In general, the ninth grade and benchmarking students also had teachers that reported a considerable amount of collaboration with other teachers. According to TIMSS 2011 reports from teachers, almost all students have the benefit of teachers who collaborate with other teachers to improve instruction.

### *Instruction to Engage Students in Learning*

Historically, educational studies, including TIMSS, have struggled to link student achievement to instructional activities. Typically, teachers are asked to report how frequently they use various instruction activities and strategies, and such information can be very useful. However, in light of the growing body of evidence about the complexities of teaching and learning, researchers are beginning to understand these lists of activities cannot be used as proxies for the characteristics of good teaching.

To help build a better bridge between curriculum and instruction, TIMSS 2011 collected information about the concept of student content engagement as described by McLaughlin, McGrath, Burian-Fitzgerald, Lanahan, Scotchmer, Enyeart, and Salganik (2005). According to this work, supported by the U.S. National Center for Education Statistics, student content engagement focuses on the importance of the activity that brings the student and the subject matter content together. Engagement refers to the cognitive interaction between the student and instructional content, and may take the form of listening to the teacher or providing an explanation of a problem solution. It is the student's in-the-moment cognitive interaction with instructional content.

To measure aspects of student content engagement, TIMSS 2011 developed both a teacher scale, called the Engaging Students in Learning scale, and a student scale called the Engaged in Science Lessons scale.

Exhibit 8.14 presents the fourth grade results for the Engaging Students in Learning scale. The scale contains six items related to teachers' instructional practices intended to interest students and reinforce learning:

- ◆ Summarizing the lesson's learning goals;
- ◆ Relating the lesson to students' daily lives;
- ◆ Questioning to elicit reasons and explanations;
- ◆ Encouraging students to show improvement;
- ◆ Praising students for good effort; and
- ◆ Bringing interesting materials to class.

Students were categorized according to their teachers' responses, with **Most Lessons** corresponding to teachers who used three of the six practices in "every or almost every lesson" and the other three in "about half the lessons," on average.

Many fourth grade students, 71 percent on average, internationally, had teachers that made efforts to engage them in instruction by using a variety of strategies in **Most Lessons**, and most of the remaining students had teachers that used engaging instructional practices in **About Half the Lessons** (with a few exceptions). Although the fourth grade students whose teachers used engaging instruction in **Most Lessons** had somewhat higher average science achievement than other students, the pattern varied considerably across the fourth grade, sixth grade, and benchmarking participants.

Exhibit 8.15 presents the eighth grade results based on a somewhat shorter Engaging Students in Learning scale. At the eighth grade, two items were removed from the scale because relatively small percentages of students had teachers that frequently related lessons to students' daily lives, and even smaller percentages had teachers that routinely brought interesting materials to class (see Exhibit 8.16). Perhaps eighth grade teachers should make greater efforts to make science relevant to students' daily lives and provide interesting materials, especially in light of the drop by the eighth grade in students' liking science learning. On the other hand, teachers in some of the highest achieving countries reported the least use of these instructional practices.

## Exhibit 8.14: Instruction to Engage Students in Learning

Reported by Teachers

Students were scored according to their teachers' responses to how often they used each of six instructional practices on the *Engaging Students in Learning* scale. Students with teachers who used engagement practices in **Most Lessons** had a score on the scale of at least 9.1, which corresponds to their teachers using three of the six practices "every or almost every lesson" and using the other three in "about half the lessons," on average. Students with teachers who used engagement practices in **Some Lessons** had a score no higher than 6.0, which corresponds to their teachers using three of the six practices in "some lessons" and using the other three in "about half the lessons," on average. All other students had teachers who used engagement practices in **About Half the Lessons**.

Country	Most Lessons		About Half the Lessons		Some Lessons		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Romania	94 (1.8)	505 (6.3)	6 (1.5)	495 (19.2)	1 (0.0)	~ ~	11.4 (0.15)
Lithuania	93 (1.6)	514 (2.6)	7 (1.6)	517 (8.6)	0 (0.0)	~ ~	11.1 (0.10)
United Arab Emirates	90 (1.4)	432 (2.8)	9 (1.4)	412 (10.2)	1 (0.0)	~ ~	11.4 (0.09)
Bahrain	90 (2.2)	452 (3.9)	10 (2.2)	422 (12.5)	0 (0.0)	~ ~	11.0 (0.17)
Qatar	90 (2.4)	390 (4.6)	10 (2.4)	429 (20.3)	0 (0.0)	~ ~	11.3 (0.13)
Portugal	89 (2.1)	522 (4.3)	10 (2.1)	516 (8.7)	0 (0.0)	~ ~	10.8 (0.13)
Kazakhstan	89 (2.1)	496 (5.6)	11 (2.1)	492 (12.6)	0 (0.0)	~ ~	11.6 (0.14)
United States r	88 (1.5)	544 (2.1)	11 (1.4)	549 (7.9)	1 (0.5)	~ ~	10.9 (0.09)
Hungary	88 (1.9)	533 (4.2)	12 (1.9)	535 (8.8)	0 (0.0)	~ ~	10.8 (0.11)
Croatia	87 (2.2)	517 (2.2)	12 (2.2)	509 (6.1)	0 (0.2)	~ ~	10.5 (0.10)
Oman	86 (2.4)	380 (3.8)	14 (2.4)	368 (16.8)	1 (0.6)	~ ~	10.7 (0.12)
England	85 (3.1)	529 (3.6)	15 (3.1)	530 (8.9)	0 (0.0)	~ ~	10.3 (0.13)
Malta	85 (0.1)	447 (2.0)	15 (0.1)	445 (3.9)	0 (0.0)	~ ~	10.9 (0.00)
Slovak Republic	84 (2.2)	530 (4.2)	16 (2.2)	539 (6.0)	0 (0.3)	~ ~	10.5 (0.11)
Slovenia	84 (2.8)	519 (2.9)	16 (2.8)	526 (7.0)	0 (0.0)	~ ~	10.5 (0.13)
Chile	83 (3.5)	479 (3.1)	17 (3.5)	493 (8.4)	0 (0.0)	~ ~	11.0 (0.16)
Russian Federation	82 (3.0)	552 (3.5)	17 (2.9)	551 (7.6)	1 (0.7)	~ ~	10.7 (0.16)
Georgia	81 (2.2)	457 (4.0)	19 (2.2)	448 (11.2)	0 (0.0)	~ ~	10.6 (0.13)
Northern Ireland r	80 (3.6)	515 (3.6)	19 (3.6)	525 (7.1)	1 (0.6)	~ ~	9.8 (0.12)
Tunisia	78 (3.7)	344 (6.1)	21 (3.5)	353 (10.1)	2 (1.1)	~ ~	10.4 (0.18)
Serbia	78 (3.4)	516 (3.7)	22 (3.4)	514 (5.2)	0 (0.4)	~ ~	10.3 (0.12)
Australia r	78 (3.4)	522 (3.6)	22 (3.4)	511 (7.3)	0 (0.2)	~ ~	10.1 (0.13)
Iran, Islamic Rep. of	75 (2.7)	457 (5.0)	24 (2.8)	439 (7.8)	1 (0.4)	~ ~	10.3 (0.13)
Kuwait	74 (3.5)	349 (5.8)	24 (3.4)	344 (10.9)	2 (1.1)	~ ~	10.2 (0.17)
Poland	74 (3.1)	503 (3.1)	25 (3.1)	509 (4.0)	1 (0.6)	~ ~	10.2 (0.12)
Saudi Arabia	73 (3.3)	432 (6.3)	25 (3.1)	424 (10.4)	1 (1.1)	~ ~	10.3 (0.15)
Italy	73 (3.1)	524 (3.5)	27 (3.0)	528 (4.7)	1 (0.0)	~ ~	10.3 (0.14)
Czech Republic	72 (3.7)	539 (2.6)	27 (3.6)	530 (6.2)	1 (0.8)	~ ~	9.7 (0.12)
Thailand	69 (3.5)	477 (6.3)	29 (3.5)	463 (10.9)	2 (1.0)	~ ~	10.0 (0.17)
Azerbaijan	69 (3.4)	442 (6.7)	31 (3.4)	431 (11.7)	0 (0.0)	~ ~	9.9 (0.12)
Korea, Rep. of	69 (4.2)	589 (2.4)	30 (4.1)	580 (3.2)	1 (0.9)	~ ~	10.3 (0.19)
Armenia	69 (3.7)	418 (4.5)	31 (3.7)	414 (8.0)	1 (0.5)	~ ~	10.1 (0.16)
Singapore	68 (2.5)	581 (4.6)	28 (2.8)	583 (6.6)	4 (1.1)	612 (11.3)	9.8 (0.12)
Ireland	68 (3.1)	513 (3.6)	31 (3.1)	522 (7.1)	1 (0.5)	~ ~	9.8 (0.12)
New Zealand	67 (3.1)	497 (3.5)	32 (3.0)	497 (4.1)	0 (0.4)	~ ~	9.7 (0.10)
Spain	66 (3.5)	506 (3.2)	33 (3.5)	506 (5.5)	2 (1.1)	~ ~	9.9 (0.16)
Morocco	64 (3.7)	270 (6.6)	33 (3.6)	252 (7.6)	3 (1.3)	249 (29.4)	9.7 (0.16)
Turkey	64 (3.5)	472 (5.5)	34 (3.4)	444 (8.2)	2 (0.9)	~ ~	9.9 (0.13)
Chinese Taipei	62 (4.2)	552 (3.1)	31 (3.8)	552 (4.1)	7 (2.0)	540 (6.9)	9.6 (0.22)
Hong Kong SAR	62 (4.7)	538 (4.0)	35 (4.4)	527 (10.8)	3 (1.5)	552 (4.6)	9.3 (0.17)
Belgium (Flemish)	56 (3.2)	511 (2.7)	43 (3.3)	507 (3.0)	1 (0.5)	~ ~	9.1 (0.10)
Sweden r	55 (4.4)	539 (3.6)	42 (4.6)	529 (4.7)	2 (1.2)	~ ~	9.1 (0.16)
Japan	52 (4.0)	559 (2.3)	44 (4.2)	558 (2.8)	4 (1.3)	558 (8.8)	8.9 (0.13)
Austria	51 (3.4)	528 (3.3)	46 (3.3)	535 (4.4)	3 (1.3)	535 (9.6)	9.1 (0.13)
Germany	47 (3.4)	520 (3.9)	49 (3.4)	534 (3.6)	4 (1.4)	552 (6.5)	8.7 (0.11)
Yemen	43 (4.6)	216 (9.2)	51 (4.5)	205 (10.7)	5 (1.9)	199 (25.1)	8.8 (0.17)
Netherlands r	41 (3.9)	528 (3.4)	55 (4.2)	532 (3.4)	4 (2.0)	531 (12.0)	8.5 (0.11)
Norway	41 (5.0)	493 (3.8)	56 (5.1)	496 (3.1)	3 (1.5)	481 (8.4)	8.8 (0.16)
Finland	33 (3.1)	576 (3.1)	61 (3.1)	567 (3.5)	5 (1.3)	576 (6.0)	8.4 (0.10)
Denmark	27 (2.9)	529 (4.8)	65 (3.1)	531 (3.2)	8 (2.3)	525 (12.0)	8.1 (0.12)
International Avg.	71 (0.5)	487 (0.6)	27 (0.4)	484 (1.2)	2 (0.1)	~ ~	

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

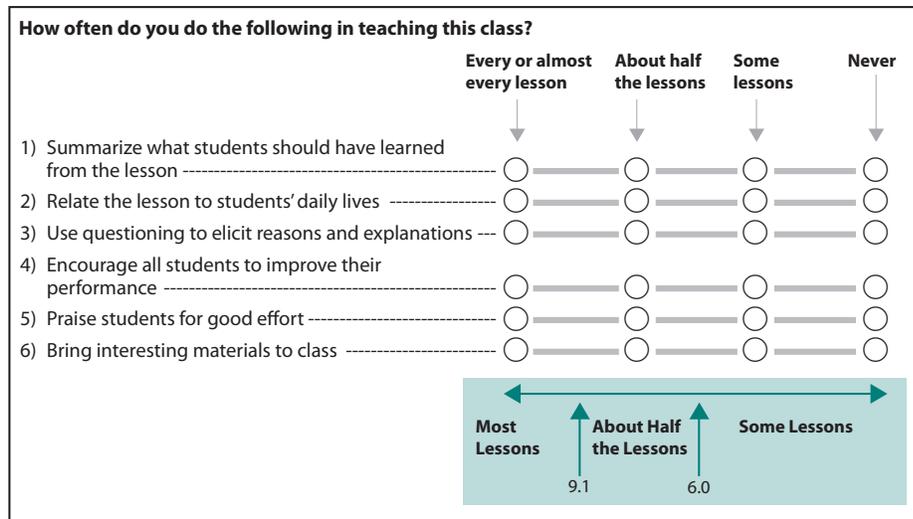
A tilde (~) indicates insufficient data to report achievement.

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

**Exhibit 8.14: Instruction to Engage Students in Learning (Continued)**

Country	Most Lessons		About Half the Lessons		Some Lessons		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Sixth Grade Participants</b>							
Honduras	79 (4.1)	440 (6.0)	20 (4.1)	405 (15.6)	1 (1.0)	~ ~	10.3 (0.18)
Botswana	76 (3.8)	373 (7.3)	24 (3.8)	366 (13.7)	0 (0.0)	~ ~	10.3 (0.16)
Yemen	40 (4.0)	351 (10.4)	51 (4.3)	337 (10.1)	9 (2.6)	369 (17.7)	8.6 (0.16)
<b>Benchmarking Participants</b>							
Florida, US	96 (1.9)	543 (3.8)	4 (1.9)	538 (30.3)	0 (0.0)	~ ~	11.1 (0.16)
Dubai, UAE	94 (0.8)	466 (3.6)	4 (0.8)	494 (13.8)	2 (0.1)	~ ~	11.5 (0.10)
Abu Dhabi, UAE	90 (2.2)	414 (5.4)	10 (2.2)	412 (19.2)	0 (0.0)	~ ~	11.6 (0.15)
North Carolina, US	88 (2.8)	536 (5.0)	10 (3.1)	553 (12.7)	1 (1.3)	~ ~	10.8 (0.15)
Alberta, Canada	84 (3.8)	543 (3.2)	16 (3.8)	537 (9.0)	0 (0.0)	~ ~	10.3 (0.13)
Ontario, Canada	79 (3.1)	528 (3.0)	21 (3.1)	526 (7.0)	0 (0.0)	~ ~	10.0 (0.12)
Quebec, Canada	58 (4.2)	518 (3.7)	41 (4.3)	514 (3.9)	2 (0.6)	~ ~	9.3 (0.14)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



## Exhibit 8.15: Instruction to Engage Students in Learning

Reported by Teachers

Students were scored according to their teachers' responses to how often they used each of four instructional practices on the *Engaging Students in Learning* scale. Students with teachers who used engagement practices in **Most Lessons** had a score on the scale of at least 8.7, which corresponds to their teachers using two of the four practices "every or almost every lesson" and using the other two in "about half the lessons," on average. Students with teachers who used engagement practices in **Some Lessons** had a score no higher than 5.7, which corresponds to their teachers using two of the four practices in "some lessons" and using the other two in "about half the lessons," on average. All other students had teachers who used engagement practices in **About Half the Lessons**.

Country	Most Lessons		About Half the Lessons		Some Lessons		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Palestinian Nat'l Auth.	94 (1.6)	422 (3.2)	6 (1.6)	398 (15.6)	0 (0.0)	~ ~	10.9 (0.12)
United Arab Emirates	94 (1.1)	462 (2.5)	6 (1.1)	471 (11.6)	0 (0.0)	~ ~	10.9 (0.07)
Qatar	93 (1.7)	420 (3.8)	6 (1.4)	411 (12.0)	1 (0.9)	~ ~	10.5 (0.15)
Indonesia	93 (1.1)	404 (4.7)	7 (1.1)	416 (8.9)	0 (0.3)	~ ~	10.8 (0.12)
England	r 93 (1.6)	532 (5.6)	7 (1.6)	533 (13.0)	1 (0.4)	~ ~	10.8 (0.10)
Kazakhstan	91 (1.2)	493 (4.1)	8 (1.2)	468 (8.7)	0 (0.2)	~ ~	10.8 (0.08)
Romania	91 (1.4)	466 (3.4)	8 (1.2)	456 (7.5)	1 (0.6)	~ ~	10.7 (0.09)
Lithuania	90 (1.1)	514 (2.6)	10 (1.2)	519 (5.1)	0 (0.2)	~ ~	10.5 (0.07)
Ukraine	89 (1.6)	502 (3.7)	10 (1.6)	491 (6.4)	1 (0.3)	~ ~	10.6 (0.09)
Morocco	89 (1.4)	377 (2.4)	10 (1.4)	375 (5.1)	1 (0.5)	~ ~	10.5 (0.09)
Jordan	89 (2.2)	451 (4.4)	9 (2.1)	441 (18.4)	2 (1.0)	~ ~	10.4 (0.12)
Saudi Arabia	89 (2.7)	438 (4.3)	11 (2.7)	428 (8.6)	0 (0.0)	~ ~	10.2 (0.14)
Macedonia, Rep. of	89 (1.3)	414 (5.7)	9 (1.2)	385 (10.6)	2 (0.6)	~ ~	10.7 (0.08)
United States	s 88 (1.9)	532 (3.3)	10 (1.8)	514 (12.1)	1 (0.6)	~ ~	10.5 (0.10)
Lebanon	88 (2.3)	406 (4.8)	11 (2.1)	404 (13.4)	1 (0.5)	~ ~	10.4 (0.12)
Syrian Arab Republic	88 (2.4)	424 (4.1)	11 (2.3)	437 (10.4)	1 (0.6)	~ ~	10.2 (0.11)
Chile	87 (2.6)	461 (3.0)	12 (2.5)	464 (10.1)	1 (0.0)	~ ~	10.4 (0.15)
Ghana	86 (3.0)	305 (5.8)	14 (3.0)	303 (14.9)	0 (0.0)	~ ~	10.6 (0.15)
Oman	85 (2.2)	422 (3.4)	15 (2.2)	406 (10.7)	0 (0.1)	~ ~	10.3 (0.12)
Georgia	84 (1.7)	420 (3.2)	14 (1.6)	424 (4.4)	2 (0.5)	~ ~	10.3 (0.10)
Bahrain	84 (2.1)	460 (2.8)	16 (2.1)	418 (8.5)	0 (0.0)	~ ~	10.5 (0.10)
Russian Federation	83 (1.0)	545 (3.0)	15 (1.0)	533 (6.8)	1 (0.4)	~ ~	10.0 (0.05)
Thailand	83 (3.2)	450 (4.6)	12 (2.7)	456 (14.1)	5 (1.8)	443 (21.7)	10.2 (0.16)
Israel	83 (2.5)	518 (4.6)	16 (2.4)	525 (9.7)	1 (0.8)	~ ~	10.2 (0.13)
Tunisia	83 (2.8)	438 (2.9)	14 (2.3)	439 (4.7)	4 (1.5)	437 (6.7)	10.3 (0.15)
Hungary	83 (1.6)	520 (3.2)	16 (1.5)	534 (5.0)	2 (0.5)	~ ~	10.2 (0.09)
New Zealand	81 (3.5)	510 (5.1)	16 (3.3)	520 (10.4)	3 (1.4)	503 (50.3)	9.7 (0.15)
Iran, Islamic Rep. of	81 (2.6)	477 (4.2)	18 (2.6)	460 (10.0)	1 (0.6)	~ ~	10.0 (0.12)
Australia	s 81 (2.7)	527 (6.9)	18 (2.7)	524 (7.9)	1 (0.3)	~ ~	9.8 (0.12)
Slovenia	81 (1.8)	542 (2.6)	17 (1.7)	545 (4.3)	2 (0.5)	~ ~	9.9 (0.07)
Turkey	79 (2.7)	482 (4.1)	17 (2.5)	482 (8.8)	3 (1.1)	513 (30.9)	9.9 (0.13)
Italy	78 (3.2)	501 (3.2)	20 (3.1)	506 (6.5)	1 (0.9)	~ ~	9.8 (0.15)
Armenia	77 (2.2)	437 (3.4)	21 (2.2)	442 (5.9)	3 (0.8)	435 (11.2)	10.0 (0.11)
Malaysia	77 (3.2)	427 (6.8)	19 (2.8)	418 (17.3)	4 (1.6)	425 (36.0)	9.7 (0.16)
Sweden	r 65 (3.2)	511 (3.3)	28 (2.8)	507 (4.3)	7 (1.9)	529 (8.5)	9.0 (0.14)
Singapore	63 (2.6)	593 (6.0)	30 (2.7)	585 (8.5)	7 (1.2)	586 (13.2)	9.1 (0.12)
Chinese Taipei	61 (4.4)	562 (3.7)	26 (4.0)	569 (5.0)	13 (2.7)	563 (7.2)	8.8 (0.22)
Korea, Rep. of	58 (3.3)	559 (2.6)	33 (3.1)	560 (3.6)	9 (2.1)	567 (8.1)	9.0 (0.17)
Hong Kong SAR	51 (4.9)	539 (5.9)	35 (4.5)	532 (6.6)	14 (3.1)	527 (15.8)	8.4 (0.22)
Finland	48 (2.8)	555 (3.0)	45 (2.5)	549 (2.6)	7 (1.3)	549 (5.8)	8.4 (0.10)
Norway	46 (4.1)	488 (4.0)	48 (4.5)	499 (3.3)	6 (2.1)	497 (12.1)	8.4 (0.15)
Japan	44 (4.2)	560 (3.7)	44 (4.1)	556 (3.9)	12 (2.8)	559 (6.0)	8.2 (0.18)
International Avg.	80 (0.4)	478 (0.6)	17 (0.4)	474 (1.5)	3 (0.2)	509 (5.6)	

Centerpoint of scale set at 10.

(1) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

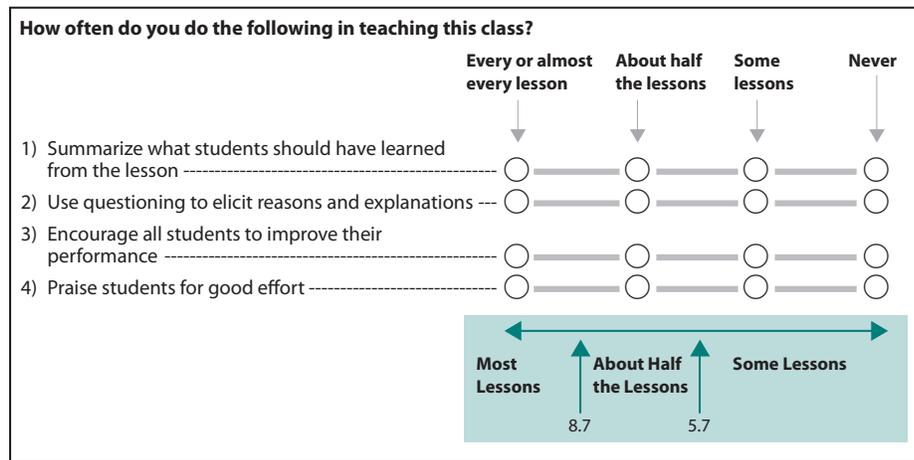
An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

An "x" indicates data are available for less than 50% of students.

**Exhibit 8.15: Instruction to Engage Students in Learning (Continued)**

Country	Most Lessons		About Half the Lessons		Some Lessons		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Ninth Grade Participants</b>							
Botswana	90 (2.2)	404 (4.0)	8 (2.2)	398 (7.3)	1 (1.0)	~ ~	10.4 (0.13)
Honduras	85 (3.3)	369 (4.7)	14 (3.2)	367 (6.7)	0 (0.4)	~ ~	10.4 (0.17)
South Africa	76 (3.0)	323 (4.5)	19 (2.8)	346 (14.2)	5 (1.9)	353 (22.4)	9.5 (0.15)
<b>Benchmarking Participants</b>							
Dubai, UAE	r 95 (1.2)	484 (3.2)	5 (1.2)	411 (17.6)	0 (0.0)	~ ~	11.0 (0.07)
Abu Dhabi, UAE	93 (2.3)	459 (4.5)	7 (2.3)	495 (18.2)	0 (0.0)	~ ~	10.7 (0.13)
Connecticut, US	s 92 (3.2)	539 (7.1)	7 (2.9)	495 (45.5)	1 (0.1)	~ ~	11.1 (0.19)
Indiana, US	s 91 (3.5)	532 (5.4)	8 (3.4)	533 (17.5)	1 (1.1)	~ ~	10.6 (0.23)
Massachusetts, US	s 91 (4.4)	563 (7.4)	9 (4.4)	579 (15.1)	0 (0.0)	~ ~	10.5 (0.22)
North Carolina, US	s 88 (4.9)	531 (10.3)	11 (4.8)	501 (33.4)	1 (0.1)	~ ~	10.8 (0.30)
Alberta, Canada	86 (2.7)	546 (2.7)	14 (2.7)	546 (6.0)	0 (0.0)	~ ~	10.1 (0.13)
California, US	s 85 (4.0)	506 (8.0)	13 (3.2)	487 (14.0)	2 (1.8)	~ ~	10.2 (0.21)
Ontario, Canada	85 (2.7)	520 (3.0)	14 (2.6)	525 (8.6)	1 (0.7)	~ ~	10.2 (0.14)
Alabama, US	s 85 (4.8)	483 (9.0)	11 (3.8)	508 (19.3)	4 (3.2)	466 (33.6)	10.5 (0.20)
Colorado, US	s 84 (4.6)	544 (6.6)	15 (4.5)	554 (19.2)	1 (0.8)	~ ~	10.5 (0.29)
Minnesota, US	r 83 (5.0)	552 (7.0)	16 (5.1)	556 (9.7)	1 (0.7)	~ ~	9.8 (0.25)
Quebec, Canada	63 (4.5)	518 (3.5)	31 (4.1)	527 (6.3)	6 (1.9)	518 (12.6)	8.8 (0.16)
Florida, US	x x	x x	x x	x x	x x	x x	x x

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



**Exhibit 8.16: Teachers Relate Lessons to Students' Daily Lives and Bring Interesting Materials to Class**

Reported by Teachers

Country	Relate Lessons to Students' Daily Lives				Bring Interesting Materials to Class			
	Every Lesson or Almost Every Lesson		About Half the Lessons or Less		Every Lesson or Almost Every Lesson		About Half the Lessons or Less	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	59 (2.4)	441 (3.7)	41 (2.4)	434 (4.6)	27 (2.8)	447 (5.5)	73 (2.8)	435 (3.8)
Australia	s 50 (3.6)	531 (8.8)	50 (3.6)	522 (6.1)	s 25 (3.9)	518 (11.9)	75 (3.9)	529 (6.2)
Bahrain	61 (3.4)	462 (3.3)	39 (3.4)	439 (4.7)	40 (2.9)	475 (5.9)	60 (2.9)	440 (3.2)
Chile	78 (2.7)	461 (3.1)	22 (2.7)	461 (6.2)	34 (4.0)	456 (6.4)	66 (4.0)	463 (3.2)
Chinese Taipei	55 (4.0)	558 (3.5)	45 (4.0)	571 (3.9)	15 (3.0)	555 (8.7)	85 (3.0)	565 (2.5)
England	r 42 (3.2)	530 (7.7)	58 (3.2)	534 (6.1)	r 23 (3.4)	530 (13.6)	77 (3.4)	533 (5.9)
Finland	53 (2.6)	555 (2.9)	47 (2.6)	548 (2.7)	17 (1.8)	560 (3.7)	83 (1.8)	550 (2.5)
Georgia	56 (2.5)	421 (3.9)	44 (2.5)	418 (3.6)	44 (2.5)	419 (4.5)	56 (2.5)	421 (3.1)
Ghana	77 (3.6)	305 (6.3)	23 (3.6)	306 (11.1)	36 (4.2)	302 (10.1)	64 (4.2)	307 (6.9)
Hong Kong SAR	47 (4.6)	533 (6.0)	53 (4.6)	537 (6.0)	19 (4.0)	543 (9.5)	81 (4.0)	533 (4.3)
Hungary	75 (1.8)	523 (3.3)	25 (1.8)	521 (4.7)	34 (2.3)	518 (5.0)	66 (2.3)	525 (3.3)
Indonesia	86 (2.7)	407 (4.2)	14 (2.7)	419 (9.7)	38 (3.6)	415 (5.3)	62 (3.6)	399 (6.4)
Iran, Islamic Rep. of	52 (3.5)	483 (5.2)	48 (3.5)	465 (6.2)	29 (3.5)	488 (7.7)	71 (3.5)	469 (4.5)
Israel	68 (3.7)	514 (4.8)	32 (3.7)	526 (7.1)	47 (3.6)	517 (5.6)	53 (3.6)	518 (6.6)
Italy	41 (3.7)	503 (4.1)	59 (3.7)	501 (4.1)	14 (2.8)	503 (6.3)	86 (2.8)	502 (2.9)
Japan	32 (3.9)	557 (3.1)	68 (3.9)	558 (3.1)	15 (3.2)	565 (6.8)	85 (3.2)	556 (2.5)
Jordan	80 (2.8)	452 (5.2)	20 (2.8)	436 (10.3)	31 (3.6)	446 (6.0)	69 (3.6)	451 (5.4)
Kazakhstan	73 (2.5)	493 (4.4)	27 (2.5)	484 (7.0)	63 (2.7)	490 (4.4)	37 (2.7)	490 (6.5)
Korea, Rep. of	57 (3.6)	560 (2.3)	43 (3.6)	561 (3.3)	35 (3.6)	563 (2.9)	65 (3.6)	559 (2.6)
Lebanon	72 (2.3)	408 (5.2)	28 (2.3)	398 (8.2)	31 (2.8)	407 (8.1)	69 (2.8)	404 (5.8)
Lithuania	62 (2.2)	515 (3.0)	38 (2.2)	513 (3.1)	40 (2.2)	516 (3.0)	60 (2.2)	514 (2.9)
Macedonia, Rep. of	75 (2.2)	412 (5.7)	25 (2.2)	407 (10.3)	59 (2.4)	422 (6.3)	41 (2.4)	395 (6.7)
Malaysia	62 (3.5)	428 (6.5)	38 (3.5)	424 (11.2)	16 (2.8)	431 (14.5)	84 (2.8)	424 (6.6)
Morocco	70 (2.0)	377 (2.6)	30 (2.0)	376 (4.2)	33 (2.2)	385 (3.8)	67 (2.2)	373 (2.6)
New Zealand	47 (3.9)	505 (5.7)	53 (3.9)	517 (7.5)	15 (2.3)	500 (9.7)	85 (2.3)	513 (5.1)
Norway	32 (3.9)	494 (4.7)	68 (3.9)	493 (2.9)	18 (3.1)	485 (7.6)	82 (3.1)	495 (2.6)
Oman	66 (3.1)	424 (4.4)	34 (3.1)	411 (7.9)	27 (2.6)	423 (7.8)	73 (2.6)	418 (4.6)
Palestinian Nat'l Auth.	77 (3.7)	422 (4.0)	23 (3.7)	416 (8.1)	45 (3.9)	424 (6.3)	55 (3.9)	417 (4.7)
Qatar	67 (3.8)	427 (5.7)	33 (3.8)	405 (10.1)	46 (4.8)	423 (8.4)	54 (4.8)	417 (9.2)
Romania	81 (2.0)	467 (3.5)	19 (2.0)	456 (6.6)	48 (2.6)	467 (3.8)	52 (2.6)	462 (4.3)
Russian Federation	64 (2.0)	545 (3.8)	36 (2.0)	538 (3.7)	43 (1.6)	545 (4.1)	57 (1.6)	541 (3.5)
Saudi Arabia	80 (3.4)	433 (4.0)	20 (3.4)	450 (10.0)	37 (4.0)	439 (6.1)	63 (4.0)	435 (5.0)
Singapore	46 (2.8)	590 (6.1)	54 (2.8)	591 (5.6)	14 (1.7)	600 (13.1)	86 (1.7)	589 (4.6)
Slovenia	71 (1.7)	543 (3.0)	29 (1.7)	543 (3.0)	29 (2.1)	542 (2.7)	71 (2.1)	543 (3.0)
Sweden	r 44 (3.8)	516 (4.1)	56 (3.8)	508 (3.7)	r 27 (2.8)	512 (5.5)	73 (2.8)	511 (3.2)
Syrian Arab Republic	73 (3.2)	423 (4.7)	27 (3.2)	434 (7.7)	34 (3.9)	433 (6.8)	66 (3.9)	423 (4.6)
Thailand	54 (3.6)	455 (5.2)	46 (3.6)	446 (6.3)	36 (3.8)	462 (7.9)	64 (3.8)	444 (5.0)
Tunisia	70 (3.1)	441 (2.8)	30 (3.1)	434 (4.3)	29 (3.3)	441 (5.4)	71 (3.3)	437 (2.7)
Turkey	76 (2.4)	482 (4.1)	24 (2.4)	488 (6.4)	18 (2.4)	490 (12.9)	82 (2.4)	482 (3.6)
Ukraine	61 (2.8)	509 (3.5)	39 (2.8)	488 (4.6)	39 (2.8)	504 (4.3)	61 (2.8)	499 (3.8)
United Arab Emirates	75 (2.1)	459 (2.9)	25 (2.1)	472 (5.8)	45 (2.3)	459 (3.8)	55 (2.3)	465 (3.5)
United States	s 64 (2.5)	531 (4.4)	36 (2.5)	527 (4.6)	s 38 (2.7)	536 (5.1)	62 (2.7)	526 (4.2)
International Avg.	63 (0.5)	478 (0.7)	37 (0.5)	476 (1.0)	32 (0.5)	480 (1.1)	68 (0.5)	476 (0.7)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

(1) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent. An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students. An "x" indicates data are available for less than 50% of students.

**Exhibit 8.16: Teachers Relate Lessons to Students' Daily Lives and Bring Interesting Materials to Class (Continued)**

Country	Relate Lessons to Students' Daily Lives				Bring Interesting Materials to Class			
	Every Lesson or Almost Every Lesson		About Half the Lessons or Less		Every Lesson or Almost Every Lesson		About Half the Lessons or Less	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
<b>Ninth Grade Participants</b>								
Botswana	75 (3.6)	399 (4.1)	25 (3.6)	418 (8.7)	31 (4.0)	412 (7.4)	69 (4.0)	400 (4.1)
Honduras	81 (3.4)	370 (4.6)	19 (3.4)	365 (8.8)	23 (2.6)	372 (7.5)	77 (2.6)	369 (4.9)
South Africa	61 (3.6)	323 (5.4)	39 (3.6)	338 (7.2)	21 (2.9)	309 (7.3)	79 (2.9)	334 (5.0)
<b>Benchmarking Participants</b>								
Alberta, Canada	54 (4.2)	544 (3.3)	46 (4.2)	549 (3.2)	24 (3.5)	544 (4.8)	76 (3.5)	547 (2.9)
Ontario, Canada	57 (4.4)	520 (3.7)	43 (4.4)	523 (3.8)	22 (2.9)	522 (6.2)	78 (2.9)	521 (3.1)
Quebec, Canada	41 (4.1)	518 (4.0)	59 (4.1)	522 (4.3)	29 (4.5)	515 (6.4)	71 (4.5)	523 (3.6)
Abu Dhabi, UAE	71 (3.9)	457 (4.6)	29 (3.9)	472 (10.4)	45 (4.1)	458 (6.6)	55 (4.1)	465 (6.4)
Dubai, UAE	r 74 (4.3)	477 (4.7)	26 (4.3)	492 (10.0)	r 46 (4.6)	476 (6.4)	54 (4.6)	484 (5.8)
Alabama, US	s 67 (6.3)	486 (10.1)	33 (6.3)	482 (10.4)	s 48 (6.9)	481 (10.2)	52 (6.9)	488 (9.2)
California, US	s 58 (6.0)	508 (9.4)	42 (6.0)	500 (10.2)	s 36 (4.9)	521 (8.6)	64 (4.9)	496 (8.5)
Colorado, US	s 63 (8.1)	544 (8.1)	37 (8.1)	548 (9.9)	s 35 (6.1)	540 (14.4)	65 (6.1)	548 (7.5)
Connecticut, US	s 67 (5.6)	529 (7.4)	33 (5.6)	548 (14.7)	s 43 (7.0)	527 (9.9)	57 (7.0)	540 (9.6)
Florida, US	x x	x x	x x	x x	x x	x x	x x	x x
Indiana, US	s 70 (5.6)	530 (6.1)	30 (5.6)	536 (7.1)	s 48 (5.6)	530 (5.6)	52 (5.6)	533 (8.4)
Massachusetts, US	s 56 (6.2)	559 (9.2)	44 (6.2)	572 (10.6)	s 37 (5.5)	542 (12.5)	63 (5.5)	578 (6.5)
Minnesota, US	r 56 (6.0)	555 (10.0)	44 (6.0)	551 (6.7)	r 39 (6.3)	562 (9.1)	61 (6.3)	547 (8.1)
North Carolina, US	s 69 (8.5)	544 (11.3)	31 (8.5)	491 (16.0)	s 28 (7.0)	553 (21.4)	72 (7.0)	519 (11.8)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Based on the shorter four-item scale, on average, 80 percent of the eighth grade students had teachers that reported using engaging practices in most lessons, and almost all of the rest had teachers that reported using engaging practices in about half the lessons. Across the eighth grade, ninth grade, and benchmarking participants, students often had somewhat higher average science achievement if their teachers used engaging instruction in **Most Lessons** rather than **About Half the Lessons**.

Exhibits 8.17 and 8.18 present the results for the TIMSS 2011 Engaged in Science Lessons scale that looks at engagement from the student perspective. This scale asks how much students agree with the following five statements:

- ◆ I know what my teacher expects me to do;
- ◆ I think of things not related to the lesson (reverse coded);
- ◆ My teacher is easy to understand;
- ◆ I am interested in what my teacher says; and
- ◆ My teacher gives me interesting things to do.

Students considered to be **Engaged** had a score on the scale corresponding to “agreeing a lot” with at least three of the statements and “agreeing a little” with the other two, on average. Being in the **Not Engaged** category was based on a scale score corresponding to, at most, “agreeing a little” with no more than two statements and “disagreeing a little” with the other three, on average. All other students were considered to be **Somewhat Engaged**.

At the fourth grade, internationally, on average, 45 percent of students reported being **Engaged** during their science lessons, another 47 percent reported being **Somewhat Engaged**, and only 8 percent reported being **Not Engaged**. Across the fourth grade, sixth grade, and benchmarking participants, there was a positive relationship between students’ reports about being more engaged and average science achievement. **Engaged** students had higher achievement than their counterparts who reported being only **Somewhat Engaged**, and students **Not Engaged** had the lowest achievement (504 vs. 476 and 457, respectively).

At the eighth grade, internationally, on average, smaller percentages of students than at the fourth grade reported being engaged in their science lessons. In countries teaching general or integrated science, only 29 percent of the eighth grade students, on average, reported being **Engaged** during their science lessons. The majority (51%) reported being **Somewhat Engaged** and 21 percent reported being **Not Engaged**. For the general or integrated science countries, there was a direct relationship between student engagement and average science achievement—the more engaged students reported being, the higher their average science achievement; and this held across the eighth grade, ninth grade, and across benchmarking participants. Among the separate science subject countries, students reported somewhat more engagement in biology and earth science lessons (33% and 31% **Engaged**, respectively) than in chemistry and physics lessons (26% and 27% **Engaged**, respectively). In each of the science subjects, students reporting being engaged in their lessons had higher science achievement than those who were only somewhat or not engaged.

## Exhibit 8.17: Students Engaged in Science Lessons

Reported by Students

Students were scored according to their degree of agreement with five statements on the *Engaged in Science Lessons* scale. Students **Engaged** in science lessons had a score on the scale of at least 10.1, which corresponds to their “agreeing a lot” with three of the five statements and “agreeing a little” with the other two, on average. Students who were **Not Engaged** had a score no higher than 7.4, which corresponds to their “disagreeing a little” with three of the five statements and “agreeing a little” with the other two, on average. All other students were **Somewhat Engaged** in science lessons.

Country	Engaged		Somewhat Engaged		Not Engaged		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Tunisia	65 (1.6)	373 (5.3)	32 (1.4)	308 (6.7)	3 (0.4)	258 (14.1)	11.1 (0.07)
Iran, Islamic Rep. of	61 (1.1)	467 (3.8)	35 (1.0)	438 (4.8)	5 (0.5)	393 (9.7)	10.7 (0.05)
Russian Federation	59 (1.1)	559 (3.6)	36 (1.1)	545 (4.1)	5 (0.4)	544 (6.9)	10.6 (0.05)
Romania	58 (1.7)	531 (5.8)	37 (1.5)	480 (7.2)	5 (0.6)	436 (17.9)	10.6 (0.07)
Armenia	57 (1.3)	433 (4.1)	35 (1.0)	402 (4.5)	8 (0.7)	368 (8.4)	10.7 (0.07)
Malta	55 (0.8)	468 (2.0)	36 (0.8)	424 (3.4)	9 (0.4)	405 (7.2)	10.4 (0.03)
Portugal	54 (1.9)	535 (4.1)	44 (1.7)	507 (4.6)	2 (0.4)	~ ~	10.4 (0.07)
Hungary	54 (1.1)	553 (3.5)	39 (0.9)	515 (4.4)	7 (0.5)	520 (7.5)	10.4 (0.05)
Bahrain	53 (1.3)	482 (3.0)	40 (1.0)	427 (4.4)	7 (0.8)	413 (11.4)	10.5 (0.06)
Poland	52 (1.1)	515 (2.8)	42 (1.1)	497 (3.3)	6 (0.4)	491 (7.7)	10.3 (0.04)
United States	51 (0.8)	561 (2.1)	41 (0.7)	530 (2.6)	7 (0.4)	521 (5.1)	10.2 (0.03)
Ireland	51 (1.3)	529 (3.5)	41 (1.0)	506 (4.2)	8 (0.7)	503 (6.3)	10.2 (0.06)
Serbia	51 (1.4)	525 (3.0)	43 (1.1)	508 (4.0)	5 (0.6)	498 (8.8)	10.2 (0.07)
United Arab Emirates	51 (0.8)	457 (2.9)	43 (0.7)	406 (3.2)	6 (0.3)	377 (6.0)	10.4 (0.04)
Turkey	51 (1.2)	498 (3.4)	44 (0.9)	438 (4.5)	5 (0.5)	366 (10.0)	10.3 (0.05)
Kuwait	51 (1.3)	382 (5.4)	42 (1.2)	329 (4.8)	7 (0.6)	300 (10.3)	10.5 (0.05)
Lithuania	50 (1.2)	524 (2.5)	44 (1.1)	507 (3.5)	6 (0.5)	499 (6.0)	10.2 (0.04)
Kazakhstan	50 (1.7)	511 (5.0)	47 (1.7)	483 (6.0)	3 (0.3)	462 (16.4)	10.4 (0.07)
Czech Republic	49 (1.3)	540 (3.1)	43 (1.1)	533 (3.1)	8 (0.7)	537 (5.8)	10.1 (0.06)
Oman	49 (1.1)	415 (4.4)	46 (1.0)	350 (4.8)	5 (0.3)	285 (8.4)	10.3 (0.05)
Saudi Arabia	49 (1.4)	462 (5.3)	45 (1.3)	411 (6.6)	6 (0.6)	367 (12.3)	10.3 (0.07)
Norway	48 (1.5)	503 (2.5)	44 (1.3)	488 (3.0)	8 (0.8)	489 (5.8)	10.1 (0.07)
Slovenia	48 (1.2)	529 (3.0)	46 (1.2)	514 (3.1)	6 (0.5)	501 (9.4)	10.1 (0.05)
Germany	47 (1.2)	539 (3.2)	46 (1.0)	525 (3.4)	7 (0.6)	516 (7.2)	10.0 (0.05)
Croatia	47 (1.2)	520 (2.4)	46 (1.0)	514 (2.8)	7 (0.7)	509 (4.4)	10.1 (0.05)
Australia	46 (1.0)	532 (2.9)	44 (0.9)	506 (3.4)	9 (0.6)	498 (6.9)	10.0 (0.05)
Spain	46 (1.5)	519 (2.8)	46 (1.3)	495 (3.9)	8 (0.7)	500 (5.6)	10.0 (0.07)
Georgia	46 (1.0)	480 (3.3)	51 (1.0)	448 (4.6)	3 (0.3)	391 (10.3)	10.4 (0.04)
Thailand	46 (1.7)	491 (5.3)	49 (1.5)	461 (6.5)	5 (0.4)	420 (11.6)	10.1 (0.06)
Austria	44 (1.0)	539 (3.2)	47 (0.9)	526 (3.4)	9 (0.7)	526 (4.9)	9.9 (0.05)
Northern Ireland	44 (1.4)	531 (3.3)	49 (1.2)	509 (3.6)	8 (0.7)	495 (7.0)	9.9 (0.05)
England	44 (1.2)	534 (4.1)	47 (1.1)	527 (3.2)	9 (0.7)	520 (5.6)	9.8 (0.05)
Morocco	43 (2.0)	299 (5.7)	48 (1.8)	243 (4.3)	8 (0.9)	219 (10.3)	10.0 (0.08)
Italy	43 (1.2)	534 (3.4)	50 (1.0)	520 (3.1)	6 (0.5)	512 (5.9)	9.9 (0.05)
Slovak Republic	41 (1.0)	542 (4.4)	51 (0.9)	526 (3.7)	8 (0.5)	527 (6.0)	9.8 (0.04)
Azerbaijan	41 (1.5)	472 (6.8)	55 (1.4)	439 (5.5)	4 (0.4)	397 (12.5)	10.1 (0.06)
Chile	40 (1.0)	505 (3.1)	52 (0.9)	468 (2.8)	8 (0.5)	457 (5.6)	9.9 (0.04)
Singapore	40 (0.8)	604 (3.3)	49 (0.7)	572 (4.0)	11 (0.5)	567 (5.3)	9.7 (0.04)
Chinese Taipei	40 (1.2)	564 (2.4)	47 (0.9)	548 (2.9)	13 (0.9)	528 (4.8)	9.7 (0.06)
Qatar	39 (1.5)	448 (5.7)	52 (1.5)	376 (4.9)	8 (0.7)	343 (13.9)	10.0 (0.06)
New Zealand	39 (0.9)	511 (3.0)	51 (0.9)	490 (3.0)	10 (0.6)	488 (4.7)	9.7 (0.04)
Belgium (Flemish)	37 (1.1)	514 (2.4)	56 (1.0)	506 (2.4)	7 (0.5)	500 (3.5)	9.6 (0.04)
Sweden	37 (1.2)	538 (3.3)	55 (0.9)	534 (3.0)	8 (0.6)	528 (6.7)	9.5 (0.05)
Netherlands	35 (1.2)	538 (2.8)	56 (1.0)	529 (2.7)	9 (0.5)	526 (4.4)	9.5 (0.05)
Hong Kong SAR	34 (1.2)	550 (3.7)	50 (1.1)	527 (5.3)	16 (0.8)	528 (4.0)	9.4 (0.06)
Yemen	31 (1.9)	245 (7.7)	58 (1.7)	206 (7.7)	11 (1.3)	170 (13.9)	9.6 (0.09)
Denmark	27 (1.1)	533 (3.9)	56 (0.9)	527 (3.3)	18 (1.0)	528 (3.7)	9.0 (0.05)
Finland	23 (0.9)	578 (3.7)	57 (1.1)	571 (2.8)	20 (1.0)	565 (3.5)	8.8 (0.04)
Korea, Rep. of	19 (0.9)	605 (3.9)	58 (0.9)	590 (2.1)	23 (1.0)	568 (3.4)	8.6 (0.04)
Japan	12 (0.8)	573 (3.9)	54 (1.2)	561 (1.7)	34 (1.6)	551 (3.1)	8.2 (0.06)
International Avg.	45 (0.2)	504 (0.6)	47 (0.2)	476 (0.6)	8 (0.1)	457 (1.2)	

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

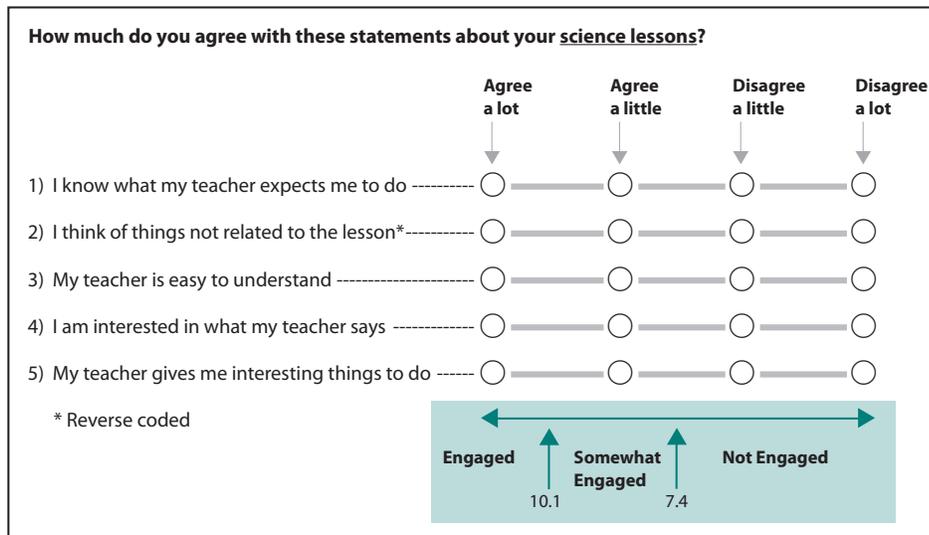
A tilde (~) indicates insufficient data to report achievement.

An “r” indicates data are available for at least 70% but less than 85% of the students.

**Exhibit 8.17: Students Engaged in Science Lessons (Continued)**

Country	Engaged		Somewhat Engaged		Not Engaged		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Sixth Grade Participants</b>							
Honduras	38 (1.5)	447 (6.6)	59 (1.5)	424 (5.9)	3 (0.4)	439 (12.0)	9.9 (0.05)
Botswana	37 (1.2)	436 (5.8)	52 (1.0)	341 (5.5)	11 (0.6)	273 (9.6)	9.7 (0.05)
Yemen	37 (1.7)	372 (7.5)	55 (1.4)	337 (7.7)	8 (0.9)	305 (15.2)	9.8 (0.08)
<b>Benchmarking Participants</b>							
North Carolina, US	56 (1.8)	556 (4.4)	38 (1.3)	519 (4.7)	5 (0.8)	518 (11.1)	10.5 (0.07)
Alberta, Canada	55 (1.4)	551 (2.7)	40 (1.3)	533 (3.3)	5 (0.5)	518 (9.6)	10.4 (0.06)
Dubai, UAE	53 (1.1)	489 (2.7)	42 (1.0)	444 (3.8)	5 (0.4)	401 (8.5)	10.4 (0.05)
Abu Dhabi, UAE	51 (1.8)	440 (5.5)	42 (1.4)	389 (5.2)	7 (0.7)	367 (11.3)	10.4 (0.08)
Florida, US	51 (1.3)	559 (4.6)	42 (1.2)	534 (3.9)	8 (0.6)	526 (5.9)	10.2 (0.06)
Ontario, Canada	48 (1.2)	538 (2.9)	44 (1.0)	521 (4.0)	7 (0.6)	508 (7.5)	10.0 (0.05)
Quebec, Canada	48 (1.2)	525 (2.5)	44 (1.2)	508 (3.5)	8 (0.5)	507 (5.5)	10.0 (0.05)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



## Exhibit 8.18: Students Engaged in Science Lessons

Reported by Students

The general/integrated science panel summarizes responses for countries where students are enrolled in science as a single subject. The remaining panels for biology, chemistry, physics, and earth science summarize responses for countries where students are taught science as separate subjects.

For general/integrated science, students were scored according to their degree of agreement with five statements on the *Engaged in Science Lessons* scale. Students **Engaged** in science lessons had a score on the scale of at least 11.2, which corresponds to their “agreeing a lot” with three of the five statements and “agreeing a little” with the other two, on average. Students who were **Not Engaged** had a score no higher than 8.4, which corresponds to their “disagreeing a little” with three of the five statements and “agreeing a little” with the other two, on average. All other students were **Somewhat Engaged** in science lessons. For biology, chemistry, physics, and earth science, a comparable procedure was used.

### Students Engaged in General/Integrated Science Lessons

General/Integrated Science Country	Engaged		Somewhat Engaged		Not Engaged		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Tunisia	55 (0.9)	446 (2.6)	39 (0.7)	430 (3.0)	6 (0.5)	431 (6.0)	11.3 (0.04)
Jordan	46 (1.0)	483 (3.3)	46 (0.9)	436 (4.1)	8 (0.5)	395 (8.7)	11.0 (0.04)
Palestinian Nat'l Auth.	44 (1.4)	448 (3.3)	47 (1.3)	406 (4.1)	9 (0.7)	381 (9.1)	10.8 (0.06)
Iran, Islamic Rep. of	43 (1.1)	482 (4.7)	47 (0.8)	468 (4.0)	9 (0.6)	477 (7.2)	10.8 (0.05)
Oman	42 (0.9)	460 (3.0)	50 (0.7)	406 (3.5)	8 (0.4)	349 (7.1)	10.8 (0.04)
Ghana	41 (1.3)	342 (5.3)	53 (1.1)	293 (5.7)	6 (0.5)	236 (12.0)	10.9 (0.05)
United Arab Emirates	38 (0.9)	487 (2.6)	49 (0.6)	454 (2.7)	12 (0.6)	445 (4.5)	10.6 (0.04)
Saudi Arabia	36 (1.3)	462 (4.1)	51 (1.1)	427 (3.9)	12 (1.0)	411 (8.4)	10.5 (0.06)
Turkey	35 (1.1)	520 (4.5)	52 (1.1)	469 (3.3)	13 (0.7)	449 (6.1)	10.4 (0.05)
Bahrain	34 (0.7)	479 (2.8)	51 (0.8)	447 (2.5)	15 (0.8)	428 (7.7)	10.4 (0.04)
Chile	33 (1.1)	472 (2.6)	53 (0.8)	456 (2.8)	14 (0.8)	463 (4.9)	10.3 (0.05)
Qatar	32 (1.4)	464 (4.6)	51 (1.1)	409 (3.3)	17 (1.1)	378 (7.1)	10.3 (0.07)
Israel	28 (1.1)	540 (4.3)	46 (1.0)	510 (4.6)	26 (1.3)	503 (5.0)	9.8 (0.07)
United States	28 (0.8)	543 (3.4)	50 (0.7)	526 (2.5)	22 (0.7)	506 (4.0)	9.9 (0.04)
Malaysia	25 (1.2)	444 (5.9)	57 (1.0)	430 (6.3)	18 (1.2)	392 (9.9)	9.9 (0.06)
England	24 (1.1)	551 (5.4)	54 (0.9)	533 (5.6)	22 (1.3)	518 (5.9)	9.8 (0.06)
Norway	23 (1.3)	514 (4.2)	54 (1.3)	495 (3.2)	23 (1.5)	475 (3.4)	9.7 (0.07)
Australia	21 (1.2)	547 (6.2)	51 (1.2)	522 (5.0)	28 (1.4)	497 (5.9)	9.5 (0.07)
New Zealand	21 (1.2)	538 (5.7)	52 (0.9)	513 (4.6)	27 (1.6)	499 (6.2)	9.5 (0.07)
Thailand	21 (1.0)	463 (4.4)	70 (1.0)	449 (4.0)	9 (0.6)	447 (7.6)	10.0 (0.04)
Singapore	20 (0.7)	600 (6.0)	59 (0.7)	593 (4.4)	21 (0.9)	574 (5.4)	9.7 (0.04)
Italy	18 (0.9)	517 (3.6)	62 (0.8)	501 (2.9)	21 (1.0)	488 (3.3)	9.6 (0.04)
Hong Kong SAR	17 (1.0)	556 (4.6)	59 (1.0)	537 (3.7)	24 (1.3)	518 (4.7)	9.5 (0.06)
Chinese Taipei	9 (0.6)	610 (4.6)	42 (1.1)	578 (2.5)	50 (1.5)	544 (2.9)	8.6 (0.06)
Japan	5 (0.5)	607 (7.3)	36 (1.5)	575 (2.7)	59 (1.7)	543 (2.6)	8.2 (0.07)
Korea, Rep. of	4 (0.3)	626 (5.4)	39 (1.2)	582 (2.4)	57 (1.3)	541 (2.2)	8.3 (0.05)
International Avg.	29 (0.2)	508 (0.9)	51 (0.2)	479 (0.8)	21 (0.2)	457 (1.3)	

### Ninth Grade Participants

Honduras	40 (1.2)	381 (5.2)	52 (1.0)	362 (3.8)	7 (0.5)	373 (6.4)	10.7 (0.05)
Botswana	39 (1.1)	440 (2.8)	49 (0.9)	392 (4.3)	11 (0.7)	359 (8.9)	10.6 (0.05)
South Africa	35 (1.0)	372 (3.5)	54 (0.7)	320 (3.8)	11 (0.6)	322 (8.2)	10.5 (0.04)

### Benchmarking Participants

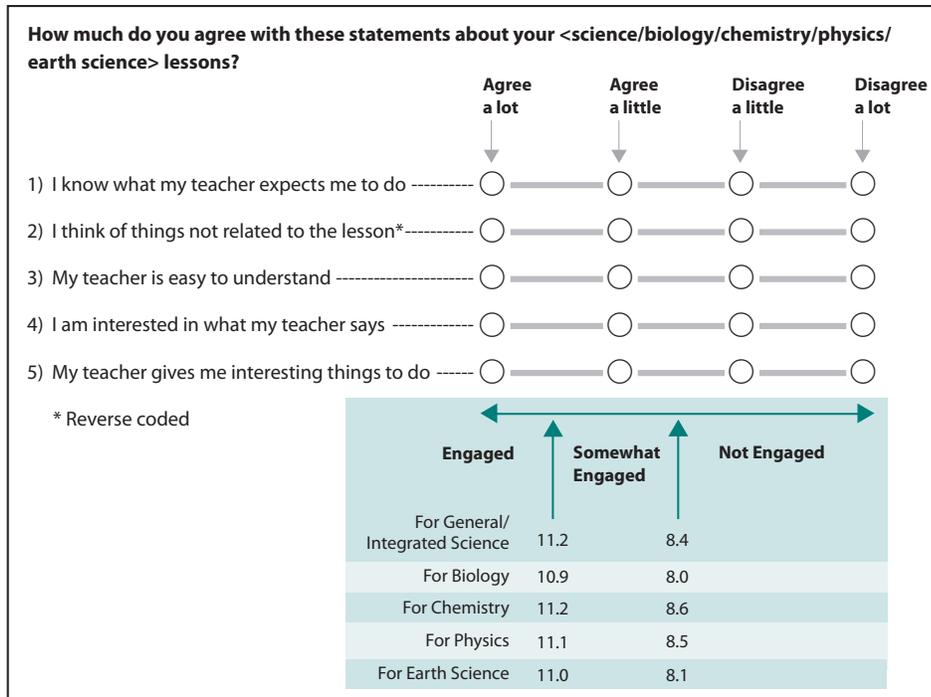
Dubai, UAE	39 (1.2)	501 (2.9)	48 (0.8)	482 (3.3)	13 (1.0)	461 (6.2)	10.6 (0.06)
Abu Dhabi, UAE	38 (1.5)	486 (4.5)	50 (1.1)	448 (4.3)	12 (0.9)	445 (7.6)	10.5 (0.07)
Massachusetts, US	33 (1.8)	577 (7.1)	49 (1.4)	566 (5.6)	18 (1.9)	553 (6.4)	10.2 (0.10)
Connecticut, US	30 (1.7)	552 (5.4)	47 (1.6)	529 (5.7)	23 (2.1)	525 (9.0)	9.9 (0.11)
Colorado, US	30 (2.0)	557 (6.0)	52 (1.9)	539 (5.1)	18 (1.8)	528 (6.9)	10.0 (0.09)
California, US	28 (1.4)	527 (4.8)	51 (1.3)	495 (5.0)	22 (1.4)	479 (6.4)	9.9 (0.07)
North Carolina, US	28 (2.1)	549 (7.3)	50 (1.2)	532 (7.2)	23 (2.3)	514 (7.8)	9.8 (0.12)
Florida, US	27 (2.0)	557 (8.2)	51 (1.4)	531 (7.7)	22 (1.8)	510 (8.2)	9.8 (0.10)
Indiana, US	26 (1.8)	550 (5.8)	48 (1.7)	532 (5.4)	25 (2.2)	519 (6.3)	9.7 (0.11)
Minnesota, US	26 (2.2)	578 (4.7)	51 (1.3)	549 (5.0)	23 (1.9)	538 (6.0)	9.8 (0.11)
Ontario, Canada	26 (1.1)	532 (4.1)	54 (1.1)	518 (3.0)	20 (1.2)	514 (3.4)	9.9 (0.06)
Alabama, US	25 (1.2)	499 (8.1)	52 (2.1)	482 (5.8)	23 (2.0)	485 (8.0)	9.8 (0.07)
Alberta, Canada	24 (1.3)	561 (3.5)	55 (1.2)	544 (2.5)	21 (1.4)	537 (3.6)	9.8 (0.07)
Quebec, Canada	21 (0.9)	533 (3.8)	56 (1.0)	523 (2.5)	23 (1.4)	504 (4.4)	9.6 (0.06)

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

A dash (-) indicates comparable data are not available.

An “r” indicates data are available for at least 70% but less than 85% of the students.



Separate Science Panels

Students Engaged in Biology Lessons

Biology Country	Engaged		Somewhat Engaged		Not Engaged		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Syrian Arab Republic	52 (1.3)	444 (3.9)	42 (1.1)	413 (3.9)	6 (0.6)	402 (7.4)	11.0 (0.06)
Armenia	52 (1.5)	454 (3.4)	41 (1.0)	423 (3.8)	7 (0.7)	445 (6.1)	10.9 (0.07)
Ukraine	49 (1.5)	512 (3.9)	44 (1.2)	493 (4.2)	7 (0.7)	492 (8.9)	10.7 (0.06)
Georgia	49 (1.3)	449 (3.3)	44 (1.0)	411 (3.6)	6 (0.6)	382 (7.3)	10.8 (0.06)
Morocco	46 (0.9)	396 (2.5)	48 (0.8)	365 (2.5)	6 (0.3)	358 (7.4)	10.7 (0.03)
Macedonia, Rep. of	46 (1.5)	430 (4.9)	44 (1.2)	397 (6.1)	11 (1.0)	418 (12.8)	10.5 (0.07)
Kazakhstan	35 (1.8)	510 (4.5)	59 (1.6)	482 (4.6)	6 (0.6)	487 (8.7)	10.3 (0.07)
Lebanon	34 (1.3)	430 (5.7)	52 (1.1)	397 (5.6)	14 (0.7)	383 (7.8)	10.1 (0.06)
Russian Federation	34 (1.0)	549 (4.3)	52 (1.0)	538 (3.2)	14 (0.9)	545 (5.4)	10.0 (0.05)
Romania	32 (1.3)	482 (4.2)	50 (1.0)	461 (3.8)	17 (1.0)	457 (6.3)	9.9 (0.07)
Hungary	28 (1.3)	530 (3.7)	52 (0.9)	517 (4.0)	20 (1.5)	529 (4.0)	9.6 (0.08)
Lithuania	22 (1.1)	518 (3.5)	53 (1.1)	513 (3.0)	25 (1.3)	517 (3.5)	9.3 (0.07)
Slovenia	16 (0.8)	549 (3.9)	56 (1.1)	541 (2.9)	28 (1.4)	545 (4.0)	9.0 (0.06)
Indonesia	15 (0.9)	402 (8.4)	78 (0.8)	406 (4.3)	7 (0.7)	415 (7.4)	9.5 (0.04)
Sweden	12 (0.8)	533 (4.4)	62 (1.0)	516 (2.9)	26 (1.2)	499 (3.2)	8.9 (0.05)
Finland	10 (0.6)	577 (4.6)	55 (1.3)	559 (2.5)	35 (1.5)	541 (2.8)	8.7 (0.05)
International Avg.	33 (0.3)	485 (1.1)	52 (0.3)	465 (1.0)	15 (0.2)	463 (1.7)	

**Exhibit 8.18: Students Engaged in Science Lessons (Continued)**

*Students Engaged in Chemistry Lessons*

Chemistry	Engaged		Somewhat Engaged		Not Engaged		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Morocco	42 (0.9)	397 (2.1)	50 (0.8)	365 (3.3)	9 (0.4)	369 (4.7)	10.9 (0.03)
Syrian Arab Republic	41 (1.2)	447 (4.4)	48 (1.0)	417 (4.0)	11 (0.7)	412 (7.7)	10.8 (0.05)
Armenia	39 (1.5)	461 (3.4)	43 (1.0)	427 (3.9)	18 (1.2)	431 (4.7)	10.5 (0.08)
Ukraine	38 (1.7)	519 (4.3)	45 (1.2)	493 (4.1)	17 (1.3)	489 (5.0)	10.5 (0.08)
Kazakhstan	33 (1.6)	515 (4.6)	57 (1.5)	482 (4.5)	9 (0.6)	472 (6.3)	10.6 (0.06)
Macedonia, Rep. of	33 (1.4)	444 (5.6)	48 (1.0)	396 (5.7)	19 (1.5)	410 (8.5)	10.3 (0.08)
Lebanon	32 (1.4)	435 (5.6)	54 (1.1)	396 (5.4)	15 (1.0)	386 (7.7)	10.5 (0.06)
Russian Federation	28 (1.0)	563 (4.1)	49 (0.7)	537 (3.7)	23 (1.0)	531 (4.1)	10.0 (0.05)
Romania	22 (1.3)	500 (5.0)	47 (1.0)	459 (3.6)	32 (1.6)	456 (4.7)	9.6 (0.08)
Hungary	21 (1.0)	541 (3.6)	46 (1.0)	514 (4.1)	33 (1.5)	527 (3.2)	9.5 (0.07)
Lithuania	21 (1.0)	535 (3.7)	47 (0.9)	511 (3.1)	32 (1.3)	508 (3.6)	9.5 (0.06)
Slovenia	17 (0.8)	571 (3.8)	54 (1.0)	544 (3.0)	28 (1.4)	527 (3.2)	9.5 (0.06)
Sweden	11 (0.7)	541 (5.6)	58 (1.0)	516 (2.8)	30 (1.3)	497 (3.1)	9.3 (0.05)
Finland	9 (0.7)	591 (5.1)	45 (1.4)	564 (2.7)	46 (1.8)	537 (2.8)	8.8 (0.07)
Indonesia	8 (0.7)	391 (8.4)	76 (1.1)	399 (4.6)	16 (1.1)	408 (8.3)	9.5 (0.03)
Georgia	--	--	--	--	--	--	--
International Avg.	26 (0.3)	497 (1.2)	51 (0.3)	468 (1.0)	23 (0.3)	464 (1.4)	

*Students Engaged in Physics Lessons*

Physics	Engaged		Somewhat Engaged		Not Engaged		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Armenia	48 (1.5)	463 (3.5)	41 (1.2)	422 (3.8)	10 (0.7)	415 (6.5)	11.0 (0.06)
Morocco	41 (0.7)	397 (2.3)	50 (0.7)	369 (3.1)	9 (0.3)	368 (4.6)	10.8 (0.03)
Syrian Arab Republic	41 (1.3)	449 (4.4)	47 (1.1)	416 (3.8)	12 (0.6)	418 (7.1)	10.8 (0.05)
Georgia	40 (1.2)	455 (3.6)	47 (1.0)	411 (3.5)	13 (0.9)	406 (6.2)	10.7 (0.06)
Ukraine	39 (1.6)	522 (4.4)	46 (1.1)	493 (3.6)	15 (1.0)	481 (5.5)	10.5 (0.08)
Macedonia, Rep. of	35 (1.2)	446 (5.4)	48 (0.9)	396 (5.8)	17 (0.9)	398 (9.2)	10.4 (0.06)
Russian Federation	33 (1.2)	564 (3.9)	50 (0.9)	537 (3.5)	18 (1.0)	521 (4.2)	10.3 (0.06)
Kazakhstan	31 (1.7)	515 (5.3)	57 (1.4)	482 (4.4)	11 (0.9)	483 (6.9)	10.4 (0.07)
Lebanon	29 (1.4)	436 (6.0)	54 (1.2)	398 (5.7)	18 (1.2)	389 (7.1)	10.2 (0.07)
Hungary	24 (1.0)	546 (3.5)	49 (0.9)	519 (3.7)	28 (1.2)	514 (4.2)	9.7 (0.06)
Romania	19 (1.2)	496 (4.8)	47 (1.2)	463 (4.2)	34 (1.4)	458 (4.4)	9.4 (0.07)
Lithuania	18 (0.9)	532 (4.6)	46 (0.9)	512 (3.1)	35 (1.3)	511 (2.9)	9.3 (0.06)
Sweden	11 (0.6)	543 (4.7)	59 (1.1)	517 (3.0)	30 (1.2)	502 (2.9)	9.3 (0.04)
Slovenia	10 (0.6)	578 (5.5)	49 (1.2)	546 (3.4)	41 (1.4)	532 (3.2)	8.9 (0.05)
Indonesia	10 (0.7)	407 (8.1)	77 (0.8)	409 (5.1)	14 (1.0)	416 (6.0)	9.6 (0.04)
Finland	8 (0.7)	598 (5.6)	42 (1.4)	564 (2.8)	50 (1.7)	540 (2.8)	8.6 (0.07)
International Avg.	27 (0.3)	497 (1.2)	51 (0.3)	466 (1.0)	22 (0.3)	459 (1.4)	

*Students Engaged in Earth Science Lessons*

Earth Science	Engaged		Somewhat Engaged		Not Engaged		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Armenia	50 (1.4)	455 (3.3)	41 (1.1)	424 (4.2)	9 (0.7)	436 (7.5)	10.9 (0.06)
Georgia	44 (1.5)	453 (3.4)	47 (1.1)	411 (3.1)	8 (0.9)	396 (6.8)	10.7 (0.06)
Macedonia, Rep. of	44 (1.4)	437 (5.2)	46 (1.0)	393 (5.4)	11 (1.0)	407 (12.8)	10.6 (0.07)
Syrian Arab Republic	43 (1.3)	445 (4.4)	47 (1.0)	416 (4.3)	10 (0.8)	402 (7.0)	10.7 (0.05)
Morocco	43 (0.7)	393 (2.0)	49 (0.7)	367 (2.8)	8 (0.3)	372 (5.9)	10.7 (0.03)
Ukraine	40 (1.6)	512 (4.5)	49 (1.2)	497 (3.7)	11 (1.0)	491 (6.7)	10.4 (0.07)
Kazakhstan	34 (1.5)	511 (4.6)	58 (1.3)	481 (4.7)	8 (0.7)	493 (7.7)	10.4 (0.07)
Romania	33 (1.4)	486 (4.3)	49 (1.0)	461 (4.3)	19 (1.1)	449 (5.5)	10.1 (0.08)
Russian Federation	29 (1.0)	551 (4.0)	52 (0.8)	540 (3.4)	19 (1.1)	539 (4.4)	9.9 (0.06)
Lithuania	26 (1.3)	526 (3.7)	49 (1.0)	510 (3.3)	25 (1.3)	514 (3.3)	9.6 (0.08)
Hungary	24 (1.4)	526 (4.6)	49 (0.9)	517 (3.7)	28 (1.5)	533 (3.7)	9.4 (0.08)
Sweden	18 (0.9)	529 (4.9)	62 (1.0)	513 (3.0)	20 (1.0)	498 (3.6)	9.4 (0.05)
Slovenia	16 (0.9)	553 (4.6)	56 (1.3)	542 (3.1)	28 (1.6)	540 (3.5)	9.1 (0.07)
Finland	11 (0.7)	576 (5.1)	55 (1.2)	560 (2.5)	34 (1.5)	536 (2.8)	8.8 (0.05)
Indonesia	10 (0.8)	398 (8.1)	77 (0.8)	405 (4.6)	14 (1.0)	410 (6.4)	9.3 (0.04)
Lebanon	--	--	--	--	--	--	--
International Avg.	31 (0.3)	490 (1.2)	52 (0.3)	469 (1.0)	17 (0.3)	468 (1.6)	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

## Students Ready to Learn

### *Instruction Limited by Students Lacking Prerequisite Knowledge or Skills*

The characteristics of the students themselves can be very important to the classroom atmosphere. To begin, students need the prerequisite science skills before they can make gains in achievement. Because prior knowledge guides learning, effective science teachers assess students' knowledge, skills, and conceptual understanding, and link new ideas, skills, and competencies to prior understandings. Lack of prerequisite knowledge and skills are psychological barriers to further science learning, because it is well known that students' new learning depends on that prior knowledge: "Every new thing that a person learns must be attached to what the person already knows" (McLaughlin et al., 2005, p. 5).

Exhibit 8.19 presents teachers' reports at the fourth grade about whether their science instruction was limited by students lacking prerequisite knowledge or skills. On average, internationally, 28 percent of the fourth grade students were in classes where students had the necessary prerequisite skills for science instruction to proceed according to teachers' plans, and 60 percent were in classes where instruction was limited to some extent. It is consistent with teachers' reports that the students in classes where instruction was progressing unimpeded had higher average science achievement than did their counterparts in classes where instruction was limited to some extent (501 vs. 485). Also consistent with teachers' reports, average science achievement was substantially lower (460) for the fourth grade students in classrooms where instruction was limited "a lot" because students lacked the prerequisite knowledge or skills. This overall pattern also was evidenced at the sixth grade and for the benchmarking participants.

Exhibit 8.20 presents teachers' reports at the eighth grade about whether their science instruction was limited by students lacking prerequisite knowledge or skills. On average, internationally, just 20 percent of the eighth grade students were in classes where students had the necessary prerequisite skills for science instruction to proceed according to teachers' plans. According to their teachers, 61 percent were in classes where instruction was limited to some extent and 19 percent in classes where instruction was limited "a lot." As students progress through school, the curriculum becomes increasingly advanced and, not surprisingly, greater percentages of students fall behind, which typically results in some differentiation in instruction for different groups of students. Especially, taking into account some type of tailored curriculum and instruction

**Exhibit 8.19: Instruction Limited by Students Lacking Prerequisite Knowledge or Skills**

Reported by Teachers

Country	Students in Classrooms Where Teachers Report Instruction Is Limited by Students Lacking Prerequisite Knowledge or Skills					
	Not At All		Some		A Lot	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Kazakhstan	64 (3.6)	497 (6.0)	30 (3.6)	484 (10.4)	5 (1.8)	540 (14.4)
Japan	53 (4.1)	561 (2.6)	44 (4.1)	556 (2.7)	3 (1.3)	551 (2.1)
Norway	46 (5.1)	496 (3.0)	53 (5.1)	493 (3.6)	1 (0.6)	~ ~
Russian Federation	44 (3.7)	555 (4.8)	44 (3.2)	553 (5.3)	12 (2.6)	538 (6.8)
Slovak Republic	42 (3.4)	550 (3.2)	52 (3.3)	522 (5.5)	6 (1.2)	492 (17.5)
Denmark	41 (3.5)	540 (3.1)	55 (3.5)	524 (3.4)	4 (1.2)	499 (26.8)
Finland	41 (3.5)	577 (2.6)	57 (3.4)	565 (3.4)	2 (0.6)	~ ~
Belgium (Flemish)	41 (3.3)	515 (2.8)	50 (3.4)	507 (2.8)	8 (1.8)	486 (8.8)
Georgia	39 (3.7)	461 (5.9)	59 (3.7)	452 (5.4)	2 (1.0)	~ ~
Sweden	r 39 (4.6)	544 (5.0)	54 (4.6)	532 (4.2)	7 (1.7)	508 (10.1)
Chinese Taipei	38 (4.2)	558 (3.6)	58 (4.4)	550 (2.8)	4 (1.4)	510 (7.9)
Ireland	37 (3.7)	534 (4.0)	55 (4.0)	512 (4.7)	8 (1.9)	463 (7.5)
Azerbaijan	36 (3.8)	460 (10.0)	62 (3.9)	431 (6.9)	2 (1.0)	~ ~
Hong Kong SAR	35 (4.7)	547 (6.0)	58 (4.9)	536 (3.3)	7 (2.4)	458 (35.4)
Croatia	35 (3.2)	517 (3.1)	61 (3.4)	516 (2.6)	4 (1.6)	511 (9.9)
Slovenia	32 (4.0)	534 (4.0)	57 (3.7)	516 (3.5)	11 (2.3)	501 (3.9)
Netherlands	r 32 (4.1)	543 (4.0)	62 (4.3)	526 (3.2)	6 (2.3)	508 (9.2)
Australia	r 31 (3.5)	542 (6.7)	59 (4.4)	513 (4.1)	10 (2.4)	482 (7.8)
Czech Republic	31 (3.7)	546 (3.8)	65 (3.4)	535 (3.1)	4 (1.4)	490 (25.3)
Austria	30 (3.0)	546 (3.3)	55 (2.6)	532 (3.2)	14 (2.6)	497 (5.1)
Korea, Rep. of	29 (4.0)	587 (4.0)	56 (4.3)	588 (2.4)	14 (3.0)	577 (4.6)
Singapore	28 (2.6)	620 (5.3)	60 (3.2)	580 (4.1)	12 (1.7)	509 (9.9)
Spain	28 (3.7)	517 (4.8)	62 (3.7)	507 (3.1)	10 (2.2)	468 (9.5)
Romania	28 (3.5)	533 (8.8)	67 (3.5)	499 (7.1)	5 (1.4)	417 (46.6)
Qatar	28 (5.0)	414 (11.2)	62 (4.9)	388 (7.6)	11 (2.1)	380 (15.1)
Hungary	28 (3.2)	557 (6.6)	63 (3.5)	531 (5.0)	9 (2.1)	483 (13.4)
Bahrain	26 (4.8)	458 (8.9)	66 (4.9)	448 (4.5)	8 (2.0)	437 (10.6)
England	26 (3.4)	560 (5.8)	62 (4.2)	525 (4.6)	13 (3.0)	493 (9.2)
Armenia	26 (3.3)	422 (7.0)	70 (3.4)	414 (4.5)	4 (1.7)	412 (21.0)
Italy	25 (3.1)	519 (5.5)	54 (3.6)	527 (4.5)	21 (3.2)	528 (5.1)
Northern Ireland	r 25 (3.6)	530 (7.1)	69 (3.8)	514 (3.4)	6 (2.1)	500 (9.6)
Serbia	24 (3.4)	528 (4.6)	70 (3.6)	514 (3.9)	6 (2.5)	491 (13.3)
Portugal	24 (3.5)	535 (6.9)	65 (3.9)	520 (4.7)	10 (2.1)	503 (8.4)
Malta	24 (0.1)	451 (2.5)	66 (0.1)	448 (2.2)	10 (0.1)	429 (4.6)
New Zealand	23 (3.2)	515 (4.8)	65 (3.1)	497 (2.7)	12 (1.6)	464 (8.5)
United Arab Emirates	23 (2.1)	456 (7.1)	66 (2.6)	426 (3.6)	12 (1.5)	407 (7.3)
Oman	23 (2.1)	384 (7.0)	52 (2.6)	381 (5.5)	25 (2.7)	366 (6.9)
Germany	22 (3.0)	546 (4.8)	68 (3.2)	529 (3.1)	11 (2.1)	488 (9.9)
Poland	20 (2.9)	510 (6.5)	71 (3.4)	505 (2.6)	10 (2.0)	490 (7.8)
Saudi Arabia	18 (3.0)	452 (11.5)	64 (3.5)	430 (7.4)	17 (3.4)	397 (13.5)
Kuwait	17 (3.2)	370 (11.9)	72 (4.0)	346 (5.9)	12 (2.7)	328 (12.9)
United States	r 16 (2.0)	566 (5.1)	65 (2.6)	548 (2.5)	19 (2.0)	517 (4.8)
Lithuania	16 (2.0)	529 (5.9)	74 (2.7)	513 (2.8)	10 (2.1)	500 (5.8)
Iran, Islamic Rep. of	16 (2.6)	495 (8.8)	64 (3.7)	453 (5.2)	20 (2.9)	419 (10.4)
Chile	15 (3.1)	500 (9.2)	65 (3.9)	481 (4.1)	20 (3.2)	467 (9.2)
Yemen	14 (3.3)	215 (14.4)	68 (4.2)	207 (8.7)	18 (3.2)	201 (17.0)
Thailand	12 (2.3)	520 (13.9)	70 (3.8)	472 (5.8)	18 (3.4)	443 (15.6)
Tunisia	11 (2.0)	358 (13.6)	58 (3.8)	353 (7.6)	31 (3.7)	330 (9.1)
Morocco	7 (1.7)	282 (18.2)	55 (3.8)	270 (6.8)	38 (4.3)	252 (9.9)
Turkey	6 (1.7)	502 (12.0)	60 (3.5)	474 (6.1)	34 (3.4)	436 (7.4)
International Avg.	28 (0.5)	501 (1.1)	60 (0.5)	485 (0.7)	11 (0.3)	460 (2.1)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.  
 A tilde (~) indicates insufficient data to report achievement.  
 An "r" indicates data are available for at least 70% but less than 85% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 8.19: Instruction Limited by Students Lacking Prerequisite Knowledge or Skills (Continued)**

Country	Students in Classrooms Where Teachers Report Instruction Is Limited by Students Lacking Prerequisite Knowledge or Skills					
	Not At All		Some		A Lot	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
<b>Sixth Grade Participants</b>						
Honduras	20 (3.7)	456 (17.9)	68 (4.1)	422 (6.9)	12 (2.8)	444 (12.6)
Yemen	16 (3.3)	348 (15.7)	67 (4.6)	348 (8.1)	17 (3.6)	325 (18.0)
Botswana	8 (2.4)	456 (31.5)	57 (4.2)	387 (7.7)	35 (3.8)	328 (8.7)
<b>Benchmarking Participants</b>						
Dubai, UAE	r 38 (3.4)	493 (7.2)	54 (3.5)	456 (6.6)	7 (0.9)	423 (13.6)
Quebec, Canada	29 (4.3)	530 (4.7)	57 (4.8)	513 (3.4)	13 (2.8)	502 (4.8)
Alberta, Canada	r 21 (4.2)	547 (7.4)	65 (4.8)	544 (3.1)	14 (3.1)	522 (9.4)
Ontario, Canada	19 (2.7)	542 (6.3)	64 (3.6)	530 (3.5)	18 (3.0)	506 (5.7)
Abu Dhabi, UAE	17 (3.4)	435 (16.3)	69 (4.3)	410 (6.1)	14 (3.2)	406 (14.1)
Florida, US	s 11 (3.2)	581 (14.6)	62 (5.8)	546 (4.7)	27 (5.4)	520 (7.2)
North Carolina, US	7 (2.4)	556 (19.7)	61 (5.0)	541 (4.8)	32 (4.9)	526 (7.8)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 8.20: Instruction Limited by Students Lacking Prerequisite Knowledge or Skills**

Reported by Teachers

Country	Students in Classrooms Where Teachers Report Instruction Is Limited by Students Lacking Prerequisite Knowledge or Skills					
	Not At All		Some		A Lot	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Kazakhstan	54 (2.6)	496 (5.5)	40 (2.7)	482 (5.6)	6 (1.4)	503 (12.1)
Japan	44 (4.5)	571 (3.1)	51 (4.6)	548 (3.3)	6 (2.1)	541 (6.0)
Russian Federation	41 (2.3)	560 (3.8)	44 (2.7)	535 (4.0)	15 (1.4)	519 (6.0)
Sweden	r 33 (3.4)	529 (3.4)	59 (3.6)	506 (3.3)	7 (1.9)	470 (10.3)
Australia	s 32 (3.7)	560 (9.7)	58 (3.5)	516 (5.9)	10 (2.0)	481 (14.4)
Korea, Rep. of	31 (3.6)	558 (3.8)	54 (3.9)	561 (2.7)	15 (2.9)	562 (4.8)
England	r 29 (3.2)	562 (8.0)	62 (3.2)	526 (6.4)	9 (1.7)	482 (18.8)
Macedonia, Rep. of	29 (2.4)	390 (8.3)	60 (2.3)	424 (6.1)	11 (1.6)	380 (14.4)
Malaysia	27 (3.8)	473 (10.2)	55 (4.1)	432 (6.3)	18 (3.1)	336 (13.3)
Finland	27 (2.6)	569 (3.5)	63 (2.6)	550 (2.3)	10 (1.7)	522 (6.6)
New Zealand	27 (2.9)	547 (6.8)	55 (2.9)	504 (5.3)	19 (2.4)	480 (11.9)
Singapore	26 (2.3)	624 (8.7)	66 (2.6)	584 (4.8)	7 (1.3)	533 (20.1)
United Arab Emirates	23 (2.1)	479 (6.5)	64 (2.6)	459 (3.1)	13 (1.8)	447 (9.4)
Israel	21 (2.7)	548 (9.7)	53 (3.8)	523 (4.8)	25 (3.3)	482 (9.0)
Hong Kong SAR	21 (3.5)	558 (7.6)	70 (4.4)	532 (4.5)	9 (2.6)	505 (19.1)
Norway	21 (3.7)	501 (4.4)	72 (4.0)	492 (3.2)	8 (2.1)	485 (12.3)
Slovenia	19 (1.6)	549 (3.4)	67 (1.9)	543 (2.9)	14 (1.5)	534 (5.3)
Hungary	19 (2.0)	543 (5.6)	68 (2.1)	526 (2.9)	12 (1.6)	474 (7.1)
Lebanon	18 (2.6)	421 (12.2)	65 (3.3)	408 (6.0)	17 (2.5)	379 (11.3)
Ukraine	18 (2.3)	513 (6.1)	47 (2.9)	506 (4.5)	34 (2.9)	489 (5.0)
Romania	18 (1.8)	477 (6.8)	68 (2.1)	465 (3.6)	14 (1.6)	445 (7.6)
Qatar	18 (2.1)	451 (13.0)	62 (4.5)	420 (8.0)	20 (3.9)	384 (15.3)
Bahrain	18 (2.6)	476 (10.1)	64 (2.6)	454 (2.8)	18 (2.6)	428 (8.4)
Chile	17 (2.8)	482 (8.3)	57 (4.4)	463 (4.2)	26 (3.8)	443 (5.4)
Armenia	16 (2.1)	453 (8.2)	77 (2.0)	437 (3.6)	7 (1.6)	419 (8.4)
Italy	15 (2.9)	520 (6.9)	59 (3.6)	505 (3.0)	26 (3.5)	483 (6.9)
United States	s 15 (2.1)	556 (9.3)	67 (2.7)	532 (4.0)	18 (2.0)	500 (6.7)
Chinese Taipei	15 (2.9)	585 (7.6)	64 (4.0)	565 (3.5)	21 (3.4)	543 (4.6)
Lithuania	14 (1.4)	531 (5.0)	68 (1.7)	516 (2.5)	18 (1.5)	497 (5.1)
Indonesia	13 (3.6)	402 (19.7)	67 (4.1)	403 (4.8)	20 (3.2)	414 (6.7)
Morocco	13 (1.7)	397 (6.0)	41 (2.4)	382 (2.9)	46 (2.1)	367 (3.5)
Saudi Arabia	13 (2.9)	440 (11.7)	65 (3.7)	438 (4.5)	22 (3.6)	430 (8.1)
Oman	12 (1.6)	438 (10.1)	59 (3.4)	419 (5.1)	30 (3.2)	413 (7.6)
Thailand	11 (2.4)	475 (16.2)	71 (3.5)	454 (4.8)	19 (2.9)	427 (8.8)
Tunisia	10 (2.5)	454 (12.5)	64 (3.4)	439 (3.0)	25 (3.4)	431 (4.3)
Syrian Arab Republic	10 (2.2)	441 (10.7)	64 (3.4)	427 (4.4)	26 (3.4)	417 (8.5)
Palestinian Nat'l Auth.	9 (2.5)	465 (12.9)	52 (4.0)	423 (4.9)	39 (4.3)	407 (5.8)
Iran, Islamic Rep. of	9 (2.1)	512 (16.9)	60 (3.5)	477 (4.6)	31 (3.5)	458 (6.5)
Georgia	8 (1.1)	444 (5.9)	74 (2.4)	418 (3.3)	18 (2.3)	418 (5.3)
Jordan	6 (1.7)	448 (17.9)	55 (4.0)	459 (4.8)	39 (3.8)	435 (7.6)
Ghana	5 (1.6)	302 (24.2)	78 (3.4)	313 (6.4)	17 (3.0)	279 (9.2)
Turkey	3 (1.3)	551 (54.4)	51 (3.5)	498 (4.9)	46 (3.3)	462 (4.6)
International Avg.	20 (0.4)	496 (2.0)	61 (0.5)	478 (0.7)	19 (0.4)	455 (1.5)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

An "x" indicates data are available for less than 50% of students.

**Exhibit 8.20: Instruction Limited by Students Lacking Prerequisite Knowledge or Skills (Continued)**

Country	Students in Classrooms Where Teachers Report Instruction Is Limited by Students Lacking Prerequisite Knowledge or Skills					
	Not At All		Some		A Lot	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
<b>Ninth Grade Participants</b>						
Honduras	20 (3.7)	379 (10.3)	51 (4.6)	366 (4.9)	29 (4.5)	369 (10.5)
Botswana	15 (3.2)	438 (10.5)	42 (4.3)	408 (5.9)	43 (4.4)	388 (4.9)
South Africa	9 (2.4)	340 (21.0)	59 (3.9)	334 (5.8)	33 (3.9)	317 (6.8)
<b>Benchmarking Participants</b>						
Quebec, Canada	29 (3.7)	539 (5.7)	53 (4.1)	514 (4.1)	18 (3.4)	511 (7.8)
Dubai, UAE	r 26 (2.7)	511 (7.5)	62 (4.5)	470 (5.2)	12 (3.9)	467 (15.1)
Ontario, Canada	23 (3.2)	536 (5.5)	64 (3.8)	519 (3.4)	13 (2.5)	500 (7.3)
Minnesota, US	r 22 (5.0)	568 (11.8)	64 (4.6)	556 (6.0)	14 (3.8)	518 (27.8)
Alberta, Canada	22 (3.6)	562 (5.5)	67 (3.9)	543 (2.7)	11 (2.7)	533 (6.7)
Massachusetts, US	s 22 (6.3)	599 (14.0)	67 (7.3)	563 (10.1)	11 (4.6)	510 (31.8)
Abu Dhabi, UAE	20 (3.6)	478 (12.2)	64 (4.0)	461 (4.9)	15 (2.9)	438 (9.8)
Alabama, US	s 17 (5.3)	498 (15.9)	65 (6.5)	482 (10.0)	18 (6.2)	481 (13.1)
Colorado, US	s 17 (4.9)	552 (12.4)	69 (6.2)	554 (6.7)	13 (4.0)	492 (14.3)
Indiana, US	s 16 (5.9)	542 (12.3)	69 (6.9)	536 (6.6)	15 (3.8)	495 (12.3)
Connecticut, US	s 15 (3.8)	563 (13.6)	55 (6.4)	548 (8.5)	30 (6.6)	498 (15.5)
California, US	s 13 (3.4)	553 (19.5)	68 (4.6)	507 (8.4)	19 (3.5)	468 (16.7)
North Carolina, US	s 2 (1.7)	~ ~	68 (7.8)	545 (12.4)	30 (7.5)	491 (15.7)
Florida, US	x x	x x	x x	x x	x x	x x

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

for groups of students, it is distressing that, according to their teachers, relatively few students at the eighth grade are receiving the full instructional benefit that could be provided.

Eighth grade students in classes where instruction was not limited had higher average science achievement than did their counterparts in classes where instruction was limited to some extent (496 vs. 478). Also consistent with teachers' reports, average science achievement was substantially lower (455) for eighth grade students in classrooms where instruction was limited "a lot" because students lacked the prerequisite knowledge or skills. This pattern also was evidenced at the ninth grade and for the benchmarking participants.

### *Instruction Limited by Students Suffering from Lack of Nutrition or Sleep*

The importance of a healthy breakfast is widely advertised, including the benefit of doing better in school. Unfortunately, some children in many countries around the world suffer from hunger, and a growing body of research, mostly in developing countries, is providing evidence that malnutrition has a negative impact on educational achievement. Similarly, a number of studies in a variety of countries have shown sleep duration and quality to be related to academic functioning at school. For example, a Dutch researcher found that chronic sleep reduction can affect school achievement directly and indirectly via motivation and engagement (Meijer, 2008).

Exhibit 8.21 presents teachers' reports at the fourth grade about the degree to which their science instruction was limited by students' lack of nutrition or not having enough sleep. On average, internationally, 71 percent of the fourth grade students were in classrooms where instruction was "not at all" limited because students were lacking in basic nutrition. These fourth grade students had higher average science achievement than their peers in classrooms where instruction was limited "some" or "a lot" due to lack of basic nutrition (493 vs. 467). It is of considerable concern that 29 percent of the fourth grade students, on average, were reported to be suffering from lack of basic nutrition; and this percentage is much higher in some countries, including those that participated at the sixth grade.

Teachers reported that 54 percent of the fourth grade students, on average, were in classrooms where instruction was "not at all" limited by students suffering from not enough sleep. However, it is unfortunate that 46 percent,

on average, were in classrooms where instruction was limited “some” or “a lot” by students suffering from lack of sleep. The achievement gap for sleep deprivation was somewhat less than that related to lack of nutrition, but the fourth grade students suffering from some amount of sleep deprivation did have lower average science achievement than their more alert counterparts (by 11 points on average). Again, there was considerable variation across countries in teachers’ reports about the percentages of fourth grade students suffering from not enough sleep. According to their teachers, in a number of TIMSS 2011 countries and benchmarking participants, the majority of students were at least somewhat sleep deprived.

Exhibit 8.22 presents the eighth grade teachers’ reports about the degree to which their instruction was limited by students’ lack of nutrition or not having enough sleep. On average, internationally, 64 percent of the eighth grade students were in classrooms where instruction was “not at all” limited because students were lacking in basic nutrition. These eighth grade students had higher average science achievement than their peers in classrooms where instruction was limited “some” or “a lot” due to lack of basic nutrition (485 vs. 461). More than one-third (36%) of the eighth grade students, on average, were reported to be suffering from lack of basic nutrition; and this percentage was much higher in some countries, including those that participated at the ninth grade.

Teachers reported that 42 percent of the eighth grade students, on average, were in classrooms where instruction was “not at all” limited by students suffering from not enough sleep. However, again, it is a matter of considerable concern that the majority of eighth grade students (58%), on average, were in classrooms where instruction was limited “some” or “a lot” by students suffering from lack of sleep. Similar to the results at fourth grade, the achievement gap for sleep deprivation was somewhat less than that related to lack of nutrition, but the eighth grade students suffering from some amount of sleep deprivation did have lower average science achievement than their counterparts (by 11 points). Again, there was considerable variation across countries in teachers’ reports about the percentages of eighth grade students suffering from not enough sleep. According to their teachers, however, in a number of TIMSS 2011 countries and benchmarking participants, as much as two-thirds of students were at least somewhat sleep deprived.

**Exhibit 8.21: Instruction Limited by Students Suffering from Lack of Nutrition or Sleep**

Reported by Teachers

Country	Students in Classrooms Where Teachers Report Instruction Is Limited by Students Suffering from Lack of Basic Nutrition				Students in Classrooms Where Teachers Report Instruction Is Limited by Students Suffering from Not Enough Sleep			
	Not At All		Some or A Lot		Not At All		Some or A Lot	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	33 (3.9)	427 (7.0)	67 (3.9)	412 (4.7)	52 (4.6)	422 (5.8)	48 (4.6)	409 (5.5)
Australia	r 73 (3.0)	531 (3.4)	27 (3.0)	488 (6.6)	r 36 (3.7)	536 (4.8)	64 (3.7)	509 (5.2)
Austria	--	--	--	--	42 (3.4)	540 (3.3)	58 (3.4)	524 (3.6)
Azerbaijan	60 (3.5)	448 (7.8)	40 (3.5)	431 (8.6)	82 (2.9)	443 (6.4)	18 (2.9)	427 (9.6)
Bahrain	61 (4.5)	452 (5.6)	39 (4.5)	446 (5.4)	47 (4.9)	445 (4.7)	53 (4.9)	453 (5.5)
Belgium (Flemish)	95 (1.5)	511 (2.1)	5 (1.5)	474 (8.7)	62 (3.6)	514 (2.5)	38 (3.6)	500 (3.4)
Chile	58 (3.5)	496 (3.7)	42 (3.5)	460 (5.1)	37 (4.3)	499 (5.6)	63 (4.3)	470 (5.4)
Chinese Taipei	76 (3.8)	556 (2.6)	24 (3.8)	537 (4.8)	63 (4.1)	552 (2.7)	37 (4.1)	551 (3.5)
Croatia	83 (2.8)	517 (2.2)	17 (2.8)	512 (6.3)	44 (3.5)	513 (3.2)	56 (3.5)	519 (2.6)
Czech Republic	99 (0.9)	536 (2.5)	1 (0.9)	~ ~	67 (3.8)	539 (3.1)	33 (3.8)	531 (4.3)
Denmark	83 (2.8)	533 (3.1)	17 (2.8)	520 (6.1)	53 (3.9)	534 (3.4)	47 (3.9)	525 (4.2)
England	79 (3.0)	537 (4.4)	21 (3.0)	505 (5.0)	36 (4.3)	545 (6.1)	64 (4.3)	521 (4.4)
Finland	91 (2.2)	572 (2.5)	9 (2.2)	550 (6.6)	39 (4.0)	576 (3.8)	61 (4.0)	566 (2.6)
Georgia	46 (4.1)	469 (4.6)	54 (4.1)	444 (5.8)	64 (4.3)	455 (4.2)	36 (4.3)	455 (7.0)
Germany	85 (2.7)	533 (2.9)	15 (2.7)	503 (7.0)	52 (3.3)	539 (3.0)	48 (3.3)	517 (4.3)
Hong Kong SAR	89 (2.4)	537 (4.4)	11 (2.4)	517 (8.0)	56 (4.7)	541 (4.6)	44 (4.7)	527 (8.2)
Hungary	72 (2.9)	542 (3.9)	28 (2.9)	510 (7.9)	48 (3.4)	544 (4.7)	52 (3.4)	523 (5.6)
Iran, Islamic Rep. of	30 (3.6)	483 (6.9)	70 (3.6)	440 (4.7)	41 (3.6)	457 (5.9)	59 (3.6)	450 (5.2)
Ireland	79 (3.0)	522 (3.9)	21 (3.0)	495 (6.8)	38 (3.6)	530 (5.2)	62 (3.6)	508 (4.3)
Italy	72 (3.5)	526 (3.1)	28 (3.5)	528 (6.0)	52 (4.4)	526 (3.7)	48 (4.4)	526 (4.5)
Japan	99 (0.6)	559 (1.9)	1 (0.6)	~ ~	77 (3.3)	559 (2.1)	23 (3.3)	556 (3.5)
Kazakhstan	81 (3.2)	495 (6.0)	19 (3.2)	496 (12.4)	88 (2.9)	491 (5.5)	12 (2.9)	523 (14.1)
Korea, Rep. of	82 (3.4)	588 (2.3)	18 (3.4)	580 (2.9)	73 (3.5)	587 (2.6)	27 (3.5)	585 (3.1)
Kuwait	64 (4.1)	354 (6.4)	36 (4.1)	337 (8.2)	36 (3.8)	359 (8.6)	64 (3.8)	341 (6.1)
Lithuania	82 (3.0)	516 (3.0)	18 (3.0)	504 (5.8)	54 (3.3)	519 (3.7)	46 (3.3)	510 (3.1)
Malta	89 (0.1)	449 (1.9)	11 (0.1)	426 (3.7)	79 (0.1)	447 (1.9)	21 (0.1)	443 (3.3)
Morocco	21 (3.0)	292 (12.7)	79 (3.0)	255 (6.0)	40 (3.7)	267 (8.3)	60 (3.7)	261 (6.6)
Netherlands	r 91 (2.6)	532 (2.7)	9 (2.6)	512 (8.3)	r 54 (4.3)	537 (2.8)	46 (4.3)	522 (3.4)
New Zealand	63 (2.7)	516 (2.6)	37 (2.7)	468 (4.0)	30 (2.9)	517 (3.9)	70 (2.9)	489 (3.0)
Northern Ireland	r 80 (3.1)	524 (3.4)	20 (3.1)	489 (5.7)	r 39 (4.7)	532 (3.9)	61 (4.7)	507 (4.3)
Norway	74 (4.5)	497 (2.7)	26 (4.5)	488 (4.7)	53 (4.4)	496 (3.1)	47 (4.4)	493 (3.4)
Oman	46 (3.0)	392 (6.3)	54 (3.0)	366 (4.8)	49 (3.0)	388 (6.0)	51 (3.0)	368 (4.4)
Poland	88 (2.2)	505 (2.8)	12 (2.2)	500 (5.2)	62 (3.1)	506 (3.2)	38 (3.1)	504 (3.7)
Portugal	86 (2.8)	523 (4.1)	14 (2.8)	517 (10.4)	67 (4.0)	524 (5.4)	33 (4.0)	517 (6.0)
Qatar	60 (3.2)	415 (7.5)	40 (3.2)	363 (9.9)	40 (4.5)	402 (8.7)	60 (4.5)	390 (7.4)
Romania	50 (3.6)	528 (6.6)	50 (3.6)	481 (9.2)	62 (3.8)	509 (5.9)	38 (3.8)	498 (10.9)
Russian Federation	82 (2.5)	557 (3.7)	18 (2.5)	527 (5.9)	72 (2.7)	555 (3.9)	28 (2.7)	543 (5.8)
Saudi Arabia	47 (4.1)	438 (7.1)	53 (4.1)	422 (8.6)	32 (3.5)	431 (7.9)	68 (3.5)	426 (7.4)
Serbia	84 (2.8)	516 (3.1)	16 (2.8)	519 (8.8)	52 (4.0)	516 (3.9)	48 (4.0)	518 (3.9)
Singapore	84 (1.8)	591 (3.4)	16 (1.8)	538 (9.3)	64 (2.4)	593 (4.2)	36 (2.4)	566 (6.4)
Slovak Republic	97 (0.9)	533 (3.8)	3 (0.9)	499 (21.3)	80 (2.7)	536 (3.6)	20 (2.7)	515 (10.8)
Slovenia	88 (2.0)	522 (2.8)	12 (2.0)	505 (5.8)	48 (4.5)	524 (3.6)	52 (4.5)	516 (3.5)
Spain	89 (2.3)	508 (3.0)	11 (2.3)	490 (7.0)	62 (3.9)	512 (3.7)	38 (3.9)	496 (4.0)
Sweden	r 97 (1.2)	535 (3.3)	3 (1.2)	518 (15.9)	r 60 (4.1)	541 (3.6)	40 (4.1)	524 (5.5)
Thailand	70 (4.1)	483 (5.8)	30 (4.1)	449 (11.1)	68 (4.2)	478 (6.1)	32 (4.2)	462 (10.8)
Tunisia	49 (4.0)	359 (7.4)	51 (4.0)	333 (6.6)	69 (3.6)	345 (6.5)	31 (3.6)	348 (8.9)
Turkey	26 (2.8)	483 (9.1)	74 (2.8)	455 (5.4)	35 (3.0)	465 (5.7)	65 (3.0)	461 (5.8)
United Arab Emirates	67 (2.3)	441 (3.8)	33 (2.3)	409 (4.8)	47 (2.3)	447 (4.3)	53 (2.3)	416 (3.9)
United States	r 61 (2.2)	554 (2.5)	39 (2.2)	531 (3.2)	r 27 (2.1)	559 (3.5)	73 (2.1)	539 (2.6)
Yemen	13 (3.2)	212 (21.4)	87 (3.2)	206 (8.2)	55 (4.4)	221 (8.9)	45 (4.4)	189 (9.8)
International Avg.	71 (0.4)	493 (0.8)	29 (0.4)	467 (1.1)	54 (0.5)	492 (0.7)	46 (0.5)	481 (0.9)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

(1) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

**Exhibit 8.21: Instruction Limited by Students Suffering from Lack of Nutrition or Sleep (Continued)**

Country	Students in Classrooms Where Teachers Report Instruction Is Limited by Students Suffering from Lack of Basic Nutrition				Students in Classrooms Where Teachers Report Instruction Is Limited by Students Suffering from Not Enough Sleep				
	Not At All		Some or A Lot		Not At All		Some or A Lot		
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Sixth Grade Participants</b>									
Botswana	60 (3.9)	393 (8.9)	40 (3.9)	340 (7.3)	41 (4.3)	388 (9.1)	59 (4.3)	360 (8.5)	
Honduras	28 (4.0)	466 (11.0)	72 (4.0)	420 (6.8)	64 (4.3)	439 (6.9)	36 (4.3)	420 (10.7)	
Yemen	22 (4.0)	365 (14.6)	78 (4.0)	340 (8.5)	55 (4.5)	360 (9.6)	45 (4.5)	326 (9.7)	
<b>Benchmarking Participants</b>									
Alberta, Canada	r 60 (4.7)	550 (3.4)	40 (4.7)	528 (4.3)	r 29 (4.5)	559 (5.4)	71 (4.5)	535 (2.9)	
Ontario, Canada	63 (3.8)	536 (3.3)	37 (3.8)	514 (4.4)	26 (3.5)	540 (6.0)	74 (3.5)	523 (3.1)	
Quebec, Canada	74 (3.8)	522 (3.1)	26 (3.8)	502 (4.7)	38 (3.8)	526 (3.9)	62 (3.8)	511 (2.9)	
Abu Dhabi, UAE	61 (4.2)	420 (7.0)	39 (4.2)	405 (7.4)	44 (4.6)	421 (9.1)	56 (4.6)	408 (6.7)	
Dubai, UAE	r 86 (1.9)	478 (3.8)	14 (1.9)	406 (9.2)	r 65 (2.7)	483 (3.9)	35 (2.7)	439 (6.9)	
Florida, US	s 63 (4.6)	549 (5.8)	37 (4.6)	534 (6.7)	s 27 (4.2)	556 (8.4)	73 (4.2)	539 (4.6)	
North Carolina, US	65 (5.5)	543 (4.7)	35 (5.5)	527 (8.2)	19 (3.0)	539 (8.1)	81 (3.0)	537 (5.3)	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 8.22: Instruction Limited by Students Suffering from Lack of Nutrition or Sleep**

Reported by Teachers

Country	Students in Classrooms Where Teachers Report Instruction Is Limited by Students Suffering from Lack of Basic Nutrition				Students in Classrooms Where Teachers Report Instruction Is Limited by Students Suffering from Not Enough Sleep			
	Not At All		Some or A Lot		Not At All		Some or A Lot	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	38 (2.5)	446 (4.6)	62 (2.5)	433 (4.0)	53 (2.6)	441 (4.2)	47 (2.6)	434 (4.5)
Australia	s 76 (2.8)	540 (6.1)	24 (2.8)	484 (8.9)	s 37 (3.6)	535 (6.4)	63 (3.6)	522 (7.6)
Bahrain	53 (3.4)	469 (4.6)	47 (3.4)	436 (4.4)	31 (2.8)	473 (6.2)	69 (2.8)	445 (2.6)
Chile	55 (4.4)	476 (4.0)	45 (4.4)	444 (4.1)	26 (3.1)	484 (5.7)	74 (3.1)	453 (3.2)
Chinese Taipei	83 (3.0)	565 (2.5)	17 (3.0)	557 (8.3)	23 (3.6)	555 (6.8)	77 (3.6)	566 (2.8)
England	r 75 (2.4)	538 (5.4)	25 (2.4)	513 (11.4)	r 37 (3.4)	549 (5.4)	63 (3.4)	522 (7.7)
Finland	90 (1.2)	553 (2.5)	10 (1.2)	545 (4.9)	18 (1.9)	560 (3.2)	82 (1.9)	550 (2.7)
Georgia	39 (2.8)	430 (3.6)	61 (2.8)	414 (4.0)	47 (3.1)	420 (4.0)	53 (3.1)	421 (4.3)
Ghana	34 (4.3)	333 (11.9)	66 (4.3)	293 (6.5)	26 (3.4)	309 (8.5)	74 (3.4)	305 (7.1)
Hong Kong SAR	86 (3.3)	539 (4.2)	14 (3.3)	520 (10.7)	17 (3.2)	549 (14.7)	83 (3.2)	532 (3.5)
Hungary	82 (2.0)	531 (3.0)	18 (2.0)	488 (6.4)	43 (2.4)	531 (3.5)	57 (2.4)	517 (4.0)
Indonesia	70 (3.5)	404 (5.8)	30 (3.5)	407 (7.2)	47 (4.5)	403 (7.9)	53 (4.5)	407 (5.5)
Iran, Islamic Rep. of	30 (3.3)	499 (8.0)	70 (3.3)	464 (4.1)	35 (3.6)	487 (6.3)	65 (3.6)	468 (4.9)
Israel	82 (2.5)	527 (4.5)	18 (2.5)	478 (10.5)	47 (3.8)	535 (5.9)	53 (3.8)	503 (5.6)
Italy	90 (2.4)	504 (2.5)	10 (2.4)	491 (11.3)	68 (3.9)	502 (3.3)	32 (3.9)	501 (4.8)
Japan	99 (0.9)	558 (2.4)	1 (0.9)	~ ~	65 (3.6)	558 (2.7)	35 (3.6)	557 (4.1)
Jordan	30 (3.4)	451 (10.1)	70 (3.4)	448 (4.8)	42 (4.2)	451 (8.1)	58 (4.2)	448 (4.8)
Kazakhstan	81 (2.5)	494 (4.3)	19 (2.5)	478 (7.2)	85 (2.1)	490 (4.3)	15 (2.1)	494 (8.8)
Korea, Rep. of	73 (3.4)	559 (2.3)	27 (3.4)	562 (3.6)	28 (3.0)	560 (4.0)	72 (3.0)	559 (2.1)
Lebanon	65 (3.3)	402 (6.1)	35 (3.3)	413 (7.6)	36 (3.5)	402 (7.5)	64 (3.5)	407 (6.2)
Lithuania	80 (1.6)	517 (2.7)	20 (1.6)	504 (3.8)	60 (1.9)	516 (2.7)	40 (1.9)	512 (3.4)
Macedonia, Rep. of	76 (2.1)	420 (5.9)	24 (2.1)	379 (9.7)	r 51 (2.5)	411 (6.8)	49 (2.5)	408 (6.5)
Malaysia	74 (3.3)	442 (6.3)	26 (3.3)	379 (12.3)	59 (4.1)	448 (6.8)	41 (4.1)	394 (8.9)
Morocco	30 (2.4)	394 (3.8)	70 (2.4)	370 (2.6)	38 (2.4)	379 (3.2)	62 (2.4)	375 (2.6)
New Zealand	71 (3.0)	529 (5.3)	29 (3.0)	469 (6.9)	37 (3.8)	531 (6.5)	63 (3.8)	500 (5.5)
Norway	58 (3.7)	497 (3.1)	42 (3.7)	489 (4.5)	33 (3.8)	502 (3.8)	67 (3.8)	489 (3.2)
Oman	38 (3.4)	424 (5.4)	62 (3.4)	417 (4.1)	47 (3.4)	424 (5.9)	53 (3.4)	416 (4.6)
Palestinian Nat'l Auth.	24 (3.5)	436 (8.0)	76 (3.5)	416 (3.5)	27 (2.9)	415 (8.1)	73 (2.9)	423 (3.6)
Qatar	52 (4.3)	439 (8.9)	48 (4.3)	395 (5.9)	34 (4.1)	452 (14.1)	66 (4.1)	401 (5.8)
Romania	60 (2.9)	470 (4.6)	40 (2.9)	457 (4.4)	55 (2.4)	465 (4.8)	45 (2.4)	464 (3.8)
Russian Federation	82 (1.7)	547 (3.3)	18 (1.7)	522 (5.1)	67 (2.6)	547 (3.3)	33 (2.6)	533 (4.3)
Saudi Arabia	39 (4.2)	436 (7.7)	61 (4.2)	437 (4.2)	23 (3.4)	439 (7.9)	77 (3.4)	436 (4.8)
Singapore	89 (1.9)	596 (4.2)	11 (1.9)	538 (22.6)	30 (2.7)	611 (8.3)	70 (2.7)	582 (5.4)
Slovenia	86 (1.5)	543 (2.7)	14 (1.5)	544 (4.4)	47 (2.3)	543 (2.7)	53 (2.3)	543 (3.5)
Sweden	r 93 (1.7)	513 (2.9)	7 (1.7)	490 (9.9)	r 43 (3.5)	517 (3.9)	57 (3.5)	507 (3.9)
Syrian Arab Republic	44 (3.8)	428 (6.2)	56 (3.8)	425 (5.3)	48 (3.8)	429 (6.0)	52 (3.8)	424 (5.4)
Thailand	73 (3.2)	451 (5.2)	27 (3.2)	450 (6.5)	51 (4.4)	451 (6.4)	49 (4.4)	451 (5.2)
Tunisia	56 (3.7)	446 (3.4)	44 (3.7)	429 (3.1)	44 (3.5)	439 (3.6)	56 (3.5)	439 (4.0)
Turkey	38 (3.3)	501 (7.9)	62 (3.3)	472 (3.8)	30 (3.2)	492 (9.6)	70 (3.2)	479 (3.8)
Ukraine	81 (2.6)	504 (3.9)	19 (2.6)	489 (5.1)	78 (2.7)	502 (3.9)	22 (2.7)	496 (5.0)
United Arab Emirates	61 (2.5)	475 (3.5)	39 (2.5)	442 (3.9)	40 (2.6)	477 (4.4)	60 (2.6)	452 (3.0)
United States	s 60 (2.4)	538 (4.2)	40 (2.4)	519 (5.0)	s 15 (1.8)	534 (7.7)	85 (1.8)	529 (3.6)
International Avg.	64 (0.5)	485 (0.8)	36 (0.5)	461 (1.2)	42 (0.5)	484 (1.0)	58 (0.5)	473 (0.8)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

An "x" indicates data are available for less than 50% of students.

**Exhibit 8.22: Instruction Limited by Students Suffering from Lack of Nutrition or Sleep (Continued)**

Country	Students in Classrooms Where Teachers Report Instruction Is Limited by Students Suffering from Lack of Basic Nutrition				Students in Classrooms Where Teachers Report Instruction Is Limited by Students Suffering from Not Enough Sleep			
	Not At All		Some or A Lot		Not At All		Some or A Lot	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
<b>Ninth Grade Participants</b>								
Botswana	64 (4.1)	410 (4.7)	36 (4.1)	392 (5.8)	40 (4.0)	409 (6.9)	60 (4.0)	400 (4.5)
Honduras	25 (4.2)	392 (11.5)	75 (4.2)	362 (4.1)	34 (4.6)	367 (9.5)	66 (4.6)	371 (4.9)
South Africa	38 (3.0)	351 (8.7)	62 (3.0)	316 (5.4)	31 (3.4)	330 (8.5)	69 (3.4)	329 (5.4)
<b>Benchmarking Participants</b>								
Alberta, Canada	57 (4.8)	554 (3.3)	43 (4.8)	536 (3.3)	16 (3.3)	562 (6.3)	84 (3.3)	543 (2.6)
Ontario, Canada	64 (3.9)	528 (3.8)	36 (3.9)	509 (3.6)	23 (3.6)	533 (5.7)	77 (3.6)	517 (3.2)
Quebec, Canada	72 (3.7)	529 (3.6)	28 (3.7)	500 (5.5)	40 (4.3)	529 (5.7)	60 (4.3)	515 (3.4)
Abu Dhabi, UAE	60 (4.0)	469 (6.3)	40 (4.0)	452 (4.7)	39 (4.2)	469 (8.1)	61 (4.2)	456 (4.7)
Dubai, UAE	64 (4.5)	506 (4.7)	36 (4.5)	434 (9.9)	47 (4.6)	503 (5.3)	53 (4.6)	461 (6.0)
Alabama, US	81 (6.8)	489 (9.1)	19 (6.8)	468 (11.3)	13 (3.7)	526 (10.0)	87 (3.7)	479 (7.6)
California, US	52 (6.0)	519 (7.8)	48 (6.0)	491 (11.6)	23 (5.6)	519 (11.3)	77 (5.6)	500 (9.1)
Colorado, US	65 (7.8)	553 (7.4)	35 (7.8)	532 (13.1)	19 (4.9)	548 (8.4)	81 (4.9)	545 (7.5)
Connecticut, US	63 (6.2)	546 (9.6)	37 (6.2)	520 (10.0)	24 (5.5)	544 (14.3)	76 (5.5)	533 (8.1)
Florida, US	x x	x x	x x	x x	x x	x x	x x	x x
Indiana, US	56 (6.9)	536 (7.1)	44 (6.9)	525 (8.2)	14 (4.3)	525 (14.7)	86 (4.3)	532 (5.1)
Massachusetts, US	68 (5.8)	582 (7.2)	32 (5.8)	528 (13.0)	16 (5.9)	583 (17.5)	84 (5.9)	567 (8.3)
Minnesota, US	57 (5.0)	561 (6.4)	43 (5.0)	543 (9.8)	15 (5.1)	550 (6.6)	85 (5.1)	553 (6.7)
North Carolina, US	58 (8.1)	534 (13.6)	42 (8.1)	520 (15.9)	14 (4.1)	533 (17.1)	86 (4.1)	527 (11.6)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 8.23: Instruction Limited by Disruptive or Uninterested Students**

Reported by Teachers

Country	Students in Classrooms Where Teachers Report Instruction Is Limited by Disruptive Students				Students in Classrooms Where Teachers Report Instruction Is Limited by Uninterested Students			
	Some or Not At All		A Lot		Some or Not At All		A Lot	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	95 (1.6)	417 (4.2)	5 (1.6)	406 (12.6)	88 (2.8)	417 (4.5)	12 (2.8)	408 (8.1)
Australia	r 86 (2.7)	523 (3.8)	14 (2.7)	497 (6.2)	r 94 (1.7)	521 (3.6)	6 (1.7)	494 (11.7)
Austria	90 (2.2)	533 (3.1)	10 (2.2)	518 (7.3)	93 (2.2)	533 (2.7)	7 (2.2)	513 (8.4)
Azerbaijan	99 (0.7)	440 (5.6)	1 (0.7)	~ ~	96 (1.2)	441 (5.5)	4 (1.2)	408 (19.2)
Bahrain	77 (4.0)	451 (4.0)	23 (4.0)	441 (8.7)	80 (3.5)	456 (4.0)	20 (3.5)	425 (9.3)
Belgium (Flemish)	92 (2.1)	510 (2.1)	8 (2.1)	492 (8.2)	97 (1.3)	510 (2.0)	3 (1.3)	473 (13.2)
Chile	72 (3.8)	489 (2.9)	28 (3.8)	462 (6.5)	82 (3.4)	483 (3.2)	18 (3.4)	470 (8.5)
Chinese Taipei	96 (1.6)	551 (2.3)	4 (1.6)	557 (13.6)	97 (1.4)	552 (2.3)	3 (1.4)	540 (20.2)
Croatia	93 (1.9)	516 (2.2)	7 (1.9)	520 (6.2)	95 (1.4)	517 (2.0)	5 (1.4)	504 (6.6)
Czech Republic	88 (2.6)	538 (2.6)	12 (2.6)	527 (10.2)	95 (1.4)	539 (2.3)	5 (1.4)	500 (19.3)
Denmark	88 (1.9)	530 (2.7)	12 (1.9)	529 (10.7)	93 (1.5)	530 (2.6)	7 (1.5)	532 (17.0)
England	94 (1.9)	532 (3.6)	6 (1.9)	494 (10.2)	96 (1.7)	532 (3.5)	4 (1.7)	491 (9.6)
Finland	90 (2.3)	571 (2.6)	10 (2.3)	562 (5.2)	98 (0.7)	571 (2.5)	2 (0.7)	~ ~
Georgia	97 (1.2)	456 (3.9)	3 (1.2)	423 (23.5)	95 (1.7)	455 (4.0)	5 (1.7)	444 (15.2)
Germany	89 (2.0)	532 (3.0)	11 (2.0)	503 (7.6)	97 (1.3)	529 (2.9)	3 (1.3)	517 (10.3)
Hong Kong SAR	89 (2.8)	537 (3.7)	11 (2.8)	513 (16.9)	96 (1.5)	535 (4.2)	4 (1.5)	522 (9.6)
Hungary	91 (2.1)	535 (4.1)	9 (2.1)	519 (8.1)	93 (1.8)	535 (3.9)	7 (1.8)	507 (16.2)
Iran, Islamic Rep. of	88 (2.4)	455 (4.0)	12 (2.4)	440 (14.2)	81 (3.2)	460 (4.4)	19 (3.2)	422 (10.1)
Ireland	90 (2.5)	518 (3.4)	10 (2.5)	502 (9.8)	96 (1.6)	517 (3.4)	4 (1.6)	509 (8.1)
Italy	76 (3.3)	527 (3.3)	24 (3.3)	521 (7.3)	87 (2.6)	527 (2.9)	13 (2.6)	516 (9.4)
Japan	94 (2.0)	558 (2.0)	6 (2.0)	563 (7.4)	97 (1.3)	559 (2.0)	3 (1.3)	561 (8.8)
Kazakhstan	99 (0.7)	495 (5.1)	1 (0.7)	~ ~	97 (1.4)	495 (5.2)	3 (1.4)	498 (20.9)
Korea, Rep. of	62 (3.7)	587 (2.6)	38 (3.7)	585 (3.0)	81 (3.5)	587 (2.4)	19 (3.5)	585 (4.0)
Kuwait	77 (3.5)	352 (5.4)	23 (3.5)	333 (10.7)	79 (3.2)	353 (5.6)	21 (3.2)	327 (10.9)
Lithuania	81 (2.3)	514 (2.7)	19 (2.3)	517 (6.1)	85 (2.4)	516 (2.7)	15 (2.4)	508 (7.4)
Malta	83 (0.1)	449 (2.0)	17 (0.1)	438 (3.5)	91 (0.1)	448 (2.1)	9 (0.1)	432 (4.7)
Morocco	86 (3.6)	265 (5.3)	14 (3.6)	248 (13.2)	70 (4.0)	273 (6.1)	30 (4.0)	241 (7.5)
Netherlands	r 90 (2.8)	531 (2.6)	10 (2.8)	527 (5.1)	r 98 (0.8)	530 (2.5)	2 (0.8)	~ ~
New Zealand	89 (1.5)	502 (2.5)	11 (1.5)	455 (5.7)	97 (0.9)	499 (2.4)	3 (0.9)	455 (15.5)
Northern Ireland	r 95 (2.0)	519 (2.9)	5 (2.0)	485 (23.3)	r 98 (1.2)	517 (3.1)	2 (1.2)	~ ~
Norway	91 (2.8)	496 (2.5)	9 (2.8)	481 (8.3)	98 (1.1)	494 (2.5)	2 (1.1)	~ ~
Oman	78 (2.7)	384 (4.7)	22 (2.7)	358 (6.3)	74 (2.8)	379 (4.1)	26 (2.8)	373 (9.1)
Poland	85 (2.6)	505 (2.8)	15 (2.6)	506 (6.5)	93 (1.7)	505 (2.6)	7 (1.7)	497 (9.8)
Portugal	88 (2.4)	522 (4.4)	12 (2.4)	519 (10.5)	85 (2.9)	522 (4.6)	15 (2.9)	519 (8.7)
Qatar	80 (3.1)	410 (4.9)	20 (3.1)	330 (11.5)	76 (3.2)	408 (5.2)	24 (3.2)	353 (11.8)
Romania	98 (0.8)	504 (6.1)	2 (0.8)	~ ~	93 (2.0)	508 (6.2)	7 (2.0)	458 (23.1)
Russian Federation	94 (1.8)	552 (3.7)	6 (1.8)	550 (10.7)	95 (1.8)	553 (3.6)	5 (1.8)	534 (7.9)
Saudi Arabia	86 (3.0)	431 (6.0)	14 (3.0)	415 (17.2)	81 (3.7)	434 (5.6)	19 (3.7)	409 (14.3)
Serbia	90 (2.2)	516 (3.1)	10 (2.2)	520 (6.2)	87 (2.6)	516 (3.2)	13 (2.6)	519 (8.9)
Singapore	91 (1.9)	585 (3.4)	9 (1.9)	566 (15.9)	92 (1.4)	587 (3.3)	8 (1.4)	531 (16.8)
Slovak Republic	96 (1.0)	532 (4.0)	4 (1.0)	512 (14.3)	94 (1.6)	534 (3.4)	6 (1.6)	497 (18.5)
Slovenia	66 (3.6)	524 (3.2)	34 (3.6)	514 (3.7)	84 (2.4)	521 (3.0)	16 (2.4)	514 (4.2)
Spain	87 (2.6)	511 (2.9)	13 (2.6)	475 (9.2)	83 (3.0)	512 (2.8)	17 (3.0)	475 (7.0)
Sweden	r 94 (1.8)	537 (3.1)	6 (1.8)	506 (11.2)	r 97 (1.4)	534 (3.2)	3 (1.4)	533 (14.0)
Thailand	94 (2.4)	475 (6.3)	6 (2.4)	438 (21.8)	89 (3.0)	479 (4.9)	11 (3.0)	419 (22.2)
Tunisia	79 (3.5)	347 (6.1)	21 (3.5)	340 (10.4)	77 (3.5)	352 (6.2)	23 (3.5)	324 (11.5)
Turkey	84 (2.4)	463 (5.1)	16 (2.4)	461 (8.6)	67 (3.1)	475 (4.5)	33 (3.1)	436 (9.3)
United Arab Emirates	86 (1.7)	436 (2.7)	14 (1.7)	401 (8.8)	88 (1.6)	436 (2.8)	12 (1.6)	395 (8.4)
United States	r 86 (1.6)	548 (2.2)	14 (1.6)	524 (6.5)	r 91 (1.1)	547 (2.3)	9 (1.1)	515 (6.7)
Yemen	85 (3.2)	206 (8.1)	15 (3.2)	211 (15.5)	79 (3.7)	208 (7.9)	21 (3.7)	203 (14.9)
International Avg.	87 (0.3)	488 (0.6)	13 (0.3)	472 (1.6)	89 (0.3)	489 (0.6)	11 (0.3)	463 (1.9)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

**Exhibit 8.23: Instruction Limited by Disruptive or Uninterested Students (Continued)**

Country	Students in Classrooms Where Teachers Report Instruction Is Limited by Disruptive Students				Students in Classrooms Where Teachers Report Instruction Is Limited by Uninterested Students				
	Some or Not At All		A Lot		Some or Not At All		A Lot		
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Sixth Grade Participants</b>									
Botswana	90 (2.5)	375 (6.8)	10 (2.5)	344 (19.7)	82 (3.3)	382 (7.1)	18 (3.3)	327 (10.5)	
Honduras	95 (1.3)	432 (6.3)	5 (1.3)	437 (11.8)	89 (2.6)	432 (6.7)	11 (2.6)	430 (11.2)	
Yemen	87 (2.8)	344 (7.7)	13 (2.8)	349 (17.3)	81 (3.4)	348 (7.2)	19 (3.4)	329 (17.2)	
<b>Benchmarking Participants</b>									
Alberta, Canada	r 85 (3.1)	545 (3.0)	15 (3.1)	524 (4.5)	r 95 (1.8)	543 (2.9)	5 (1.8)	513 (8.4)	
Ontario, Canada	81 (2.6)	528 (3.4)	19 (2.6)	529 (4.7)	93 (2.1)	530 (3.1)	7 (2.1)	501 (6.6)	
Quebec, Canada	78 (4.1)	518 (3.2)	22 (4.1)	509 (4.6)	91 (2.5)	517 (2.9)	9 (2.5)	506 (5.7)	
Abu Dhabi, UAE	84 (3.5)	419 (5.3)	16 (3.5)	390 (12.4)	87 (3.0)	418 (5.7)	13 (3.0)	389 (8.9)	
Dubai, UAE	r 94 (1.1)	473 (3.5)	6 (1.1)	406 (10.7)	r 95 (0.8)	475 (3.1)	5 (0.8)	364 (14.8)	
Florida, US	s 87 (3.9)	547 (4.1)	13 (3.9)	515 (14.4)	s 88 (2.6)	546 (3.9)	12 (2.6)	522 (15.5)	
North Carolina, US	83 (4.7)	542 (4.5)	17 (4.7)	516 (11.8)	85 (3.2)	538 (5.1)	15 (3.2)	531 (10.5)	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

## Exhibit 8.24: Instruction Limited by Disruptive or Uninterested Students

Reported by Teachers

Country	Students in Classrooms Where Teachers Report Instruction Is Limited by Disruptive Students				Students in Classrooms Where Teachers Report Instruction Is Limited by Uninterested Students			
	Some or Not At All		A Lot		Some or Not At All		A Lot	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	91 (1.6)	439 (3.5)	9 (1.6)	426 (7.3)	84 (1.8)	440 (3.4)	16 (1.8)	424 (5.2)
Australia	s 87 (2.4)	533 (6.2)	13 (2.4)	488 (10.5)	s 91 (1.9)	531 (5.9)	9 (1.9)	480 (13.1)
Bahrain	79 (2.8)	459 (3.0)	21 (2.8)	433 (6.5)	73 (3.5)	465 (3.5)	27 (3.5)	423 (6.1)
Chile	63 (3.8)	470 (3.5)	37 (3.8)	444 (5.2)	62 (3.9)	468 (3.6)	38 (3.9)	448 (5.1)
Chinese Taipei	81 (3.3)	568 (2.8)	19 (3.3)	547 (5.9)	65 (4.2)	572 (3.6)	35 (4.2)	549 (4.0)
England	r 83 (2.7)	538 (5.9)	17 (2.7)	506 (11.1)	r 90 (2.0)	534 (5.7)	10 (2.0)	511 (10.9)
Finland	86 (2.3)	554 (2.5)	14 (2.3)	537 (4.0)	89 (1.7)	554 (2.4)	11 (1.7)	536 (5.9)
Georgia	91 (1.5)	419 (3.2)	9 (1.5)	434 (6.3)	86 (1.8)	420 (3.1)	14 (1.8)	419 (6.1)
Ghana	91 (2.4)	310 (5.5)	9 (2.4)	274 (17.7)	94 (2.0)	309 (5.6)	6 (2.0)	261 (24.9)
Hong Kong SAR	95 (1.7)	537 (3.3)	5 (1.7)	486 (34.9)	84 (3.1)	542 (3.5)	16 (3.1)	497 (14.4)
Hungary	88 (1.4)	526 (3.0)	12 (1.4)	502 (6.5)	87 (1.7)	526 (3.0)	13 (1.7)	498 (7.2)
Indonesia	97 (1.2)	404 (4.5)	3 (1.2)	450 (15.9)	91 (2.0)	403 (4.7)	9 (2.0)	429 (8.9)
Iran, Islamic Rep. of	91 (1.8)	476 (4.3)	9 (1.8)	457 (11.6)	73 (2.8)	483 (4.1)	27 (2.8)	453 (7.2)
Israel	65 (3.9)	532 (4.8)	35 (3.9)	492 (7.8)	72 (3.6)	529 (4.5)	28 (3.6)	489 (9.1)
Italy	80 (3.2)	506 (2.8)	20 (3.2)	487 (9.0)	69 (3.7)	509 (2.9)	31 (3.7)	487 (5.9)
Japan	97 (1.3)	558 (2.5)	3 (1.3)	542 (12.2)	97 (1.4)	558 (2.5)	3 (1.4)	533 (7.4)
Jordan	70 (3.8)	459 (4.8)	30 (3.8)	425 (7.8)	64 (3.4)	460 (5.2)	36 (3.4)	429 (7.6)
Kazakhstan	98 (0.7)	491 (4.2)	2 (0.7)	~ ~	97 (0.8)	491 (4.2)	3 (0.8)	499 (20.0)
Korea, Rep. of	63 (3.7)	561 (2.7)	37 (3.7)	558 (3.1)	74 (3.4)	561 (2.4)	26 (3.4)	557 (3.0)
Lebanon	84 (2.2)	407 (5.0)	16 (2.2)	403 (12.3)	84 (2.6)	408 (5.2)	16 (2.6)	394 (12.0)
Lithuania	74 (1.8)	519 (2.8)	26 (1.8)	503 (3.4)	77 (1.7)	519 (2.5)	23 (1.7)	498 (4.8)
Macedonia, Rep. of	91 (1.3)	412 (5.6)	9 (1.3)	387 (12.6)	85 (1.6)	414 (5.6)	15 (1.6)	387 (11.0)
Malaysia	97 (1.3)	424 (6.4)	3 (1.3)	458 (30.1)	86 (2.6)	437 (6.2)	14 (2.6)	358 (14.9)
Morocco	73 (2.4)	376 (2.7)	27 (2.4)	377 (4.1)	53 (2.1)	384 (3.0)	47 (2.1)	368 (3.4)
New Zealand	82 (2.6)	519 (4.7)	18 (2.6)	476 (8.6)	86 (2.5)	518 (5.0)	14 (2.5)	474 (9.6)
Norway	94 (1.8)	495 (2.6)	6 (1.8)	471 (16.8)	97 (2.0)	495 (2.6)	3 (2.0)	449 (41.0)
Oman	82 (2.5)	424 (4.2)	18 (2.5)	398 (7.8)	62 (3.1)	431 (4.4)	38 (3.1)	401 (6.3)
Palestinian Nat'l Auth.	67 (3.8)	424 (4.4)	33 (3.8)	413 (5.8)	59 (3.8)	423 (4.9)	41 (3.8)	417 (4.8)
Qatar	85 (2.2)	426 (4.4)	15 (2.2)	372 (10.7)	79 (2.7)	430 (4.3)	21 (2.7)	375 (8.2)
Romania	92 (1.2)	466 (3.6)	8 (1.2)	455 (6.1)	86 (1.9)	468 (3.7)	14 (1.9)	446 (6.5)
Russian Federation	87 (1.3)	546 (3.6)	13 (1.3)	520 (4.9)	87 (1.6)	547 (3.5)	13 (1.6)	516 (5.9)
Saudi Arabia	83 (3.0)	438 (4.5)	17 (3.0)	431 (6.9)	81 (3.2)	441 (4.5)	19 (3.2)	416 (7.7)
Singapore	89 (1.9)	596 (4.5)	11 (1.9)	543 (13.8)	88 (1.9)	596 (4.4)	12 (1.9)	545 (12.2)
Slovenia	71 (2.1)	544 (2.7)	29 (2.1)	539 (4.1)	76 (2.1)	545 (2.6)	24 (2.1)	537 (4.3)
Sweden	r 88 (2.2)	515 (2.8)	12 (2.2)	481 (8.5)	r 92 (1.9)	513 (3.0)	8 (1.9)	486 (6.5)
Syrian Arab Republic	r 76 (3.5)	428 (4.8)	24 (3.5)	421 (8.2)	r 67 (3.5)	433 (5.0)	33 (3.5)	412 (6.1)
Thailand	95 (1.8)	450 (4.1)	5 (1.8)	459 (12.5)	87 (2.7)	453 (4.3)	13 (2.7)	430 (10.4)
Tunisia	74 (3.3)	439 (2.8)	26 (3.3)	437 (5.2)	74 (3.7)	442 (3.0)	26 (3.7)	429 (3.9)
Turkey	69 (3.3)	491 (4.7)	31 (3.3)	467 (4.9)	57 (3.5)	496 (5.3)	43 (3.5)	466 (4.5)
Ukraine	86 (2.4)	504 (3.9)	14 (2.4)	484 (7.6)	65 (3.1)	509 (4.5)	35 (3.1)	486 (4.8)
United Arab Emirates	84 (1.9)	464 (2.6)	16 (1.9)	450 (6.9)	80 (2.3)	468 (2.7)	20 (2.3)	438 (7.3)
United States	s 83 (1.8)	534 (3.6)	17 (1.8)	509 (7.9)	s 82 (2.2)	534 (3.7)	18 (2.2)	515 (6.8)
International Avg.	83 (0.4)	481 (0.6)	17 (0.4)	462 (1.8)	79 (0.4)	482 (0.6)	21 (0.4)	456 (1.7)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

An "x" indicates data are available for less than 50% of students.

**Exhibit 8.24: Instruction Limited by Disruptive or Uninterested Students (Continued)**

Country	Students in Classrooms Where Teachers Report Instruction Is Limited by Disruptive Students				Students in Classrooms Where Teachers Report Instruction Is Limited by Uninterested Students				
	Some or Not At All		A Lot		Some or Not At All		A Lot		
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Ninth Grade Participants</b>									
Botswana	67 (3.7)	406 (4.5)	33 (3.7)	400 (6.5)	46 (3.9)	421 (5.6)	54 (3.9)	390 (5.0)	
Honduras	81 (3.9)	372 (4.9)	19 (3.9)	360 (10.1)	71 (3.9)	370 (5.2)	29 (3.9)	368 (7.7)	
South Africa	78 (3.3)	328 (4.4)	22 (3.3)	338 (10.7)	73 (3.5)	327 (4.5)	27 (3.5)	335 (8.6)	
<b>Benchmarking Participants</b>									
Alberta, Canada	85 (2.7)	547 (2.7)	15 (2.7)	541 (5.6)	91 (2.2)	548 (2.5)	9 (2.2)	530 (8.3)	
Ontario, Canada	85 (2.8)	523 (2.9)	15 (2.8)	510 (7.3)	89 (2.6)	523 (2.8)	11 (2.6)	504 (7.7)	
Quebec, Canada	71 (3.5)	528 (3.4)	29 (3.5)	502 (6.1)	80 (3.1)	524 (3.3)	20 (3.1)	507 (7.4)	
Abu Dhabi, UAE	79 (3.7)	466 (5.2)	21 (3.7)	443 (6.2)	74 (3.8)	466 (5.3)	26 (3.8)	446 (6.3)	
Dubai, UAE	r 85 (4.0)	488 (3.6)	15 (4.0)	441 (17.1)	r 84 (4.0)	490 (3.6)	16 (4.0)	431 (18.4)	
Alabama, US	s 79 (6.1)	490 (8.9)	21 (6.1)	468 (12.4)	s 66 (8.2)	496 (8.5)	34 (8.2)	465 (11.2)	
California, US	s 76 (4.6)	513 (7.4)	24 (4.6)	479 (14.1)	s 78 (4.7)	511 (8.1)	22 (4.7)	484 (10.7)	
Colorado, US	s 88 (4.0)	549 (5.8)	12 (4.0)	520 (19.4)	s 84 (5.8)	547 (6.7)	16 (5.8)	534 (15.4)	
Connecticut, US	s 79 (5.2)	549 (7.8)	21 (5.2)	486 (15.4)	s 82 (4.9)	543 (8.3)	18 (4.9)	503 (17.9)	
Florida, US	x x	x x	x x	x x	x x	x x	x x	x x	
Indiana, US	s 85 (4.4)	535 (5.2)	15 (4.4)	509 (14.8)	s 83 (4.2)	531 (5.2)	17 (4.2)	531 (14.4)	
Massachusetts, US	s 89 (4.0)	570 (8.8)	11 (4.0)	525 (33.2)	s 93 (3.3)	576 (6.4)	7 (3.3)	488 (37.0)	
Minnesota, US	r 87 (4.6)	558 (5.8)	13 (4.6)	524 (34.2)	r 92 (2.5)	556 (5.9)	8 (2.5)	527 (10.2)	
North Carolina, US	s 76 (6.4)	536 (11.4)	24 (6.4)	502 (20.0)	s 74 (6.8)	534 (12.7)	26 (6.8)	512 (17.9)	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

### *Instruction Limited by Disruptive or Uninterested Students*

The importance of classroom management and maintaining a positive and productive classroom environment is widely recognized as central to high-quality teaching (Bill & Melinda Gates Foundation, 2010). Yet, even the most experienced and effective teachers can encounter discipline problems.

Exhibit 8.23 presents teachers' reports about the extent to which their fourth grade classroom instruction in science was limited by disruptive or uninterested students. As good news, internationally, on average, teachers reported their instruction was rarely limited by either disruptive or bored students, with 87 to 89 percent of the fourth grade students in classrooms with some or no problems. However, the 11 to 13 percent of students in classrooms with a lot of student behavior problems did have lower average science achievement (from 16–26 points). Across the fourth grade, sixth grade, and benchmarking participants there was some variation in teachers' reports about disruptive and uninterested students. In general, however, teachers reported that their fourth grade students around the world appear relatively well behaved and attentive during their science lessons.

Exhibit 8.24 presents teachers' reports about the extent to which their eighth grade classroom instruction in science was limited by disruptive or uninterested students. Internationally, on average, teachers reported their instruction was limited "some or not at all" by disruptive students for 83 percent of the students and by bored students for 79 percent of the students. Although most of the eighth grade students were in science classrooms with attentive students, the 17 to 21 percent of students in classrooms with "a lot" of student behavior problems had lower average science achievement (from 19–26 points). Across the eighth grade, ninth grade, and benchmarking participants there was some variation in teachers' reports. Compared to the fourth grade, however, boredom appears to be an emerging problem in science classes at the eighth grade. It is difficult to know whether students are bored because they cannot do the science, or whether they just find science boring.

## Classroom Resources and Activities for Teaching Science

### *Resources Teachers Use for Teaching Science*

Exhibit 8.25 contains teachers' reports about the classroom materials used for teaching science at the fourth grade. On average, internationally, textbooks were used most often as the basis for science instruction, for 70 percent of the fourth grade students, and workbooks or worksheets were used the next most often, for 41 percent of the students. Science equipment and materials were used as the basis of instruction for 36 percent of the fourth grade students, and relying on computer software was relatively rare, used for only 11 percent of the students, on average. Teachers reported that all of the materials TIMSS asked about were used to some extent as supplementary resources for science instruction at the fourth grade, with science equipment and materials the most popular, used with 60 percent of the students, followed by workbooks or worksheets used with 56 percent of the students, on average. Teachers reported using computer software as a supplementary resource for 53 percent of the fourth grade students, on average.

As shown in Exhibit 8.26, textbooks also were the most frequent basis of science instruction at the eighth grade, used with 74 percent of the students internationally, on average. However, in contrast to the fourth grade, science equipment and materials were the next most frequently reported basis for instruction, used with 43 percent of the eighth grade students. Workbooks or worksheets were less frequently used than at the fourth grade (35% of students on average) but still heavily used in some countries. Computer software was more frequently reported as a basis for instruction than at the fourth grade, but was not used with many students—only 16 percent, on average. All of the following materials except textbooks were popular as supplementary instructional resources at the eighth grade: workbooks or worksheets, with 60 percent of students; science equipment and materials, with 54 percent; and computer software, with 61 percent.

**Exhibit 8.25: Resources Teachers Use for Teaching Science**

Reported by Teachers

Country	Percent of Students Whose Teachers Use											
	Textbooks		Workbooks or Worksheets		Science Equipment and Materials		Computer Software for Science Instruction					
	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement				
Armenia	r	97 (1.0)	2 (0.8)	r	6 (1.7)	58 (4.1)	r	8 (2.6)	73 (3.3)	r	3 (1.3)	41 (4.5)
Australia	r	12 (2.4)	34 (3.6)	r	16 (3.2)	76 (3.7)	r	53 (4.4)	46 (4.4)	r	7 (2.3)	59 (4.4)
Austria		46 (3.3)	45 (3.2)		33 (2.9)	66 (2.9)		17 (2.4)	81 (2.4)		2 (0.7)	52 (3.7)
Azerbaijan		95 (1.7)	5 (1.6)		34 (3.8)	65 (3.9)		17 (3.0)	78 (3.3)		7 (2.0)	33 (3.6)
Bahrain		82 (4.7)	18 (4.7)		51 (4.5)	48 (4.6)		59 (4.3)	39 (4.4)		28 (3.2)	64 (3.7)
Belgium (Flemish)		37 (3.9)	40 (4.0)		74 (3.6)	26 (3.7)		23 (3.4)	76 (3.4)		5 (1.8)	70 (3.6)
Chile	r	32 (4.2)	68 (4.1)	r	37 (4.1)	58 (4.4)	r	16 (3.2)	62 (4.5)	r	6 (2.2)	60 (4.6)
Chinese Taipei		96 (1.7)	4 (1.7)		44 (4.1)	56 (4.1)		48 (4.2)	52 (4.2)		28 (3.8)	69 (3.7)
Croatia		94 (1.3)	6 (1.3)		29 (3.4)	71 (3.4)		12 (2.4)	88 (2.4)		4 (1.0)	42 (3.3)
Czech Republic		81 (3.3)	17 (3.2)		45 (3.8)	52 (3.8)		24 (3.8)	75 (3.9)		4 (1.6)	63 (3.9)
Denmark	s	43 (4.2)	51 (4.2)	s	24 (3.8)	65 (4.1)	s	39 (3.7)	60 (3.7)	s	9 (2.7)	79 (3.5)
England	r	4 (1.0)	45 (5.0)	r	4 (1.6)	82 (3.5)	r	62 (4.9)	38 (4.9)	r	15 (3.5)	74 (3.6)
Finland		94 (1.8)	6 (1.5)		40 (3.0)	54 (3.3)		7 (1.9)	90 (2.4)		1 (0.6)	61 (3.1)
Georgia		99 (0.5)	0 (0.4)		54 (4.1)	46 (4.1)		4 (1.5)	77 (3.2)		2 (0.9)	45 (4.1)
Germany		28 (2.9)	48 (3.5)		58 (3.5)	41 (3.5)		23 (2.9)	75 (2.9)		1 (0.0)	40 (3.2)
Hong Kong SAR		95 (1.6)	3 (1.6)		46 (4.7)	54 (4.6)		19 (3.3)	80 (3.5)		36 (4.2)	59 (4.4)
Hungary		89 (2.6)	11 (2.6)		70 (3.3)	28 (3.4)		30 (3.4)	69 (3.5)		5 (1.5)	37 (3.6)
Iran, Islamic Rep. of		94 (1.9)	6 (1.9)		15 (3.3)	79 (3.5)		42 (3.5)	57 (3.5)		2 (0.6)	22 (3.8)
Ireland		38 (3.6)	50 (3.7)		12 (2.3)	85 (2.6)		55 (3.8)	45 (3.8)		8 (2.1)	63 (3.3)
Italy		70 (3.6)	28 (3.5)		23 (3.3)	76 (3.2)		9 (2.0)	74 (3.2)		3 (1.3)	35 (3.6)
Japan		82 (3.3)	17 (3.2)		17 (3.2)	76 (3.6)		62 (4.0)	38 (4.0)		2 (1.1)	52 (4.2)
Kazakhstan		87 (3.2)	11 (2.9)		13 (2.8)	86 (2.9)		21 (3.2)	75 (3.6)		10 (2.8)	72 (3.6)
Korea, Rep. of		96 (1.7)	3 (1.6)		86 (2.9)	13 (3.0)		50 (4.0)	50 (4.1)		36 (3.8)	55 (3.7)
Kuwait		93 (2.0)	5 (1.8)		77 (3.7)	23 (3.7)		91 (2.3)	9 (2.3)		28 (3.8)	66 (3.9)
Lithuania		92 (1.7)	8 (1.7)		70 (3.6)	30 (3.5)		12 (2.2)	84 (2.3)		10 (1.8)	67 (2.9)
Malta		34 (0.1)	18 (0.1)		34 (0.1)	58 (0.1)		54 (0.1)	39 (0.1)		28 (0.1)	54 (0.1)
Morocco	r	91 (2.1)	8 (1.9)	r	68 (3.4)	28 (3.4)	r	59 (5.0)	28 (4.4)	r	7 (2.0)	12 (2.6)
Netherlands	r	74 (4.2)	13 (3.0)	r	72 (4.4)	26 (4.3)	r	4 (1.8)	78 (5.0)	r	3 (1.0)	31 (5.5)
New Zealand		5 (1.4)	43 (3.0)		9 (1.8)	81 (2.4)		46 (3.3)	50 (3.1)		13 (2.2)	61 (3.4)
Northern Ireland	r	9 (2.4)	52 (4.6)	r	16 (3.0)	82 (3.2)	r	33 (4.8)	66 (4.8)	r	11 (2.8)	69 (4.1)
Norway		83 (3.7)	15 (3.5)		39 (5.2)	61 (5.2)		13 (2.7)	82 (3.3)		12 (3.1)	59 (5.0)
Oman		58 (3.1)	40 (3.0)		46 (3.1)	54 (3.1)		42 (2.9)	56 (2.9)		6 (1.2)	75 (2.7)
Poland		69 (3.8)	26 (3.5)		58 (3.8)	42 (3.9)		12 (2.6)	70 (3.2)		3 (1.3)	49 (4.1)
Portugal		62 (5.0)	38 (5.0)		34 (4.0)	64 (4.1)		35 (4.9)	60 (4.8)		4 (1.2)	64 (4.5)
Qatar		75 (2.9)	20 (3.1)		57 (2.9)	42 (3.1)		62 (3.2)	38 (3.2)		44 (4.7)	41 (5.1)
Romania		94 (1.7)	6 (1.7)		36 (4.1)	64 (4.2)		26 (3.1)	72 (3.0)		5 (1.8)	47 (3.8)
Russian Federation		94 (1.7)	6 (1.7)		48 (4.2)	51 (4.1)		9 (1.9)	88 (2.2)		3 (1.2)	56 (2.9)
Saudi Arabia		96 (1.6)	4 (1.5)		52 (4.0)	47 (3.9)		72 (3.9)	24 (3.7)		36 (4.0)	47 (4.5)
Serbia		77 (2.9)	23 (2.9)		16 (3.1)	82 (3.2)		15 (2.7)	79 (3.2)		3 (1.0)	20 (3.1)
Singapore		68 (2.7)	27 (2.5)		69 (2.6)	31 (2.6)		60 (2.5)	40 (2.5)		19 (2.0)	78 (2.3)
Slovak Republic		92 (1.8)	8 (1.8)		39 (3.0)	59 (3.2)		16 (2.4)	83 (2.5)		5 (1.5)	66 (3.0)
Slovenia		89 (2.4)	10 (2.2)		50 (3.8)	48 (3.9)		45 (3.8)	55 (3.8)		4 (1.3)	72 (3.4)
Spain		87 (2.5)	12 (2.5)		34 (3.7)	64 (3.7)		5 (1.9)	82 (3.2)		4 (1.8)	64 (3.2)
Sweden	r	36 (4.4)	55 (4.3)	r	19 (3.8)	68 (4.7)	r	44 (4.7)	53 (4.8)	r	3 (1.4)	30 (4.4)
Thailand		69 (4.4)	31 (4.4)		47 (4.5)	52 (4.5)		50 (4.4)	48 (4.5)		12 (3.2)	59 (4.3)
Tunisia		44 (5.0)	55 (4.9)		66 (3.8)	33 (3.6)		91 (2.5)	7 (2.1)		10 (2.3)	30 (4.4)
Turkey		93 (1.5)	6 (1.4)		43 (3.0)	56 (3.1)		33 (3.3)	65 (3.4)		19 (2.8)	56 (3.1)
United Arab Emirates		75 (2.0)	18 (2.1)		53 (2.4)	46 (2.4)		64 (2.0)	35 (2.0)		31 (2.1)	53 (2.3)
United States	r	46 (2.6)	40 (2.6)	r	23 (2.0)	71 (1.9)	r	46 (2.7)	53 (2.7)	r	8 (1.3)	56 (2.6)
Yemen		89 (2.7)	11 (2.7)		47 (4.7)	50 (4.7)		43 (4.8)	37 (4.5)		2 (1.2)	9 (2.1)
International Avg.		70 (0.4)	22 (0.4)		41 (0.5)	56 (0.5)		36 (0.5)	60 (0.5)		11 (0.3)	53 (0.5)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.  
An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

**Exhibit 8.25: Resources Teachers Use for Teaching Science (Continued)**

Country	Percent of Students Whose Teachers Use											
	Textbooks		Workbooks or Worksheets		Science Equipment and Materials		Computer Software for Science Instruction					
	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement				
<b>Sixth Grade Participants</b>												
Botswana	r	67 (4.7)	33 (4.7)	r	17 (3.8)	43 (4.9)	r	48 (4.7)	46 (4.9)	r	2 (1.1)	8 (2.4)
Honduras		93 (2.2)	6 (2.0)		35 (4.0)	61 (4.3)		14 (3.3)	48 (3.9)		3 (1.4)	24 (4.3)
Yemen		81 (3.7)	19 (3.7)		59 (3.5)	36 (3.6)		40 (4.4)	40 (3.9)		1 (0.6)	7 (1.8)
<b>Benchmarking Participants</b>												
Alberta, Canada	r	2 (1.1)	22 (3.1)	r	23 (3.1)	70 (3.6)	r	72 (3.3)	28 (3.3)	r	7 (2.0)	80 (3.6)
Ontario, Canada	r	33 (3.7)	54 (3.5)	r	28 (3.4)	69 (3.4)	r	36 (3.8)	61 (3.8)	r	7 (1.7)	51 (3.9)
Quebec, Canada		23 (3.7)	40 (4.5)		42 (4.3)	52 (4.5)		31 (4.0)	66 (4.2)		2 (1.2)	26 (3.4)
Abu Dhabi, UAE		70 (3.6)	16 (3.4)		63 (3.8)	36 (3.8)		68 (3.6)	31 (3.6)		34 (4.0)	52 (4.4)
Dubai, UAE	r	57 (3.7)	36 (3.8)	r	28 (1.8)	71 (1.9)	r	56 (2.6)	44 (2.6)	r	25 (2.4)	61 (2.3)
Florida, US	s	64 (5.5)	34 (5.3)	s	24 (4.8)	68 (5.4)	s	32 (6.3)	62 (6.1)	s	24 (5.6)	53 (5.5)
North Carolina, US	r	26 (6.2)	45 (6.2)	r	8 (3.5)	79 (5.2)	r	62 (7.4)	34 (6.9)	r	14 (4.3)	62 (6.2)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 8.26: Resources Teachers Use for Teaching Science**

Reported by Teachers

Country	Percent of Students Whose Teachers Use							
	Textbooks		Workbooks or Worksheets		Science Equipment and Materials		Computer Software for Science Instruction	
	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement
Armenia	96 (0.8)	4 (0.8)	29 (2.3)	67 (2.5)	16 (1.8)	78 (2.0)	5 (0.9)	75 (2.2)
Australia	s 45 (3.5)	51 (3.3)	s 34 (2.9)	65 (2.9)	s 47 (4.3)	53 (4.3)	s 12 (2.3)	77 (2.7)
Bahrain	86 (2.3)	14 (2.3)	49 (3.1)	51 (3.1)	47 (2.9)	50 (3.1)	28 (2.8)	70 (3.0)
Chile	44 (4.3)	56 (4.3)	28 (3.4)	62 (4.0)	25 (3.4)	65 (4.1)	13 (2.7)	67 (3.9)
Chinese Taipei	92 (1.9)	7 (1.7)	31 (4.1)	66 (4.0)	13 (2.4)	86 (2.5)	9 (2.1)	69 (3.6)
England	r 8 (1.9)	78 (2.7)	r 21 (3.0)	76 (3.2)	r 62 (3.7)	37 (3.7)	r 29 (3.2)	67 (3.2)
Finland	78 (2.0)	22 (2.0)	26 (2.0)	67 (2.3)	38 (2.1)	62 (2.2)	3 (0.6)	64 (2.1)
Georgia	96 (0.9)	4 (0.9)	55 (2.7)	44 (2.8)	15 (1.7)	77 (1.5)	3 (0.8)	66 (2.6)
Ghana	60 (3.3)	39 (3.4)	18 (3.1)	60 (3.6)	34 (3.8)	50 (3.9)	1 (0.7)	16 (3.3)
Hong Kong SAR	87 (3.4)	12 (3.2)	42 (4.2)	58 (4.2)	56 (4.2)	44 (4.2)	32 (4.4)	62 (4.8)
Hungary	87 (1.4)	13 (1.4)	47 (2.2)	43 (2.2)	44 (2.2)	55 (2.1)	7 (1.0)	55 (2.5)
Indonesia	97 (1.2)	3 (1.2)	22 (3.7)	78 (3.7)	52 (4.1)	47 (4.0)	4 (1.5)	59 (4.0)
Iran, Islamic Rep. of	93 (1.9)	7 (1.9)	7 (1.6)	76 (2.6)	37 (3.9)	60 (3.7)	7 (1.7)	34 (3.3)
Israel	75 (2.9)	20 (2.5)	63 (3.9)	35 (3.8)	68 (3.6)	29 (3.3)	27 (3.3)	53 (3.7)
Italy	79 (3.1)	20 (3.1)	20 (2.9)	75 (3.1)	10 (2.3)	73 (3.6)	4 (1.5)	47 (3.9)
Japan	71 (3.9)	29 (3.9)	30 (4.1)	69 (4.0)	65 (4.2)	35 (4.2)	3 (1.5)	49 (4.1)
Jordan	92 (2.1)	8 (2.1)	36 (3.6)	63 (3.6)	42 (3.2)	55 (3.3)	11 (2.3)	66 (3.4)
Kazakhstan	80 (2.0)	19 (2.0)	17 (1.6)	80 (1.7)	37 (2.4)	62 (2.4)	24 (2.2)	73 (2.2)
Korea, Rep. of	88 (2.5)	12 (2.5)	34 (3.8)	59 (4.1)	41 (3.8)	57 (3.8)	50 (3.8)	46 (3.9)
Lebanon	73 (3.0)	26 (3.0)	56 (3.5)	41 (3.5)	46 (3.6)	49 (3.6)	13 (2.2)	47 (3.2)
Lithuania	92 (1.4)	8 (1.4)	40 (1.9)	52 (2.2)	23 (1.6)	73 (1.9)	13 (1.5)	74 (1.7)
Macedonia, Rep. of	r 82 (2.1)	17 (2.0)	r 16 (1.8)	65 (2.7)	r 26 (2.1)	69 (2.2)	r 20 (2.0)	67 (2.3)
Malaysia	83 (2.5)	16 (2.3)	39 (3.8)	61 (3.8)	40 (3.4)	59 (3.4)	33 (3.8)	59 (3.8)
Morocco	35 (2.2)	64 (2.2)	50 (2.2)	43 (2.3)	81 (2.0)	15 (2.0)	14 (1.6)	46 (2.5)
New Zealand	16 (2.9)	77 (2.9)	23 (3.3)	74 (3.5)	48 (3.9)	52 (3.9)	14 (2.8)	70 (3.5)
Norway	92 (2.5)	8 (2.4)	25 (3.8)	73 (4.0)	33 (4.1)	66 (4.1)	4 (1.7)	79 (3.5)
Oman	67 (3.1)	33 (3.1)	33 (3.3)	65 (3.3)	43 (3.3)	57 (3.4)	11 (1.8)	77 (2.6)
Palestinian Nat'l Auth.	89 (2.5)	11 (2.5)	35 (3.8)	65 (3.8)	59 (3.9)	40 (3.9)	8 (2.4)	70 (3.4)
Qatar	59 (3.2)	39 (3.0)	61 (3.2)	37 (3.0)	60 (3.3)	38 (3.1)	45 (4.2)	47 (4.6)
Romania	85 (1.8)	15 (1.8)	53 (2.4)	45 (2.4)	50 (2.5)	47 (2.4)	16 (1.8)	63 (2.5)
Russian Federation	82 (1.4)	18 (1.4)	18 (1.4)	73 (1.6)	31 (1.6)	67 (1.7)	13 (0.9)	75 (1.5)
Saudi Arabia	91 (2.5)	7 (2.0)	46 (4.3)	50 (4.1)	65 (4.0)	30 (3.8)	42 (4.2)	45 (4.5)
Singapore	52 (2.3)	39 (2.5)	66 (2.7)	34 (2.7)	32 (2.8)	67 (2.8)	23 (2.4)	69 (2.4)
Slovenia	84 (1.5)	15 (1.6)	38 (2.2)	55 (2.3)	26 (1.8)	69 (1.8)	20 (2.0)	74 (2.0)
Sweden	r 76 (3.0)	23 (3.0)	r 14 (2.5)	77 (3.0)	r 63 (3.3)	37 (3.3)	r 1 (0.6)	47 (3.8)
Syrian Arab Republic	88 (2.4)	12 (2.3)	39 (4.2)	54 (4.1)	r 59 (3.3)	39 (3.1)	21 (3.5)	35 (4.1)
Thailand	72 (3.4)	27 (3.5)	47 (4.2)	53 (4.2)	37 (3.9)	63 (3.9)	10 (2.7)	74 (3.9)
Tunisia	54 (3.6)	44 (3.6)	53 (3.8)	44 (3.7)	83 (2.6)	13 (2.4)	7 (2.0)	45 (3.8)
Turkey	89 (2.0)	11 (2.0)	44 (3.3)	56 (3.3)	35 (3.2)	62 (3.4)	17 (2.8)	72 (3.1)
Ukraine	85 (1.8)	15 (1.8)	17 (1.7)	80 (1.8)	29 (2.4)	67 (2.5)	4 (0.9)	65 (3.2)
United Arab Emirates	80 (1.7)	17 (1.7)	51 (2.1)	47 (2.1)	58 (2.4)	41 (2.4)	30 (2.3)	59 (2.4)
United States	s 36 (3.2)	60 (3.1)	s 12 (2.1)	82 (2.3)	s 48 (3.0)	52 (3.0)	s 19 (2.3)	67 (2.4)
International Avg.	74 (0.4)	24 (0.4)	35 (0.5)	60 (0.5)	43 (0.5)	54 (0.5)	16 (0.4)	61 (0.5)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.  
 An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.  
 An "x" indicates data are available for less than 50% of students.

**Exhibit 8.26: Resources Teachers Use for Teaching Science (Continued)**

Country	Percent of Students Whose Teachers Use							
	Textbooks		Workbooks or Worksheets		Science Equipment and Materials		Computer Software for Science Instruction	
	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement	As Basis for Instruction	As a Supplement
<b>Ninth Grade Participants</b>								
Botswana	43 (4.5)	57 (4.4)	34 (4.0)	46 (4.1)	73 (4.0)	25 (3.9)	1 (1.0)	35 (4.2)
Honduras	68 (4.1)	28 (3.8)	29 (4.4)	60 (5.2)	25 (4.5)	65 (5.1)	1 (0.6)	22 (3.3)
South Africa	66 (3.6)	28 (3.2)	39 (3.8)	52 (3.7)	20 (3.0)	69 (3.6)	3 (1.0)	17 (2.9)
<b>Benchmarking Participants</b>								
Alberta, Canada	47 (3.9)	50 (3.9)	20 (3.0)	75 (3.4)	41 (3.8)	58 (3.9)	24 (3.4)	60 (3.7)
Ontario, Canada	r 54 (4.2)	44 (4.1)	r 15 (3.0)	78 (3.3)	r 34 (3.5)	66 (3.5)	r 5 (1.9)	69 (4.1)
Quebec, Canada	41 (4.4)	55 (4.6)	44 (4.3)	53 (4.4)	46 (4.2)	53 (4.2)	6 (1.9)	40 (4.1)
Abu Dhabi, UAE	70 (3.5)	26 (3.7)	58 (3.5)	39 (3.6)	59 (3.6)	39 (3.7)	31 (3.9)	57 (4.4)
Dubai, UAE	r 74 (2.4)	21 (2.3)	r 35 (2.4)	63 (2.4)	r 53 (4.6)	47 (4.6)	r 34 (4.6)	61 (4.6)
Alabama, US	s 34 (6.2)	62 (6.4)	s 7 (3.1)	90 (3.2)	s 50 (7.9)	50 (7.9)	s 17 (5.1)	77 (6.1)
California, US	s 53 (5.8)	46 (5.8)	s 22 (4.0)	73 (4.6)	s 36 (5.4)	64 (5.4)	s 18 (4.2)	65 (4.9)
Colorado, US	s 30 (7.4)	64 (6.5)	s 6 (3.4)	89 (4.1)	s 63 (6.7)	37 (6.7)	s 7 (3.1)	82 (3.6)
Connecticut, US	s 24 (4.9)	72 (5.1)	s 13 (4.1)	85 (4.5)	s 52 (6.3)	47 (6.4)	s 20 (5.6)	65 (6.0)
Florida, US	x x	x x	x x	x x	x x	x x	x x	x x
Indiana, US	s 37 (6.3)	60 (6.1)	s 14 (5.2)	82 (6.3)	s 40 (5.7)	60 (5.7)	s 8 (3.0)	77 (5.5)
Massachusetts, US	s 39 (7.8)	57 (7.6)	s 13 (4.6)	85 (4.8)	s 62 (7.2)	38 (7.2)	s 11 (3.6)	69 (6.6)
Minnesota, US	r 34 (6.5)	63 (7.1)	r 19 (5.7)	76 (5.9)	r 60 (6.5)	40 (6.5)	r 21 (5.7)	71 (6.7)
North Carolina, US	s 34 (8.0)	60 (8.4)	s 21 (7.3)	74 (7.5)	s 38 (6.9)	62 (6.9)	s 22 (5.1)	68 (7.3)

### *Teacher Emphasis on Science Investigation*

As noted in the TIMSS 2011 Science Assessment Framework, one of the ways in which students have been encouraged to build upon their knowledge and understanding of science is through the process of scientific inquiry, and, as documented in the *TIMSS 2011 Encyclopedia*, the contemporary science curricula of many countries place considerable emphasis on engaging students in this process. For example, the most recent recommendations for effective instructional practices of the US National Research Council include an emphasis on inquiry activities (National Research Council, 2011). A recent meta-analysis across 138 studies indicated that using some level of inquiry-based instruction had a positive relationship with student understanding and retention of science content. In particular, instruction emphasizing active thinking and drawing conclusions from data or providing hands-on experience with scientific phenomena were associated with increased likelihood of scientific understanding (Minner, Levy, & Century, 2009).

Previous TIMSS studies have presented teachers' reports about the frequency with which they engaged in a range of inquiry-related activities. TIMSS 2011 takes this approach further, using IRT scales to summarize teacher reports at the fourth and eighth grades. The Emphasize Science Investigation scale at the fourth grade is based on teacher reports of how often, in teaching science, teachers ask students to engage in the following six activities:

- ◆ Observe natural phenomena such as the weather or a plant growing and describe what they see;
- ◆ Watch me (the teacher) demonstrate an experiment or investigation;
- ◆ Design or plan experiments or investigations;
- ◆ Conduct experiments or investigations;
- ◆ Give explanations about something they are studying; and
- ◆ Relate what they are learning in science to their daily lives.

Exhibit 8.27 presents the results for the fourth grade assessment. Students were categorized according to their teachers' responses, with **About Half the Lessons or More** corresponding to teachers who used all six activities in "about half the lessons," on average. All other students had teachers who emphasized science investigation in **Less than Half the Lessons**. As shown in the exhibit, teachers of science at the fourth grade vary widely across countries in their use of inquiry activities, with the percentage of students taught by teachers emphasizing science investigation in **About Half the Lessons or More** ranging from 4 percent in Norway to 80 to 86 percent in Iran and Tunisia. On average across the fourth grade countries, 40 percent of students were taught by teachers emphasizing science investigation in half of the lessons or more, and 60 percent had teachers emphasizing investigation less frequently. This pattern was similar among the sixth grade and benchmarking participants. There was no relationship between emphasis on science investigation and average science achievement.

Exhibit 8.28 presents the results for the eighth grade on the Emphasize Science Investigation scale, which includes the six instructional activities from the fourth grade scale and one additional activity more suited to eighth grade students: "Use scientific formulas and laws to solve routine problems." Compared to the fourth grade, there was greater use of investigation in science instruction, with almost half of the students (48%) taught by teachers emphasizing investigation in **About Half the Lessons or More**. Although on average across countries, science achievement was somewhat higher among students whose teachers more frequently emphasize inquiry activities (479 vs. 474), both the frequency of inquiry activity use and its relationship with science achievement varied considerably across the eighth grade, ninth grade, and benchmarking participants.

Reported by Teachers

Students were scored according to their teachers' responses to how often they used each of six instructional activities on the *Emphasize Science Investigation* scale. Students with teachers who emphasized science investigation in **About Half the Lessons or More** had a score on the scale of at least 10.7, which corresponds to their teachers using all six activities in "about half the lessons," on average. All other students had teachers who emphasized science investigation in **Less than Half the Lessons**.

Country	About Half the Lessons or More		Less than Half the Lessons		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Tunisia	86 (2.8)	349 (5.9)	14 (2.8)	323 (11.2)	12.1 (0.17)
Iran, Islamic Rep. of	80 (2.6)	452 (4.7)	20 (2.6)	455 (8.9)	11.9 (0.13)
United Arab Emirates	75 (2.0)	426 (3.2)	25 (2.0)	442 (6.1)	11.5 (0.10)
Oman	75 (3.1)	384 (4.3)	25 (3.1)	361 (8.3)	11.4 (0.10)
Thailand	74 (4.2)	482 (5.4)	26 (4.2)	441 (13.6)	11.3 (0.17)
Bahrain	74 (4.2)	454 (4.5)	26 (4.2)	436 (9.3)	11.3 (0.19)
Kuwait	73 (3.6)	349 (5.9)	27 (3.6)	341 (8.1)	11.2 (0.14)
Saudi Arabia	70 (4.0)	434 (5.7)	30 (4.0)	419 (11.5)	11.2 (0.17)
Romania	65 (3.6)	508 (6.4)	35 (3.6)	497 (10.1)	11.0 (0.13)
Qatar	63 (3.6)	394 (8.0)	37 (3.6)	391 (11.3)	10.9 (0.12)
Korea, Rep. of	58 (4.8)	588 (2.7)	42 (4.8)	585 (2.9)	10.7 (0.16)
Morocco	57 (4.8)	265 (7.2)	43 (4.8)	256 (7.7)	10.8 (0.21)
Turkey	55 (3.6)	472 (5.6)	45 (3.6)	451 (7.4)	10.6 (0.15)
Chinese Taipei	54 (3.9)	557 (2.9)	46 (3.9)	546 (3.3)	10.4 (0.17)
Japan	51 (4.2)	558 (2.3)	49 (4.2)	559 (3.0)	10.4 (0.16)
Azerbaijan	51 (4.0)	434 (7.2)	49 (4.0)	442 (9.3)	10.4 (0.10)
Singapore	50 (2.6)	585 (4.6)	50 (2.6)	582 (4.9)	10.4 (0.11)
Italy	49 (3.2)	523 (4.1)	51 (3.2)	528 (3.5)	10.5 (0.11)
Kazakhstan	47 (3.9)	498 (6.9)	53 (3.9)	493 (7.6)	10.4 (0.11)
Chile	45 (4.2)	478 (5.2)	55 (4.2)	484 (4.4)	10.4 (0.15)
Serbia	45 (3.8)	518 (3.8)	55 (3.8)	514 (4.7)	10.5 (0.12)
Ireland	43 (3.6)	519 (4.5)	57 (3.6)	513 (4.4)	10.0 (0.13)
Georgia	43 (3.7)	455 (5.7)	57 (3.7)	455 (5.2)	10.2 (0.08)
United States	41 (2.9)	548 (3.3)	59 (2.9)	541 (3.2)	9.9 (0.10)
England	41 (4.7)	535 (7.5)	59 (4.7)	524 (4.4)	10.0 (0.15)
Armenia	36 (4.5)	409 (6.5)	64 (4.5)	420 (5.1)	10.0 (0.13)
Portugal	34 (4.1)	525 (7.2)	66 (4.1)	520 (4.1)	9.8 (0.22)
Australia	34 (4.0)	535 (5.9)	66 (4.0)	511 (4.7)	9.1 (0.21)
Slovenia	33 (3.2)	517 (3.5)	67 (3.2)	522 (3.6)	9.8 (0.11)
Yemen	32 (4.6)	210 (10.2)	68 (4.6)	206 (9.2)	9.6 (0.17)
Russian Federation	32 (3.3)	554 (5.1)	68 (3.3)	551 (4.4)	10.0 (0.09)
Slovak Republic	29 (3.3)	534 (6.6)	71 (3.3)	530 (4.1)	9.8 (0.10)
Lithuania	27 (3.4)	518 (5.2)	73 (3.4)	513 (2.9)	9.9 (0.10)
Denmark	26 (4.0)	536 (4.9)	74 (4.0)	527 (3.8)	9.1 (0.15)
Malta	25 (0.1)	446 (3.3)	75 (0.1)	447 (1.9)	9.5 (0.00)
Sweden	24 (4.1)	535 (6.3)	76 (4.1)	535 (3.7)	9.0 (0.19)
Spain	23 (3.5)	512 (6.0)	77 (3.5)	504 (3.4)	9.8 (0.10)
Hungary	22 (3.1)	527 (7.9)	78 (3.1)	535 (4.3)	9.5 (0.12)
Croatia	21 (2.7)	513 (4.7)	79 (2.7)	517 (2.3)	9.9 (0.08)
Czech Republic	20 (3.3)	538 (4.7)	80 (3.3)	536 (2.9)	9.4 (0.10)
New Zealand	20 (2.4)	498 (6.5)	80 (2.4)	499 (2.4)	8.6 (0.13)
Finland	13 (2.3)	580 (4.9)	87 (2.3)	570 (2.7)	9.1 (0.10)
Northern Ireland	13 (3.1)	510 (12.2)	87 (3.1)	518 (4.0)	8.0 (0.16)
Germany	12 (2.5)	520 (7.2)	88 (2.5)	531 (2.9)	8.8 (0.11)
Hong Kong SAR	12 (3.0)	536 (9.3)	88 (3.0)	535 (4.4)	8.7 (0.12)
Poland	11 (2.3)	494 (9.1)	89 (2.3)	506 (2.5)	8.7 (0.13)
Austria	8 (1.8)	534 (8.1)	92 (1.8)	531 (3.0)	8.2 (0.10)
Belgium (Flemish)	7 (1.6)	518 (8.9)	93 (1.6)	508 (2.0)	8.6 (0.10)
Netherlands	5 (2.2)	542 (9.2)	95 (2.2)	530 (2.4)	8.3 (0.14)
Norway	4 (1.6)	493 (9.2)	96 (1.6)	494 (2.5)	7.5 (0.15)
International Avg.	40 (0.5)	488 (0.9)	60 (0.5)	484 (0.9)	

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

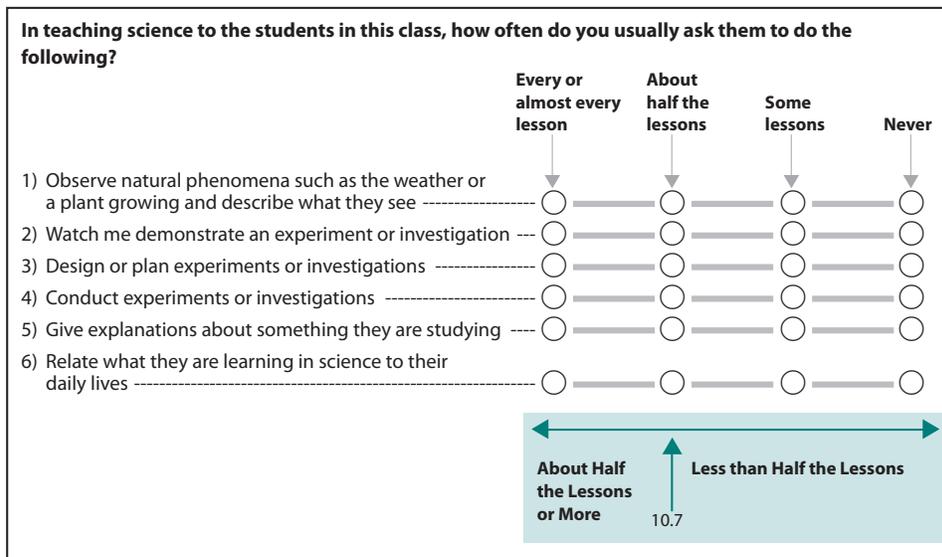
An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 8.27: Teachers Emphasize Science Investigation (Continued)**

Country	About Half the Lessons or More		Less than Half the Lessons		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Sixth Grade Participants</b>					
Botswana	48 (4.6)	377 (10.8)	52 (4.6)	371 (7.8)	10.6 (0.19)
Honduras	45 (4.4)	442 (7.4)	55 (4.4)	421 (9.9)	10.4 (0.14)
Yemen	29 (4.3)	354 (12.0)	71 (4.3)	341 (8.8)	9.7 (0.15)
<b>Benchmarking Participants</b>					
Abu Dhabi, UAE	78 (3.9)	413 (5.2)	22 (3.9)	415 (14.2)	11.6 (0.17)
Dubai, UAE	r 73 (2.0)	454 (4.2)	27 (2.0)	494 (6.6)	11.4 (0.10)
Alberta, Canada	r 48 (4.5)	545 (4.4)	52 (4.5)	539 (4.4)	10.0 (0.14)
North Carolina, US	r 44 (6.2)	534 (7.0)	56 (6.2)	537 (5.4)	9.9 (0.23)
Florida, US	s 42 (5.6)	546 (7.1)	58 (5.6)	542 (5.7)	10.0 (0.24)
Quebec, Canada	36 (4.6)	522 (3.8)	64 (4.6)	513 (3.0)	9.7 (0.18)
Ontario, Canada	32 (3.7)	527 (5.2)	68 (3.7)	527 (3.4)	9.4 (0.12)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



Reported by Teachers

Students were scored according to their teachers' responses to how often they used each of seven instructional activities on the *Emphasize Science Investigation* scale. Students with teachers who emphasized science investigation in **About Half the Lessons or More** had a score on the scale of at least 10.2, which corresponds to their teachers using all seven activities in "about half the lessons," on average. All other students had teachers who emphasized science investigation in **Less than Half the Lessons**.

Country	About Half the Lessons or More		Less than Half the Lessons		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Jordan	82 (2.9)	453 (4.9)	18 (2.9)	436 (10.5)	11.3 (0.14)
Tunisia	74 (3.6)	440 (3.0)	26 (3.6)	433 (4.6)	11.1 (0.16)
Palestinian Nat'l Auth.	72 (3.7)	429 (4.2)	28 (3.7)	403 (6.4)	11.3 (0.18)
Oman	71 (3.2)	425 (4.3)	29 (3.2)	406 (9.5)	11.0 (0.12)
Lebanon	70 (2.5)	405 (5.6)	30 (2.5)	405 (7.6)	11.0 (0.12)
Qatar	69 (3.3)	423 (6.4)	31 (3.3)	410 (13.5)	10.9 (0.18)
Saudi Arabia	67 (3.7)	438 (4.8)	33 (3.7)	434 (6.0)	10.7 (0.16)
Thailand	67 (4.2)	449 (5.0)	33 (4.2)	453 (9.0)	10.7 (0.16)
Ghana	67 (4.2)	310 (7.2)	33 (4.2)	299 (8.9)	11.1 (0.22)
Romania	65 (2.2)	466 (3.9)	35 (2.2)	462 (4.8)	10.8 (0.10)
Iran, Islamic Rep. of	65 (3.3)	479 (4.8)	35 (3.3)	465 (6.3)	10.7 (0.11)
Morocco	64 (2.3)	380 (2.8)	36 (2.3)	370 (3.4)	10.8 (0.08)
United Arab Emirates	62 (2.5)	458 (3.3)	38 (2.5)	468 (4.7)	10.7 (0.12)
Syrian Arab Republic	59 (3.7)	424 (5.0)	41 (3.7)	430 (5.9)	10.3 (0.12)
Turkey	59 (3.6)	482 (5.4)	41 (3.6)	483 (5.9)	10.5 (0.13)
Kazakhstan	58 (2.4)	492 (5.3)	42 (2.4)	489 (5.1)	10.5 (0.09)
Indonesia	54 (3.6)	405 (7.0)	46 (3.6)	406 (5.3)	10.3 (0.12)
Malaysia	53 (3.8)	433 (7.4)	47 (3.8)	417 (9.6)	10.2 (0.14)
Bahrain	52 (2.7)	462 (3.6)	48 (2.7)	444 (3.1)	10.4 (0.09)
Ukraine	52 (2.7)	503 (3.8)	48 (2.7)	498 (4.1)	10.1 (0.07)
Macedonia, Rep. of	r 51 (2.2)	419 (6.2)	49 (2.2)	407 (6.5)	10.3 (0.11)
United States	s 47 (2.4)	537 (5.2)	53 (2.4)	524 (4.2)	9.7 (0.10)
Chile	47 (4.1)	462 (3.8)	53 (4.1)	459 (4.4)	10.0 (0.14)
Georgia	47 (2.2)	420 (3.8)	53 (2.2)	420 (3.3)	10.1 (0.08)
Israel	38 (3.4)	505 (7.4)	62 (3.4)	526 (5.4)	9.5 (0.15)
Russian Federation	38 (2.1)	548 (3.1)	62 (2.1)	539 (3.7)	9.7 (0.07)
England	r 37 (2.9)	544 (9.1)	63 (2.9)	525 (6.4)	9.4 (0.12)
Armenia	36 (2.4)	443 (4.8)	64 (2.4)	435 (3.6)	9.7 (0.06)
Hong Kong SAR	36 (4.0)	553 (6.1)	64 (4.0)	526 (5.1)	9.4 (0.16)
Korea, Rep. of	35 (3.8)	565 (3.3)	65 (3.8)	557 (2.4)	9.6 (0.10)
New Zealand	35 (3.6)	510 (7.1)	65 (3.6)	513 (6.3)	9.3 (0.11)
Australia	s 34 (3.2)	523 (10.6)	66 (3.2)	528 (6.0)	9.2 (0.14)
Finland	32 (2.0)	558 (2.9)	68 (2.0)	549 (2.6)	9.3 (0.09)
Japan	32 (4.3)	559 (4.2)	68 (4.3)	557 (3.0)	9.3 (0.16)
Italy	29 (3.1)	502 (4.7)	71 (3.1)	502 (3.4)	9.4 (0.11)
Singapore	29 (2.7)	595 (9.2)	71 (2.7)	588 (5.2)	9.1 (0.09)
Hungary	28 (2.1)	523 (3.7)	72 (2.1)	522 (3.3)	9.2 (0.07)
Sweden	r 26 (3.3)	508 (6.6)	74 (3.3)	512 (3.0)	8.8 (0.13)
Lithuania	24 (1.7)	512 (4.1)	76 (1.7)	515 (2.7)	9.3 (0.05)
Chinese Taipei	21 (3.4)	552 (6.4)	79 (3.4)	567 (2.8)	8.6 (0.17)
Slovenia	20 (1.4)	545 (3.1)	80 (1.4)	542 (2.9)	8.7 (0.06)
Norway	5 (1.9)	468 (18.1)	95 (1.9)	495 (2.5)	7.5 (0.16)
International Avg.	48 (0.5)	479 (0.9)	52 (0.5)	474 (0.9)	

Centerpoint of scale set at 10.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

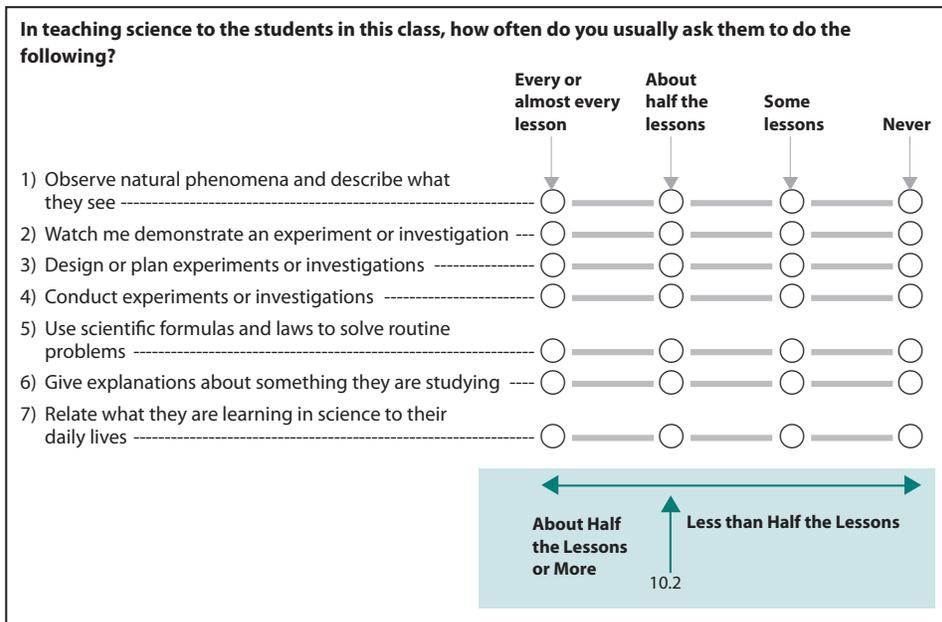
An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students. An "x" indicates data are available for less than 50% of students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 8.28: Teachers Emphasize Science Investigation (Continued)**

Country	About Half the Lessons or More		Less than Half the Lessons		Average Scale Score
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
<b>Ninth Grade Participants</b>					
Honduras	53 (4.5)	375 (6.9)	47 (4.5)	363 (6.0)	10.3 (0.17)
Botswana	52 (4.3)	405 (5.6)	48 (4.3)	403 (5.7)	10.3 (0.17)
South Africa	38 (3.8)	316 (7.9)	62 (3.8)	339 (6.2)	9.8 (0.16)
<b>Benchmarking Participants</b>					
Abu Dhabi, UAE	62 (4.2)	459 (5.4)	38 (4.2)	465 (7.0)	10.4 (0.17)
Alabama, US	s 61 (6.4)	483 (10.8)	39 (6.4)	488 (9.5)	10.5 (0.30)
Dubai, UAE	r 60 (5.1)	474 (5.5)	40 (5.1)	490 (6.9)	10.8 (0.27)
Colorado, US	s 55 (5.5)	546 (8.7)	45 (5.5)	541 (9.0)	9.9 (0.19)
North Carolina, US	s 47 (8.1)	516 (17.3)	53 (8.1)	536 (13.3)	9.6 (0.23)
Indiana, US	s 43 (6.5)	531 (6.7)	57 (6.5)	532 (5.7)	9.6 (0.19)
California, US	s 40 (6.1)	508 (11.1)	60 (6.1)	503 (8.3)	9.3 (0.25)
Connecticut, US	s 38 (5.8)	540 (11.5)	62 (5.8)	535 (9.0)	9.5 (0.22)
Minnesota, US	r 37 (7.2)	558 (16.4)	63 (7.2)	550 (5.1)	9.4 (0.22)
Massachusetts, US	s 34 (6.2)	588 (11.6)	66 (6.2)	552 (8.2)	8.9 (0.30)
Alberta, Canada	29 (3.8)	548 (4.3)	71 (3.8)	545 (2.7)	9.2 (0.13)
Quebec, Canada	27 (3.4)	518 (5.4)	73 (3.4)	521 (3.6)	9.2 (0.12)
Ontario, Canada	r 22 (3.6)	520 (5.3)	78 (3.6)	521 (3.4)	8.8 (0.12)
Florida, US	x x	x x	x x	x x	x x

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011



### *Computer Activities During Science Lessons*

According to the *TIMSS 2011 Encyclopedia*, countries are investing in technology as a way to enhance teaching and learning. Availability of computers and other technology in the science classroom can facilitate successful implementation of the curriculum. For example, as described in the Contextual Framework chapter of the *TIMSS 2011 Assessment Frameworks*, computers and the Internet provide students ways to explore concepts in-depth, trigger enthusiasm and motivation for learning, enable students to learn at their own pace, and provide students with access to vast information sources.

Besides giving students access to the Internet, computers can serve a number of other educational purposes. While initially limited to learning drills and practice, they are now used in a variety of ways including tutorials, simulations, games, and applications. New software enables students to pose their own problems and explore and discover mathematics and scientific properties on their own. Computer software for modeling and visualization of ideas can open a whole new world to students and help them connect these ideas to their language and symbol systems. A recent study summarizing 25 meta-analyses determined that computer use in the classroom has a significant positive effect on achievement at all grade levels and in all subjects (Tamim, Bernard, Borokhovski, Abrami, & Schmidt, 2011).

Exhibit 8.29 contains teachers' reports about the prevalence and types of computer-based activities used as part of science instruction at fourth grade. The range of computer availability across countries was very large, from 7 percent of the students in Iran to 85 percent in New Zealand. Internationally, on average, less than half (47%) of the fourth grade students had computers available during their science lessons. Average science achievement was equivalent between those fourth grade students with computers available and those without computers available.

Teachers reported that 24 to 25 percent of the fourth grade students, on average, were asked to use a computer at least monthly to do scientific procedures or experiments or to study natural phenomena through simulations. Somewhat larger percentages were asked to use a computer at least monthly to look up ideas and information (41%) and to practice skills and procedures (31%). The range in computer availability across the benchmarking participants reflected the fourth grade results across countries. However, the students participating at the sixth grade had less access to computers for science instruction than did the fourth grade TIMSS students, on average.

At the eighth grade, reports about computer availability and use were similar to those at the fourth grade (see Exhibit 8.30). Internationally, on average, less than half (46%) of the eighth grade students had computers available during their science lessons, ranging from 12 percent in Ghana to 84 percent in Kazakhstan. Students with computers available during their lessons had slightly higher science achievement than students without computers available. Approximately one-third (28–39%) of the eighth grade students, on average, were asked to do the following on at least a monthly basis: look up ideas and information, do scientific procedures or experiments, study natural phenomena through simulations, process and analyze data, and practice skills and procedures. As would be anticipated, computer use in science lessons varied considerably across countries at the eighth grade, as well as for the benchmarking participants. Countries participating at the ninth grade had less computer availability, including South Africa, Botswana, and Honduras.

**Exhibit 8.29: Computer Activities During Science Lessons**
*Reported by Teachers*

Country	Computers Available for Science Lessons			Percent of Students Whose Teachers Have Them Use Computers At Least Monthly			
	Percent of Students	Average Achievement		To Look Up Ideas and Information	To Do Scientific Procedures or Experiments	To Study Natural Phenomena Through Simulations	To Practice Skills and Procedures
	Yes	Yes	No				
New Zealand	85 (2.3)	497 (2.8)	505 (5.5)	79 (2.5)	42 (3.3)	47 (2.9)	40 (3.3)
Belgium (Flemish)	84 (2.9)	510 (2.1)	502 (6.4)	78 (3.3)	21 (3.3)	26 (3.4)	56 (3.8)
Denmark	r 81 (2.6)	530 (3.3)	526 (7.5)	s 71 (3.4)	s 25 (3.7)	s 37 (4.5)	s 45 (3.9)
Northern Ireland	r 78 (3.5)	519 (3.6)	511 (6.3)	r 73 (3.9)	r 47 (4.0)	r 42 (4.3)	r 53 (4.4)
Australia	r 77 (3.4)	520 (4.5)	519 (6.0)	r 72 (3.8)	r 42 (3.4)	s 48 (4.2)	r 38 (3.5)
Malta	74 (0.1)	438 (2.2)	471 (2.7)	65 (0.1)	50 (0.1)	39 (0.1)	59 (0.1)
Japan	74 (3.7)	558 (2.2)	562 (3.5)	40 (4.2)	15 (3.1)	35 (4.3)	18 (3.1)
England	74 (4.3)	531 (3.8)	519 (9.3)	68 (5.0)	40 (4.8)	51 (5.1)	43 (4.8)
Austria	73 (3.4)	533 (2.8)	527 (6.0)	60 (3.5)	20 (2.6)	20 (2.8)	32 (3.3)
Norway	72 (3.9)	494 (2.9)	495 (3.4)	61 (4.6)	22 (3.9)	22 (3.6)	38 (4.4)
Sweden	r 68 (4.7)	538 (3.2)	528 (6.5)	r 49 (4.6)	r 11 (3.1)	r 10 (2.5)	r 21 (3.5)
Kazakhstan	67 (3.6)	484 (6.3)	513 (9.6)	62 (3.7)	58 (3.5)	52 (3.7)	64 (3.5)
Finland	66 (3.1)	572 (2.9)	570 (3.2)	59 (3.7)	17 (2.7)	15 (2.2)	42 (3.5)
United States	r 65 (2.6)	544 (2.8)	544 (3.7)	r 51 (2.5)	r 31 (2.1)	r 34 (2.0)	r 34 (2.3)
Netherlands	r 64 (4.7)	527 (3.3)	534 (3.9)	r 58 (5.0)	r 13 (3.4)	r 16 (3.4)	r 27 (4.5)
Chinese Taipei	63 (4.1)	553 (3.0)	549 (3.9)	53 (4.1)	44 (4.0)	46 (4.1)	46 (4.2)
Singapore	62 (2.5)	579 (4.3)	590 (6.0)	56 (2.8)	44 (2.8)	39 (3.0)	49 (2.9)
Ireland	62 (3.6)	518 (4.5)	513 (5.0)	55 (3.9)	29 (3.5)	35 (3.4)	30 (3.5)
Hong Kong SAR	61 (4.3)	531 (5.1)	541 (5.7)	49 (4.2)	43 (3.9)	39 (4.3)	43 (4.0)
Germany	61 (3.5)	533 (3.4)	523 (4.0)	54 (3.2)	14 (2.4)	15 (2.4)	23 (2.9)
Chile	r 59 (4.3)	485 (4.2)	475 (5.3)	r 51 (4.0)	r 33 (3.4)	r 37 (4.0)	r 42 (3.8)
Czech Republic	53 (4.0)	537 (3.8)	536 (2.9)	45 (4.1)	22 (3.4)	16 (3.0)	37 (4.2)
Qatar	51 (3.6)	382 (8.4)	406 (9.1)	50 (3.7)	45 (3.6)	45 (3.4)	47 (3.3)
Lithuania	49 (3.8)	517 (4.4)	512 (3.2)	45 (4.1)	30 (3.3)	21 (2.8)	41 (3.8)
Portugal	47 (5.3)	528 (7.6)	516 (4.2)	46 (5.3)	29 (3.9)	30 (4.2)	39 (4.3)
Slovak Republic	45 (3.2)	537 (4.0)	527 (5.9)	42 (3.2)	17 (2.3)	24 (2.7)	43 (3.2)
Slovenia	41 (3.7)	523 (3.4)	518 (3.4)	37 (3.6)	12 (2.1)	20 (2.7)	21 (3.0)
Azerbaijan	41 (3.6)	446 (8.3)	434 (7.7)	30 (3.7)	24 (3.7)	28 (3.7)	30 (3.7)
United Arab Emirates	40 (2.7)	427 (4.7)	429 (3.8)	36 (2.5)	33 (2.5)	33 (2.6)	33 (2.4)
Spain	40 (3.8)	510 (4.7)	502 (3.4)	33 (3.5)	21 (3.2)	20 (3.3)	29 (3.5)
Bahrain	37 (4.1)	454 (6.1)	447 (4.8)	36 (4.1)	32 (4.1)	32 (3.9)	35 (4.0)
Turkey	36 (3.4)	491 (4.8)	447 (5.9)	35 (3.4)	34 (3.3)	28 (3.4)	35 (3.3)
Hungary	36 (3.5)	523 (6.2)	539 (4.5)	34 (3.5)	14 (2.5)	15 (2.6)	27 (3.2)
Korea, Rep. of	35 (3.6)	589 (3.5)	586 (2.3)	25 (3.3)	20 (3.0)	23 (3.4)	23 (3.3)
Kuwait	34 (4.0)	347 (7.6)	347 (6.3)	31 (4.1)	28 (3.9)	29 (4.1)	30 (4.0)
Russian Federation	33 (3.7)	556 (6.6)	550 (3.8)	28 (2.8)	20 (2.5)	19 (2.4)	31 (3.5)
Italy	31 (3.2)	528 (4.0)	525 (3.5)	28 (3.1)	21 (2.8)	18 (2.7)	23 (2.9)
Thailand	29 (4.0)	469 (9.3)	472 (7.4)	26 (3.9)	20 (3.5)	24 (3.7)	23 (3.7)
Romania	28 (3.5)	509 (11.2)	502 (6.7)	23 (3.5)	21 (3.2)	21 (3.3)	23 (3.5)
Georgia	25 (2.9)	464 (8.0)	452 (4.6)	23 (2.9)	13 (2.5)	15 (2.7)	22 (2.9)
Saudi Arabia	24 (3.3)	421 (10.0)	432 (6.9)	21 (3.2)	15 (3.0)	15 (2.6)	18 (3.2)
Poland	19 (3.1)	496 (5.4)	507 (2.9)	16 (2.8)	7 (2.0)	11 (2.5)	13 (2.8)
Oman	18 (2.1)	390 (9.4)	375 (4.8)	15 (1.9)	11 (1.6)	12 (1.9)	12 (1.7)
Armenia	r 18 (3.2)	418 (7.0)	416 (4.9)	r 13 (2.6)	r 11 (2.5)	r 10 (2.4)	r 13 (2.7)
Tunisia	16 (3.1)	317 (12.0)	350 (5.6)	14 (3.0)	12 (2.8)	11 (2.5)	14 (3.0)
Yemen	15 (3.1)	196 (22.0)	212 (7.7)	8 (2.7)	7 (2.7)	8 (2.8)	7 (2.7)
Croatia	15 (2.3)	514 (4.9)	516 (2.3)	13 (2.2)	7 (1.5)	5 (1.4)	12 (2.3)
Serbia	13 (2.6)	511 (8.9)	516 (3.4)	10 (2.1)	7 (1.5)	7 (1.6)	8 (1.9)
Morocco	r 9 (2.2)	285 (12.5)	257 (5.5)	r 5 (1.6)	r 4 (1.3)	r 4 (1.0)	r 7 (1.8)
Iran, Islamic Rep. of	7 (1.8)	512 (17.5)	448 (4.2)	5 (1.5)	6 (1.6)	4 (1.3)	5 (1.5)
International Avg.	47 (0.5)	488 (1.0)	486 (0.8)	41 (0.5)	24 (0.4)	25 (0.4)	31 (0.5)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent. An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

**Exhibit 8.29: Computer Activities During Science Lessons (Continued)**

Country	Computers Available for Science Lessons			Percent of Students Whose Teachers Have Them Use Computers At Least Monthly			
	Percent of Students	Average Achievement		To Look Up Ideas and Information	To Do Scientific Procedures or Experiments	To Study Natural Phenomena Through Simulations	To Practice Skills and Procedures
	Yes	Yes	No				
<b>Sixth Grade Participants</b>							
Yemen	13 (3.2)	368 (15.3)	342 (8.0)	5 (2.1)	5 (2.0)	5 (2.0)	4 (1.8)
Botswana	6 (1.6)	416 (34.0)	371 (6.2)	3 (0.7)	3 (0.7)	3 (0.7)	3 (0.7)
Honduras	6 (1.4)	447 (7.0)	431 (6.6)	5 (1.5)	5 (1.5)	4 (1.7)	5 (1.5)
<b>Benchmarking Participants</b>							
Florida, US	s 79 (4.5)	541 (4.5)	552 (12.5)	s 66 (5.3)	s 49 (4.8)	s 50 (5.4)	s 50 (5.8)
North Carolina, US	r 79 (5.9)	537 (5.7)	534 (11.0)	r 75 (6.1)	r 50 (6.6)	r 50 (7.7)	r 38 (6.5)
Alberta, Canada	r 75 (4.1)	544 (3.5)	535 (4.6)	r 69 (4.3)	r 43 (4.6)	r 48 (4.8)	r 49 (4.4)
Ontario, Canada	r 52 (3.8)	531 (3.9)	522 (4.2)	r 48 (3.9)	r 25 (3.4)	r 25 (3.1)	r 29 (3.6)
Quebec, Canada	r 50 (4.0)	522 (3.6)	511 (3.4)	r 47 (3.9)	r 25 (3.3)	r 23 (3.0)	r 28 (3.8)
Dubai, UAE	r 47 (3.9)	465 (7.2)	465 (7.3)	r 43 (3.9)	r 36 (4.0)	r 38 (3.9)	r 38 (3.9)
Abu Dhabi, UAE	r 39 (4.4)	411 (9.3)	414 (7.0)	r 38 (4.4)	r 36 (4.5)	r 34 (4.4)	r 36 (4.3)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Exhibit 8.30: Computer Activities During Science Lessons**

Reported by Teachers

Country	Computers Available for Science Lessons			Percent of Students Whose Teachers Have Them Use Computers At Least Monthly				
	Percent of Students	Average Achievement		To Look Up Ideas and Information	To Do Scientific Procedures or Experiments	To Study Natural Phenomena Through Simulations	To Process and Analyze Data	To Practice Skills and Procedures
	Yes	Yes	No					
Kazakhstan	84 (2.3)	489 (4.4)	500 (8.5)	81 (2.3)	77 (2.6)	73 (2.9)	79 (2.5)	82 (2.4)
Norway	77 (3.6)	495 (2.9)	490 (5.3)	72 (3.9)	35 (4.0)	42 (4.4)	34 (4.1)	54 (4.4)
Macedonia, Rep. of	r 71 (2.8)	411 (5.9)	409 (9.8)	r 66 (3.0)	r 59 (3.0)	r 61 (3.0)	r 63 (3.0)	r 64 (3.0)
Australia	s 71 (2.8)	522 (6.2)	536 (9.2)	s 66 (3.6)	s 40 (4.5)	s 44 (3.8)	s 49 (3.9)	s 47 (4.5)
Chile	70 (3.5)	460 (3.5)	463 (5.2)	60 (3.9)	43 (3.7)	42 (3.7)	54 (4.0)	48 (3.7)
Korea, Rep. of	68 (3.5)	562 (2.4)	556 (3.6)	52 (3.4)	51 (3.4)	49 (3.7)	45 (3.2)	48 (3.6)
United States	s 67 (2.7)	536 (4.1)	516 (5.8)	s 59 (2.7)	s 39 (2.6)	s 44 (2.4)	s 46 (2.4)	s 43 (2.6)
England	r 63 (3.3)	529 (7.6)	538 (5.7)	r 57 (3.1)	r 25 (2.5)	r 37 (2.9)	r 41 (3.2)	r 31 (3.5)
Finland	59 (2.5)	552 (2.8)	553 (2.7)	49 (2.7)	18 (2.2)	20 (2.3)	31 (2.4)	36 (2.5)
Sweden	r 57 (3.8)	514 (3.4)	509 (4.4)	r 53 (3.7)	r 14 (3.0)	r 17 (2.8)	r 30 (3.7)	r 23 (3.5)
Romania	57 (3.0)	468 (4.5)	460 (4.6)	52 (3.1)	43 (2.9)	43 (2.9)	42 (2.9)	51 (3.1)
Singapore	56 (2.5)	584 (6.2)	598 (6.3)	42 (2.5)	27 (2.5)	31 (2.7)	26 (2.4)	31 (2.6)
Lithuania	55 (2.3)	511 (3.2)	518 (3.1)	49 (2.4)	33 (2.2)	28 (2.0)	41 (2.4)	44 (2.4)
Russian Federation	52 (2.7)	546 (4.2)	539 (3.7)	45 (2.6)	26 (2.2)	27 (2.3)	34 (2.6)	47 (2.6)
Georgia	52 (3.1)	420 (4.9)	419 (3.9)	50 (3.3)	41 (3.1)	41 (3.1)	45 (3.3)	47 (3.1)
Japan	50 (4.3)	559 (3.6)	557 (3.4)	15 (3.1)	2 (1.2)	13 (2.8)	8 (2.4)	4 (1.5)
Ukraine	50 (3.7)	503 (4.8)	498 (4.1)	43 (3.8)	21 (2.7)	20 (2.9)	24 (3.0)	37 (3.5)
Jordan	49 (3.5)	457 (5.8)	441 (6.0)	48 (3.6)	44 (3.6)	42 (3.8)	39 (3.6)	46 (3.5)
Hungary	48 (2.6)	515 (4.6)	528 (4.0)	45 (2.4)	25 (2.0)	29 (2.2)	30 (2.3)	36 (2.4)
Armenia	48 (3.2)	447 (4.4)	430 (4.3)	r 44 (3.3)	r 34 (3.1)	r 29 (2.8)	r 39 (3.0)	r 43 (3.2)
Qatar	48 (3.0)	426 (10.4)	409 (6.4)	47 (2.6)	43 (2.5)	44 (2.9)	40 (2.9)	46 (2.7)
Slovenia	47 (2.4)	543 (2.8)	543 (3.2)	40 (2.3)	21 (1.9)	30 (2.2)	29 (2.2)	31 (2.3)
Israel	46 (4.2)	530 (6.2)	508 (6.2)	39 (4.1)	24 (3.5)	28 (3.7)	27 (3.7)	34 (3.8)
United Arab Emirates	42 (2.3)	462 (3.8)	461 (3.5)	41 (2.3)	r 37 (2.3)	36 (2.5)	r 36 (2.4)	r 38 (2.2)
Turkey	40 (3.5)	499 (6.9)	473 (3.9)	38 (3.4)	35 (3.2)	36 (3.6)	31 (3.2)	33 (3.4)
Chinese Taipei	40 (4.3)	557 (4.9)	568 (3.1)	24 (3.5)	24 (3.6)	21 (3.5)	18 (3.2)	23 (3.6)
Palestinian Nat'l Auth.	40 (3.7)	432 (6.2)	412 (4.1)	38 (3.8)	34 (3.6)	33 (3.8)	28 (3.6)	34 (3.7)
New Zealand	39 (4.1)	499 (6.5)	519 (6.4)	37 (4.0)	13 (2.5)	25 (3.7)	21 (3.2)	23 (3.4)
Bahrain	38 (3.1)	466 (4.8)	446 (3.1)	34 (3.2)	33 (3.4)	32 (3.1)	30 (3.1)	35 (3.1)
Italy	36 (3.2)	509 (5.0)	497 (3.2)	30 (3.0)	13 (2.5)	14 (2.4)	20 (2.9)	18 (2.6)
Hong Kong SAR	34 (4.1)	526 (8.1)	540 (4.6)	24 (4.0)	23 (3.9)	19 (3.7)	22 (3.8)	19 (3.9)
Syrian Arab Republic	r 33 (4.3)	420 (7.6)	427 (4.9)	r 28 (4.1)	r 28 (3.9)	r 28 (4.1)	r 28 (4.1)	r 26 (4.0)
Saudi Arabia	31 (3.9)	446 (8.4)	433 (4.3)	30 (3.9)	29 (3.8)	29 (3.9)	27 (3.8)	30 (3.9)
Indonesia	31 (4.1)	390 (9.5)	411 (4.5)	21 (3.5)	19 (3.5)	19 (3.7)	19 (3.5)	17 (3.3)
Thailand	31 (4.1)	455 (7.9)	449 (5.3)	28 (3.8)	23 (3.6)	25 (3.7)	26 (3.7)	24 (3.4)
Iran, Islamic Rep. of	31 (3.3)	500 (8.7)	462 (4.0)	21 (3.4)	23 (3.4)	18 (2.9)	17 (3.0)	19 (2.9)
Oman	21 (2.7)	440 (7.7)	414 (4.0)	21 (2.7)	13 (2.1)	16 (2.3)	15 (2.4)	17 (2.5)
Morocco	19 (1.7)	397 (5.7)	372 (2.4)	15 (1.6)	13 (1.6)	15 (1.5)	12 (1.5)	13 (1.5)
Tunisia	19 (3.2)	449 (8.0)	436 (2.7)	11 (2.7)	6 (2.0)	10 (2.5)	11 (2.5)	11 (2.4)
Malaysia	17 (3.3)	447 (13.1)	421 (6.8)	17 (3.2)	15 (3.0)	17 (3.2)	15 (3.0)	14 (2.9)
Lebanon	14 (1.8)	421 (12.1)	402 (4.8)	10 (1.8)	9 (1.8)	9 (1.6)	9 (1.7)	10 (1.8)
Ghana	12 (2.8)	308 (14.8)	307 (6.0)	5 (1.5)	4 (1.4)	4 (1.3)	4 (1.4)	5 (1.5)
International Avg.	46 (0.5)	481 (1.0)	475 (0.8)	39 (0.5)	28 (0.5)	30 (0.5)	31 (0.5)	33 (0.5)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.  
 An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.  
 An "x" indicates data are available for less than 50% of students.

**Exhibit 8.30: Computer Activities During Science Lessons (Continued)**

Country	Computers Available for Science Lessons			Percent of Students Whose Teachers Have Them Use Computers At Least Monthly				
	Percent of Students	Average Achievement		To Look Up Ideas and Information	To Do Scientific Procedures or Experiments	To Study Natural Phenomena Through Simulations	To Process and Analyze Data	To Practice Skills and Procedures
	Yes	Yes	No					
<b>Ninth Grade Participants</b>								
South Africa	17 (2.6)	325 (13.3)	330 (4.4)	7 (1.6)	7 (1.7)	7 (1.7)	7 (1.7)	7 (1.8)
Botswana	13 (3.0)	407 (8.6)	402 (4.1)	9 (2.4)	5 (1.6)	5 (1.8)	5 (2.1)	6 (2.1)
Honduras	9 (3.0)	378 (17.4)	368 (4.5)	8 (2.9)	3 (1.2)	3 (1.2)	3 (1.3)	7 (2.9)
<b>Benchmarking Participants</b>								
Alberta, Canada	79 (3.3)	545 (2.8)	549 (4.6)	73 (3.7)	55 (4.3)	55 (4.1)	55 (4.1)	55 (3.9)
Indiana, US	s 68 (5.7)	531 (5.7)	533 (8.8)	s 60 (5.3)	s 32 (6.0)	s 40 (6.0)	s 41 (5.3)	s 41 (6.3)
Minnesota, US	r 64 (6.9)	553 (8.8)	553 (7.5)	r 57 (7.0)	r 40 (7.7)	r 53 (7.1)	r 44 (7.3)	r 43 (7.8)
Colorado, US	s 62 (6.6)	547 (8.7)	545 (9.3)	s 52 (7.1)	s 41 (6.0)	s 41 (6.3)	s 46 (6.6)	s 43 (7.7)
North Carolina, US	s 61 (7.4)	537 (11.8)	516 (17.4)	s 61 (7.4)	s 44 (7.1)	s 40 (7.3)	s 54 (7.1)	s 47 (7.2)
Massachusetts, US	s 59 (8.2)	573 (12.3)	547 (12.0)	s 47 (9.6)	s 27 (7.5)	s 37 (8.1)	s 37 (8.4)	s 31 (7.2)
California, US	s 58 (5.7)	505 (11.2)	505 (5.6)	x x	x x	x x	x x	x x
Ontario, Canada	r 56 (4.2)	520 (3.7)	522 (4.6)	r 53 (4.3)	r 36 (4.2)	r 32 (4.0)	r 36 (4.2)	r 33 (4.0)
Connecticut, US	s 56 (6.9)	533 (9.2)	541 (13.4)	s 47 (7.3)	s 31 (5.4)	s 37 (6.8)	s 35 (6.2)	s 34 (6.3)
Dubai, UAE	r 52 (2.6)	493 (4.8)	465 (5.0)	r 52 (2.6)	r 41 (4.6)	r 45 (2.6)	r 46 (3.5)	r 47 (2.8)
Quebec, Canada	47 (4.2)	526 (4.7)	515 (4.0)	38 (4.2)	18 (2.9)	21 (3.2)	24 (3.7)	24 (3.9)
Alabama, US	s 42 (7.2)	490 (16.1)	481 (5.2)	s 34 (7.4)	s 24 (6.3)	s 24 (7.1)	s 22 (6.5)	s 28 (7.7)
Abu Dhabi, UAE	38 (4.5)	453 (6.9)	466 (6.0)	35 (4.3)	32 (4.2)	31 (4.5)	r 30 (4.3)	33 (4.2)
Florida, US	x x	x x	x x	x x	x x	x x	x x	x x

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

### *Science Homework*

Homework is a way to extend instruction and assess student progress. TIMSS has consistently shown that the amount of homework assigned for mathematics and science varies both within and across countries. In some situations, homework is assigned typically to students who need it the most to keep up to their classmates. In other situations, students receive homework for practice or as an enrichment exercise. Because of the different approaches and policies associated with assigning homework, it generally shows mixed results in relation to average student achievement.

The eighth grade students in TIMSS were asked how often their teacher gives homework in science (or biology, chemistry, physics, and earth science for separate science countries) and how much time they usually spend on it when it is given. Weekly time on science homework was estimated by multiplying the frequency of assignment by the amount of time spent. Exhibit 8.31 presents the results, with countries ordered by the percentage of students reporting they spent 3 hours or more per week. However, spending as much time as this on science homework was relatively rare. Among countries teaching science as general or integrated subject, the range was from a high of 11 percent of students in Malaysia to 1 percent in England and Korea and to zero in Japan. It should be mentioned that although students in several of the high-performing East Asian countries report relatively small amounts of homework, many of them attend special tutoring schools.

On average, internationally, only 5 percent of the eighth grade students reported doing as much as 3 hours of science homework per week, and these students had the lowest average science achievement. The majority of students (67%) reported doing 45 minutes or less of weekly science homework, and a further 29 percent reported doing more than 45 minutes but less than 3 hours—these students had the highest average science achievement. Both Botswana and South Africa at the ninth grade had relatively high percentages of students reporting 3 hours of science homework per week, although the percentages for benchmarking participants were more comparable to the international averages at eighth grade.

For each of the four science subjects, eighth grade students in separate science countries reported about the same amount of homework as students in general or integrated science countries reported for science overall. This means, of course, that the total time spent on science homework by students in separate science countries is a lot more than in general or integrated science

### Exhibit 8.31: Weekly Time Students Spend on Science Homework

Reported by Students

The general/integrated science panel summarizes responses for countries where students are enrolled in science as a single subject. The remaining panels for biology, chemistry, physics, and earth science summarize responses for countries where students are taught science as separate subjects.

#### Weekly Time Students Spend on General/Integrated Science Homework

General/Integrated Science	3 Hours or More		More than 45 Minutes but Less than 3 Hours		45 Minutes or Less	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Malaysia	11 (0.6)	417 (6.3)	52 (1.1)	437 (6.1)	37 (1.3)	420 (8.2)
Thailand	10 (0.6)	449 (5.7)	52 (1.1)	455 (4.4)	38 (1.1)	450 (4.2)
Ghana	9 (0.6)	293 (6.4)	38 (1.3)	323 (6.0)	53 (1.3)	306 (6.0)
Jordan	8 (0.5)	447 (6.6)	32 (0.9)	464 (3.8)	61 (1.1)	456 (3.8)
Turkey	8 (0.5)	466 (5.1)	39 (1.0)	487 (3.5)	54 (1.1)	487 (4.3)
Palestinian Nat'l Auth.	7 (0.7)	388 (9.4)	31 (1.3)	424 (4.1)	62 (1.6)	427 (3.5)
Bahrain	6 (0.6)	415 (9.9)	25 (1.0)	465 (4.8)	69 (1.0)	457 (2.5)
Iran, Islamic Rep. of	6 (0.5)	471 (10.5)	30 (0.9)	476 (5.1)	64 (1.1)	474 (3.9)
Chinese Taipei	6 (0.6)	565 (7.4)	39 (1.3)	580 (2.9)	55 (1.5)	555 (2.6)
Singapore	6 (0.4)	609 (6.2)	49 (0.9)	603 (3.7)	46 (1.0)	576 (5.7)
Italy	5 (0.5)	478 (7.6)	35 (1.3)	502 (3.5)	60 (1.5)	504 (3.1)
Tunisia	4 (0.4)	416 (6.2)	20 (0.7)	428 (3.3)	76 (0.9)	445 (2.6)
Qatar	4 (0.4)	398 (11.1)	28 (1.0)	445 (6.7)	68 (1.1)	414 (3.4)
Oman	4 (0.4)	373 (10.3)	17 (0.7)	411 (5.2)	79 (0.9)	432 (3.0)
United Arab Emirates	4 (0.2)	443 (6.6)	25 (0.7)	479 (3.2)	71 (0.7)	464 (2.6)
Israel	4 (0.4)	499 (10.7)	23 (1.1)	511 (5.2)	74 (1.4)	522 (4.4)
Chile	4 (0.4)	446 (7.3)	29 (1.0)	456 (2.8)	68 (1.1)	466 (2.9)
United States	3 (0.3)	518 (6.3)	24 (0.8)	533 (4.0)	73 (0.9)	525 (2.6)
Saudi Arabia	3 (0.4)	401 (13.6)	14 (0.9)	425 (4.8)	83 (1.1)	441 (3.8)
Norway	3 (0.3)	465 (11.0)	36 (1.5)	494 (3.4)	62 (1.6)	498 (3.0)
New Zealand	2 (0.5)	~ ~	19 (1.6)	533 (5.9)	79 (1.7)	512 (4.7)
Hong Kong SAR	2 (0.3)	~ ~	24 (1.3)	540 (3.9)	74 (1.4)	536 (3.7)
Australia	2 (0.2)	~ ~	17 (1.0)	535 (6.8)	81 (1.1)	519 (4.8)
England	1 (0.2)	~ ~	26 (1.4)	555 (5.4)	73 (1.5)	528 (5.3)
Korea, Rep. of	1 (0.2)	~ ~	8 (1.0)	541 (4.8)	91 (1.2)	563 (2.1)
Japan	0 (0.1)	~ ~	10 (1.2)	553 (6.1)	90 (1.3)	559 (2.6)
International Avg.	5 (0.1)	448 (1.9)	29 (0.2)	487 (0.9)	67 (0.2)	482 (0.8)

#### Ninth Grade Participants

South Africa	13 (0.7)	308 (7.3)	39 (0.7)	346 (4.3)	48 (0.8)	338 (3.9)
Botswana	10 (0.7)	364 (5.0)	35 (0.9)	412 (3.9)	55 (1.1)	415 (3.9)
Honduras	--	--	--	--	--	--

#### Benchmarking Participants

Massachusetts, US	8 (1.5)	559 (10.3)	41 (2.3)	574 (6.0)	51 (2.6)	563 (5.5)
Connecticut, US	5 (1.0)	516 (12.1)	34 (2.6)	539 (6.4)	61 (3.0)	536 (5.2)
California, US	5 (0.8)	492 (10.9)	32 (1.7)	511 (4.6)	64 (2.0)	496 (5.8)
Dubai, UAE	4 (0.4)	462 (8.4)	33 (0.7)	502 (4.0)	63 (0.8)	481 (2.5)
Abu Dhabi, UAE	4 (0.4)	439 (11.7)	22 (1.3)	471 (6.7)	74 (1.4)	462 (4.5)
North Carolina, US	4 (0.6)	524 (9.4)	23 (2.0)	541 (11.1)	73 (2.3)	531 (6.2)
Alberta, Canada	3 (0.5)	540 (6.6)	28 (1.4)	544 (3.9)	69 (1.7)	549 (2.3)
Indiana, US	3 (1.0)	537 (17.7)	22 (1.8)	530 (7.3)	75 (2.3)	536 (4.2)
Minnesota, US	3 (0.6)	526 (12.8)	29 (2.0)	556 (7.2)	68 (2.5)	556 (4.4)
Florida, US	3 (0.5)	557 (12.9)	23 (1.9)	552 (9.1)	74 (2.1)	527 (7.4)
Alabama, US	2 (0.3)	~ ~	14 (1.4)	490 (11.3)	84 (1.5)	489 (5.9)
Colorado, US	2 (0.4)	~ ~	16 (1.3)	534 (8.5)	82 (1.6)	546 (4.8)
Ontario, Canada	2 (0.2)	~ ~	24 (1.6)	524 (4.2)	75 (1.7)	521 (2.7)
Quebec, Canada	1 (0.3)	~ ~	13 (1.0)	519 (5.3)	86 (1.1)	522 (2.4)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.  
 A dash (–) indicates comparable data are not available. A tilde (~) indicates insufficient data to report achievement.  
 An "r" indicates data are available for at least 70% but less than 85% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**A. How often does your teacher give you homework in <science/biology/chemistry/physics/earth science>?**

- 1) Every day
- 2) 3 or 4 times a week
- 3) 1 or 2 times a week
- 4) Less than once a week
- 5) Never

**B. When your teacher gives you <science/biology/chemistry/physics/earth science> homework, about how many minutes do you usually spend on your homework?**

- 1) My teacher never gives me homework
- 2) 1-15 minutes
- 3) 16-30 minutes
- 4) 31-60 minutes
- 5) 61-90 minutes
- 6) More than 90 minutes

The weekly time spent on <science> homework was calculated by multiplying how often students were given homework weekly by the minutes they spent on that homework.

**The values for Part A were:** Every day = 5; 3 or 4 times a week = 3.5; 1 or 2 times a week = 1.5; Less than once a week = 0.5; and Never = 0.

**The values for Part B were:** My teacher never gives me homework = 0; 1-15 minutes = 8; 16-30 minutes = 23; 31-60 minutes = 45; 61-90 minutes = 75; and More than 90 minutes = 105.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Separate Science Panels

Weekly Time Students Spend on Biology Homework

Biology	3 Hours or More		More than 45 Minutes but Less than 3 Hours		45 Minutes or Less	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Kazakhstan	17 (0.9)	482 (7.0)	41 (1.1)	490 (4.7)	42 (1.4)	498 (4.7)
Russian Federation	8 (0.6)	518 (5.9)	35 (0.9)	540 (3.6)	57 (1.0)	549 (3.2)
Georgia	7 (0.7)	424 (7.2)	25 (1.3)	437 (4.1)	68 (1.7)	432 (3.0)
Syrian Arab Republic	7 (0.5)	410 (5.8)	27 (0.8)	427 (4.0)	66 (1.0)	435 (4.1)
Ukraine	7 (0.7)	489 (6.3)	35 (1.4)	498 (4.5)	58 (1.7)	507 (3.6)
Armenia	7 (0.5)	437 (7.9)	30 (1.0)	440 (4.8)	63 (1.1)	444 (3.4)
Indonesia	5 (0.5)	409 (6.2)	35 (1.0)	416 (5.4)	61 (1.0)	408 (4.9)
Morocco	4 (0.3)	367 (6.0)	24 (0.6)	383 (3.3)	72 (0.8)	384 (2.6)
Lebanon	4 (0.5)	360 (8.2)	20 (1.2)	396 (6.4)	76 (1.3)	414 (5.4)
Lithuania	4 (0.3)	486 (8.8)	17 (1.0)	502 (4.2)	79 (1.2)	520 (2.6)
Hungary	3 (0.4)	496 (9.0)	17 (0.8)	509 (4.7)	79 (1.1)	531 (2.8)
Macedonia, Rep. of	2 (0.3)	~ ~	15 (1.0)	382 (6.6)	82 (1.1)	424 (5.2)
Romania	2 (0.3)	~ ~	12 (0.8)	447 (5.7)	86 (0.9)	474 (3.5)
Sweden	2 (0.2)	~ ~	16 (0.9)	508 (4.4)	82 (0.9)	518 (2.5)
Slovenia	1 (0.2)	~ ~	8 (0.8)	524 (7.1)	91 (0.9)	548 (2.6)
Finland	1 (0.2)	~ ~	11 (0.8)	541 (4.8)	88 (0.8)	556 (2.6)

**Exhibit 8.31: Weekly Time Students Spend on Science Homework (Continued)**

*Weekly Time Students Spend on Chemistry Homework*

Chemistry	3 Hours or More		More than 45 Minutes but Less than 3 Hours		45 Minutes or Less	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Kazakhstan	30 (1.1)	486 (5.6)	48 (1.0)	499 (4.3)	22 (1.0)	484 (5.9)
Russian Federation	15 (0.7)	528 (4.4)	47 (0.9)	545 (3.6)	38 (1.1)	548 (3.5)
Ukraine	12 (0.8)	484 (5.6)	40 (1.2)	503 (4.0)	48 (1.4)	508 (3.9)
Armenia	12 (0.7)	432 (4.6)	36 (1.0)	443 (3.9)	53 (1.3)	444 (3.6)
Syrian Arab Republic	8 (0.6)	420 (6.0)	33 (0.9)	432 (4.0)	59 (1.1)	432 (4.5)
Lithuania	7 (0.6)	497 (6.4)	28 (1.1)	513 (3.6)	65 (1.5)	519 (2.7)
Romania	6 (0.7)	450 (11.1)	22 (1.1)	475 (5.5)	72 (1.6)	471 (3.5)
Macedonia, Rep. of	r 5 (0.5)	371 (11.4)	23 (1.2)	409 (7.3)	72 (1.5)	424 (5.3)
Morocco	r 5 (0.3)	363 (5.6)	25 (0.7)	383 (3.3)	70 (0.7)	385 (2.7)
Hungary	4 (0.4)	495 (7.9)	19 (1.0)	513 (5.0)	77 (1.3)	530 (3.0)
Lebanon	4 (0.4)	381 (11.0)	22 (1.2)	390 (6.4)	74 (1.4)	415 (5.3)
Indonesia	r 3 (0.3)	388 (9.0)	24 (1.1)	410 (6.0)	73 (1.2)	413 (3.9)
Slovenia	3 (0.5)	499 (10.1)	13 (0.9)	527 (4.6)	85 (1.3)	549 (2.8)
Finland	2 (0.2)	~ ~	15 (0.8)	545 (3.4)	83 (0.9)	556 (2.6)
Sweden	r 2 (0.2)	~ ~	17 (1.0)	509 (3.8)	82 (1.0)	519 (2.6)
Georgia	--	--	--	--	--	--
International Avg.	8 (0.2)	446 (2.2)	27 (0.3)	473 (1.2)	65 (0.3)	480 (1.0)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

*Weekly Time Students Spend on Physics Homework*

Physics	3 Hours or More		More than 45 Minutes but Less than 3 Hours		45 Minutes or Less	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Kazakhstan	26 (1.1)	485 (6.2)	45 (1.2)	497 (4.7)	29 (1.1)	491 (4.9)
Russian Federation	13 (0.9)	530 (7.0)	42 (1.1)	546 (3.1)	45 (1.3)	545 (4.0)
Georgia	13 (0.7)	437 (4.9)	36 (1.1)	440 (3.2)	51 (1.4)	426 (3.1)
Ukraine	12 (0.8)	498 (7.6)	41 (1.2)	503 (4.0)	48 (1.6)	505 (3.7)
Armenia	11 (0.6)	434 (5.5)	36 (0.8)	446 (3.9)	53 (1.0)	442 (3.5)
Syrian Arab Republic	9 (0.6)	419 (5.0)	29 (0.8)	431 (4.6)	62 (1.0)	433 (4.5)
Lithuania	7 (0.6)	498 (6.7)	26 (1.0)	513 (3.9)	66 (1.5)	519 (2.7)
Macedonia, Rep. of	7 (0.7)	370 (11.4)	23 (1.1)	411 (6.9)	70 (1.4)	423 (5.2)
Morocco	7 (0.3)	364 (5.9)	26 (0.7)	383 (3.6)	67 (0.7)	383 (2.5)
Slovenia	6 (0.8)	523 (6.8)	23 (1.0)	533 (4.3)	71 (1.4)	550 (2.9)
Indonesia	6 (0.5)	403 (6.2)	40 (1.2)	420 (4.4)	54 (1.3)	404 (5.6)
Romania	6 (0.5)	445 (9.0)	21 (1.2)	468 (6.2)	74 (1.5)	472 (3.5)
Lebanon	4 (0.5)	371 (9.6)	25 (1.1)	400 (6.4)	71 (1.2)	413 (5.3)
Hungary	4 (0.4)	488 (6.8)	17 (1.0)	512 (4.5)	80 (1.2)	530 (2.9)
Finland	2 (0.2)	~ ~	14 (0.9)	548 (3.9)	84 (0.9)	557 (2.5)
Sweden	r 2 (0.2)	~ ~	17 (0.9)	511 (4.1)	81 (1.0)	519 (2.6)
International Avg.	8 (0.2)	448 (1.9)	29 (0.3)	473 (1.1)	63 (0.3)	476 (1.0)

*Weekly Time Students Spend on Earth Science Homework*

Earth Science	3 Hours or More		More than 45 Minutes but Less than 3 Hours		45 Minutes or Less	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Kazakhstan	17 (0.9)	477 (6.0)	39 (1.0)	491 (4.8)	43 (1.1)	499 (4.7)
Georgia	r 8 (1.3)	432 (6.7)	25 (1.0)	437 (4.5)	67 (1.5)	435 (3.2)
Armenia	8 (0.6)	438 (6.5)	29 (1.0)	438 (4.7)	64 (1.3)	445 (3.2)
Russian Federation	7 (0.6)	520 (6.3)	32 (0.9)	539 (3.8)	60 (1.1)	549 (3.3)
Syrian Arab Republic	r 7 (0.6)	404 (6.1)	24 (0.9)	423 (4.6)	68 (1.1)	436 (4.3)
Ukraine	7 (0.5)	485 (7.4)	33 (1.3)	499 (4.9)	60 (1.4)	509 (3.4)
Lithuania	6 (0.5)	491 (6.7)	25 (1.1)	509 (3.4)	69 (1.4)	520 (2.8)
Indonesia	r 4 (0.5)	401 (6.4)	30 (1.0)	414 (4.9)	65 (1.2)	409 (5.3)
Morocco	r 4 (0.3)	363 (6.5)	25 (0.7)	378 (2.6)	71 (0.8)	386 (2.8)
Hungary	3 (0.4)	500 (7.4)	16 (0.8)	512 (4.6)	81 (1.0)	529 (3.0)
Romania	3 (0.3)	433 (10.2)	13 (0.9)	462 (6.0)	84 (1.0)	473 (3.4)
Macedonia, Rep. of	r 3 (0.4)	369 (14.8)	12 (0.8)	390 (8.6)	85 (0.8)	422 (5.1)
Sweden	r 2 (0.3)	~ ~	16 (0.9)	506 (4.4)	82 (1.0)	519 (2.5)
Slovenia	2 (0.2)	~ ~	7 (0.5)	519 (5.5)	91 (0.7)	548 (2.7)
Finland	1 (0.2)	~ ~	11 (0.8)	541 (4.3)	88 (0.8)	556 (2.5)
Lebanon	--	--	--	--	--	--
International Avg.	6 (0.1)	443 (2.3)	23 (0.2)	470 (1.3)	72 (0.3)	482 (0.9)

countries. However, there was an inverse relationship between time spent on homework and average science achievement in the separate science countries, with average achievement highest among students spending 45 minutes or less on each subject.

### *Science Classroom Assessment*

Teachers have a number of informal and formal ways to evaluate student learning. Informal assessments during instruction help teachers identify the needs of particular individuals, gauge the pace of instruction, and signal the need to adapt or reteach. Formal tests typically are used to make important decisions about the students, such as grades or marks.

Exhibit 8.32 presents teachers' reports about how often they give eighth grade students science tests or examinations. Internationally, on average, the eighth grade students were tested fairly regularly in science—35 percent at least every two weeks, and 41 percent about monthly. Just 24 percent were tested less often, approximately a few times a year.

The exhibit also contains teachers' reports about the types of questions they included in their tests and examinations. Most frequently, the test questions involved application of knowledge and understanding, which were used always or almost always for 78 percent of the students, on average, across the countries, and at least sometimes for 22 percent of the students. The test questions in science often also required students to provide explanations or justifications for their answers—almost always for 54 percent of students and sometimes for 42 percent, with only 3 percent almost never. Questions involving developing hypotheses and designing scientific investigations were used less frequently—always or almost always for 21 percent of the students, on average, sometimes for 62 percent of the students, and rarely for 17 percent of the students. However, across the eighth grade, ninth grade, and benchmarking participants, there was considerable variation in testing practices.

Exhibit 8.32: Classroom Assessment

Reported by Teachers

Country	Percentage of Students Whose Teachers Give Science Tests or Examinations			Percentage of Students Whose Teachers Give Test Questions								
				Involving Application of Knowledge and Understanding			Involving Developing Hypotheses and Designing Scientific Investigations			Requiring Explanations or Justifications		
	Every 2 Weeks or More	About Once a Month	A Few Times a Year or Less	Always or Almost Always	Sometimes	Never or Almost Never	Always or Almost Always	Sometimes	Never or Almost Never	Always or Almost Always	Sometimes	Never or Almost Never
Armenia	20 (1.8)	47 (2.6)	33 (2.8)	72 (2.3)	27 (2.2)	1 (0.6)	5 (1.2)	57 (2.9)	38 (2.7)	59 (2.6)	39 (2.4)	2 (0.8)
Australia	s 9 (2.1)	47 (3.9)	44 (4.3)	s 83 (2.3)	17 (2.4)	0 (0.2)	s 30 (3.0)	56 (4.4)	14 (3.4)	s 59 (3.6)	40 (3.8)	1 (0.8)
Bahrain	79 (2.3)	17 (2.2)	4 (0.8)	79 (2.4)	21 (2.4)	0 (0.0)	20 (1.5)	66 (2.3)	14 (2.4)	75 (2.4)	24 (2.3)	1 (0.8)
Chile	34 (4.2)	65 (4.2)	1 (0.8)	84 (2.5)	16 (2.5)	0 (0.0)	26 (3.6)	59 (4.0)	15 (2.8)	60 (4.2)	37 (4.1)	3 (1.4)
Chinese Taipei	98 (1.1)	2 (0.9)	1 (0.6)	83 (3.1)	17 (3.1)	0 (0.0)	28 (3.8)	61 (3.7)	12 (2.7)	25 (3.8)	59 (3.6)	16 (3.3)
England	r 13 (2.5)	50 (4.1)	36 (3.8)	r 78 (3.1)	22 (3.0)	1 (0.6)	r 38 (3.2)	55 (2.8)	7 (1.4)	r 58 (3.1)	41 (3.1)	1 (0.6)
Finland	1 (0.5)	21 (1.8)	78 (1.9)	84 (2.1)	16 (2.1)	0 (0.2)	4 (1.1)	42 (2.0)	54 (2.0)	81 (1.8)	18 (1.7)	1 (0.3)
Georgia	19 (2.4)	57 (2.5)	24 (2.1)	84 (2.2)	16 (2.2)	0 (0.2)	11 (1.4)	77 (1.9)	12 (1.6)	63 (2.4)	37 (2.4)	0 (0.0)
Ghana	73 (3.8)	27 (3.8)	0 (0.0)	70 (3.7)	29 (3.8)	1 (0.0)	33 (4.0)	61 (4.2)	5 (1.9)	63 (4.1)	36 (4.1)	1 (0.7)
Hong Kong SAR	20 (3.6)	39 (4.7)	41 (4.9)	57 (4.1)	43 (4.1)	0 (0.0)	14 (3.3)	77 (4.0)	8 (2.3)	37 (4.7)	58 (5.0)	4 (1.9)
Hungary	42 (2.2)	53 (2.2)	5 (0.8)	82 (1.6)	18 (1.6)	0 (0.1)	2 (0.6)	46 (2.2)	51 (2.2)	31 (2.0)	58 (2.3)	11 (1.8)
Indonesia	64 (3.7)	34 (3.7)	3 (1.0)	73 (3.5)	27 (3.5)	0 (0.0)	16 (3.3)	72 (3.7)	12 (2.4)	38 (4.4)	57 (4.5)	5 (1.6)
Iran, Islamic Rep. of	55 (3.3)	32 (3.1)	13 (2.4)	62 (2.8)	37 (2.7)	1 (0.8)	18 (2.8)	69 (3.3)	13 (1.9)	46 (3.8)	47 (3.8)	6 (2.1)
Israel	7 (2.0)	38 (3.5)	55 (3.2)	91 (2.5)	9 (2.5)	0 (0.0)	39 (4.4)	57 (4.3)	4 (1.1)	80 (2.8)	20 (2.8)	0 (0.0)
Italy	12 (2.5)	51 (3.6)	37 (3.8)	69 (3.5)	29 (3.7)	2 (1.0)	22 (3.0)	59 (3.6)	19 (2.9)	52 (3.9)	47 (3.9)	1 (0.6)
Japan	15 (3.3)	28 (3.7)	56 (4.2)	85 (2.9)	14 (3.0)	1 (0.0)	24 (3.5)	50 (3.9)	26 (3.6)	60 (4.6)	40 (4.6)	0 (0.0)
Jordan	46 (4.1)	49 (4.0)	5 (1.5)	79 (3.5)	21 (3.5)	0 (0.0)	14 (3.0)	72 (3.7)	14 (2.7)	46 (4.2)	51 (4.3)	3 (1.3)
Kazakhstan	74 (2.5)	23 (2.4)	3 (0.8)	87 (1.7)	13 (1.7)	0 (0.0)	17 (2.0)	78 (2.0)	5 (1.1)	67 (2.3)	32 (2.3)	1 (0.5)
Korea, Rep. of	41 (4.1)	41 (3.7)	17 (2.7)	85 (3.2)	15 (3.2)	0 (0.0)	33 (3.7)	59 (4.0)	8 (2.2)	28 (3.2)	62 (3.5)	10 (2.3)
Lebanon	70 (3.0)	29 (3.0)	2 (0.9)	83 (2.9)	17 (2.9)	0 (0.0)	45 (3.4)	51 (3.4)	4 (1.3)	77 (2.7)	23 (2.8)	0 (0.2)
Lithuania	22 (1.9)	71 (2.1)	8 (1.2)	87 (1.2)	13 (1.1)	0 (0.2)	12 (1.3)	72 (1.7)	16 (1.4)	72 (1.8)	28 (1.8)	0 (0.2)
Macedonia, Rep. of	r 8 (1.1)	30 (2.1)	63 (2.4)	r 37 (1.8)	52 (2.0)	11 (1.2)	r 23 (2.3)	68 (2.6)	9 (1.5)	r 52 (2.4)	47 (2.4)	2 (0.6)
Malaysia	13 (2.6)	43 (3.8)	44 (4.1)	64 (3.7)	36 (3.7)	0 (0.0)	37 (3.7)	60 (3.9)	3 (1.3)	38 (3.4)	60 (3.3)	2 (1.1)
Morocco	4 (1.1)	57 (2.4)	39 (2.3)	86 (1.8)	13 (1.7)	0 (0.0)	18 (1.8)	67 (2.2)	15 (1.9)	51 (2.4)	45 (2.5)	4 (1.1)
New Zealand	8 (1.8)	69 (3.0)	23 (2.8)	74 (2.9)	26 (2.9)	0 (0.0)	23 (3.1)	67 (3.3)	9 (2.1)	68 (3.3)	31 (3.3)	1 (0.5)
Norway	2 (1.0)	64 (3.2)	34 (3.2)	66 (3.9)	34 (3.9)	0 (0.0)	6 (1.9)	58 (4.5)	36 (4.2)	56 (4.3)	44 (4.3)	0 (0.0)
Oman	14 (2.1)	58 (2.9)	29 (3.0)	78 (3.1)	22 (3.1)	0 (0.0)	22 (2.6)	68 (3.3)	11 (2.2)	60 (3.6)	39 (3.6)	1 (0.6)
Palestinian Nat'l Auth.	59 (3.1)	37 (3.2)	4 (1.6)	82 (3.2)	18 (3.2)	0 (0.0)	16 (2.8)	66 (3.5)	18 (3.2)	71 (3.8)	27 (3.7)	2 (1.3)
Qatar	70 (4.0)	25 (4.1)	5 (1.7)	68 (3.3)	31 (3.3)	1 (0.7)	29 (3.2)	65 (3.2)	6 (1.5)	56 (4.5)	40 (4.4)	4 (1.1)
Romania	38 (2.3)	52 (2.3)	11 (1.6)	85 (1.9)	14 (1.8)	0 (0.3)	23 (2.2)	63 (2.6)	14 (1.9)	63 (2.6)	36 (2.6)	0 (0.2)
Russian Federation	67 (2.2)	28 (1.9)	5 (1.1)	87 (1.5)	13 (1.5)	0 (0.0)	5 (0.7)	72 (1.6)	23 (1.7)	55 (2.1)	44 (2.0)	1 (0.3)
Saudi Arabia	56 (4.2)	38 (4.2)	6 (1.7)	74 (3.7)	25 (3.6)	1 (0.6)	13 (2.7)	66 (4.0)	21 (3.7)	29 (3.7)	62 (4.1)	9 (2.4)
Singapore	28 (1.9)	49 (2.5)	23 (2.0)	71 (2.5)	29 (2.5)	0 (0.0)	7 (1.5)	52 (2.6)	41 (2.7)	50 (3.0)	47 (3.1)	3 (0.9)
Slovenia	0 (0.2)	1 (0.4)	98 (0.5)	87 (1.6)	13 (1.6)	0 (0.0)	17 (1.5)	59 (2.1)	24 (2.0)	51 (2.1)	46 (2.0)	3 (0.8)
Sweden	r 1 (0.8)	39 (4.1)	60 (4.1)	r 91 (1.7)	8 (1.7)	0 (0.1)	r 17 (2.7)	66 (3.8)	18 (2.6)	r 66 (3.1)	30 (3.0)	4 (1.3)
Syrian Arab Republic	r 33 (4.2)	43 (3.9)	25 (3.3)	r 66 (3.7)	34 (3.7)	0 (0.4)	r 12 (2.6)	61 (4.1)	26 (3.6)	r 35 (3.5)	54 (3.9)	11 (2.3)
Thailand	63 (4.1)	32 (3.9)	5 (1.4)	58 (3.7)	42 (3.7)	0 (0.0)	28 (3.8)	68 (4.0)	3 (1.5)	64 (4.2)	35 (4.1)	1 (0.9)
Tunisia	4 (1.5)	39 (3.6)	56 (3.7)	85 (2.8)	13 (2.8)	1 (0.8)	10 (2.1)	72 (3.4)	19 (3.1)	45 (3.8)	52 (4.0)	3 (1.3)
Turkey	21 (3.1)	76 (3.2)	2 (1.0)	80 (2.6)	20 (2.6)	0 (0.4)	20 (2.8)	61 (3.6)	19 (2.8)	23 (2.9)	61 (3.2)	16 (2.5)
Ukraine	44 (3.0)	43 (2.8)	13 (1.9)	95 (0.9)	5 (0.9)	0 (0.0)	63 (2.8)	37 (2.7)	0 (0.2)	73 (2.4)	26 (2.4)	1 (0.3)
United Arab Emirates	r 57 (2.7)	40 (2.6)	3 (0.7)	r 84 (1.7)	16 (1.6)	1 (0.5)	r 20 (1.7)	66 (2.2)	14 (1.8)	r 52 (2.4)	44 (2.4)	3 (1.0)
United States	s 62 (2.8)	33 (3.0)	6 (1.1)	s 79 (2.1)	21 (2.1)	0 (0.0)	s 19 (2.1)	65 (2.6)	16 (2.0)	s 49 (2.6)	43 (2.7)	8 (1.5)
International Avg.	35 (0.4)	41 (0.5)	24 (0.4)	78 (0.4)	22 (0.4)	1 (0.1)	21 (0.4)	62 (0.5)	17 (0.4)	54 (0.5)	42 (0.5)	3 (0.2)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

An "r" indicates data are available for at least 70% but less than 85% of the students. An "s" indicates data are available for at least 50% but less than 70% of the students.

An "x" indicates data are available for less than 50% of students.

**Exhibit 8.32: Classroom Assessment (Continued)**

Country	Percentage of Students Whose Teachers Give Science Tests or Examinations			Percentage of Students Whose Teachers Give Test Questions								
				Involving Application of Knowledge and Understanding			Involving Developing Hypotheses and Designing Scientific Investigations			Requiring Explanations or Justifications		
	Every 2 Weeks or More	About Once a Month	A Few Times a Year or Less	Always or Almost Always	Sometimes	Never or Almost Never	Always or Almost Always	Sometimes	Never or Almost Never	Always or Almost Always	Sometimes	Never or Almost Never
<b>Ninth Grade Participants</b>												
Botswana	18 (3.3)	82 (3.3)	0 (0.0)	75 (3.8)	25 (3.8)	0 (0.0)	15 (3.1)	75 (3.4)	10 (2.5)	62 (4.6)	38 (4.5)	1 (0.0)
Honduras	57 (4.3)	40 (4.3)	3 (1.3)	81 (3.2)	19 (3.2)	0 (0.0)	21 (3.5)	61 (4.7)	18 (3.8)	37 (4.6)	54 (4.4)	9 (2.8)
South Africa	23 (3.8)	63 (4.4)	14 (2.4)	68 (3.6)	31 (3.6)	0 (0.3)	31 (3.5)	64 (3.8)	6 (1.7)	53 (3.4)	47 (3.4)	0 (0.0)
<b>Benchmarking Participants</b>												
Alberta, Canada	56 (4.4)	37 (4.3)	6 (2.1)	79 (3.5)	21 (3.5)	0 (0.0)	18 (3.5)	62 (3.9)	20 (3.1)	51 (4.3)	48 (4.3)	1 (0.7)
Ontario, Canada	r 27 (3.5)	51 (4.3)	22 (3.5)	r 82 (3.2)	17 (3.2)	1 (0.5)	r 25 (4.2)	60 (4.4)	15 (2.7)	r 70 (4.1)	29 (4.1)	1 (0.9)
Quebec, Canada	27 (3.9)	59 (4.5)	14 (3.1)	r 73 (4.0)	27 (4.1)	0 (0.4)	r 21 (3.9)	66 (4.3)	13 (3.1)	r 60 (4.2)	39 (4.2)	0 (0.3)
Abu Dhabi, UAE	r 61 (4.7)	36 (4.6)	3 (1.3)	r 80 (3.4)	20 (3.4)	0 (0.0)	r 14 (3.0)	65 (4.3)	21 (3.8)	r 48 (4.7)	49 (4.9)	3 (1.8)
Dubai, UAE	r 57 (2.5)	40 (2.5)	3 (0.6)	r 87 (1.8)	13 (1.8)	0 (0.0)	r 20 (1.9)	73 (2.1)	6 (1.0)	r 55 (3.4)	44 (3.4)	1 (0.2)
Alabama, US	s 85 (5.2)	15 (5.2)	0 (0.0)	s 80 (7.0)	20 (7.0)	0 (0.0)	s 24 (5.6)	59 (7.4)	17 (5.1)	s 45 (6.4)	46 (6.4)	9 (4.9)
California, US	s 56 (5.4)	36 (5.4)	8 (3.2)	s 74 (5.3)	26 (5.3)	0 (0.0)	s 13 (3.6)	55 (5.2)	33 (5.3)	s 31 (5.1)	46 (5.4)	23 (5.6)
Colorado, US	s 47 (7.3)	43 (7.4)	11 (4.2)	s 85 (4.5)	15 (4.5)	0 (0.0)	s 34 (6.6)	60 (7.7)	6 (3.8)	s 73 (5.7)	27 (5.7)	0 (0.0)
Connecticut, US	s 34 (6.6)	51 (5.5)	15 (4.5)	s 89 (3.8)	11 (3.8)	0 (0.0)	s 45 (6.4)	51 (6.2)	4 (1.2)	s 86 (4.3)	12 (3.9)	1 (1.4)
Florida, US	x x	x x	x x	x x	x x	x x	x x	x x	x x	x x	x x	x x
Indiana, US	s 54 (5.9)	34 (5.9)	11 (5.0)	s 72 (6.7)	27 (6.7)	1 (0.8)	s 9 (3.7)	69 (5.9)	22 (5.3)	s 50 (7.5)	41 (6.8)	9 (3.2)
Massachusetts, US	s 43 (7.5)	55 (7.3)	2 (1.4)	s 85 (5.0)	15 (5.0)	0 (0.0)	s 19 (6.0)	61 (6.5)	20 (5.6)	s 73 (6.3)	27 (6.3)	0 (0.0)
Minnesota, US	r 70 (4.7)	27 (5.3)	4 (1.9)	r 87 (3.7)	13 (3.7)	0 (0.0)	r 15 (5.6)	70 (6.9)	15 (4.8)	r 48 (5.4)	48 (5.7)	4 (2.1)
North Carolina, US	s 64 (8.5)	33 (8.5)	3 (2.6)	s 75 (7.4)	25 (7.4)	0 (0.0)	s 10 (4.6)	72 (6.5)	17 (6.6)	s 39 (7.4)	52 (7.9)	9 (4.2)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



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# Appendices



# Appendix A

## Countries Participating in TIMSS 2011 and in Earlier TIMSS Assessments

Appendix A.1: Countries Participating in TIMSS 2011 and in Earlier TIMSS Assessments

Country	Grade 4				Grade 8				
	2011	2007	2003	1995	2011	2007	2003	1999	1995
Armenia	●	○	●		●	○	●		
Australia	●	●	●	●	●	●	●	○	●
Austria	●	●		●					●
Azerbaijan	●								
Bahrain	●				●	●	●		
Belgium (Flemish)	●		●				●	●	●
Botswana						●	●		
Chile	●				●		●	●	
Chinese Taipei	●	●	●		●	●	●	●	
Croatia	●								
Czech Republic	●	●		●		●		●	●
Denmark	●	●							●
England	●	●	●	●	●	●	●	●	●
<sup>1</sup> Finland	●				●			○	
Georgia	●	●			●	●			
Germany	●	●							●
Ghana					●	●	●		
Hong Kong SAR	●	●	●	●	●	●	●	●	●
Hungary	●	●	●	●	●	●	●	●	●
Indonesia				○	●	●	○	○	○
Iran, Islamic Rep. of	●	●	●	●	●	●	●	●	●
Ireland	●			●					●
Israel				●	●	○	○	○	○
Italy	●	●	●	○	●	●	●	●	○
Japan	●	●	●	●	●	●	●	●	●
Jordan					●	●	●	●	
Kazakhstan	●	○			●				
Korea, Rep. of	●			●	●	●	●	●	●
Kuwait	●	○		○		○			○
Lebanon					●	●	●		
Lithuania	●	●	●		●	●	●	●	●
Macedonia, Rep. of					●	●	●	●	
Malaysia					●	●	●	●	
Malta	●					●			
Morocco	●	●	●		●	○	○	○	
Netherlands	●	●	●	●			●	●	●
New Zealand	●	●	●	●	●		●	●	●
Northern Ireland	●								
Norway	●	●	●	●	●	●	●		●
Oman	●				●	●	●		
Palestinian Nat'l Auth.					●	●	●		
Poland	●								
Portugal	●			●					●
Qatar	●	○			●	○			
Romania	●				●	●	●	●	●
Russian Federation	●	●	●		●	●	●	●	●
Saudi Arabia	●				●	○	○		
Serbia	●					●	●		
Singapore	●	●	●	●	●	●	●	●	●
Slovak Republic	●	●					●	●	●
Slovenia	●	●	●	●	●	●	●	○	●
South Africa							●	●	○
Spain	●								●
Sweden	●	●			●	●	●		●
Syrian Arab Republic					●	●	○		
Thailand	●			○	●	●		●	○
Tunisia	●	●	●		●	●	●	●	
Turkey	●				●	○		○	
Ukraine		●			●	●			
United Arab Emirates	●				●				
United States	●	●	●	●	●	●	●	●	●
Yemen	●	●	○						

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

● Indicates participation in that testing cycle.

○ Indicates participation but data not comparable for measuring trends to 2011, primarily due to countries improving translations or increasing population coverage.

<sup>1</sup> Finland assessed their fourth and eighth grade students in 2011. Also, to measure trends from their 1999 seventh grade results, Finland assessed their seventh grade students in 2011 as well.

**Appendix A.1: Countries Participating in TIMSS 2011 and in Earlier TIMSS Assessments (Continued)**

Country	Grade 4				Grade 8				
	2011	2007	2003	1995	2011	2007	2003	1999	1995
<b>Out of Grade Participants</b>									
Botswana (6,9)	●				●				
Honduras (6,9)	●				●				
South Africa (9)					●				
Yemen (6)	●								
<b>Benchmarking Participants</b>									
Alberta, Canada	●	●		●	●			●	●
Ontario, Canada	●	●	●	●	●	●	●	●	●
Quebec, Canada	●	●	●	●	●	●	●	●	●
Abu Dhabi, UAE	●				●				
Dubai, UAE	●	●			●	●			
Alabama, US					●				
California, US					●				
Colorado, US				●	●				
Connecticut, US					●			●	
Florida, US	●				●				
Indiana, US			●		●		●	●	
Massachusetts, US		●			●	●		●	
Minnesota, US		●		●	●	●			●
North Carolina, US	●				●			●	

● Indicates participation in that testing cycle.

○ Indicates participation but data not comparable for measuring trends to 2011, primarily due to countries improving translations or increasing population coverage.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



# Appendix B

## Characteristics of the Items in the TIMSS 2011 Science Assessment

**Appendix B.1: Distribution of Assessment Items by Content Domain, Cognitive Domain, and Item Format**

TIMSS Assessment Items	Multiple-choice Items	Constructed-response Items	Total Items	Percentage of Score Points
<b>Content Domain</b>				
Life Science	36 (36)	39 (46)	75 (82)	45%
Physical Science	37 (37)	26 (27)	63 (64)	35%
Earth Science	20 (20)	14 (18)	34 (38)	21%
<b>Total</b>	<b>93 (93)</b>	<b>79 (91)</b>	<b>172 (184)</b>	<b>100%</b>
Percentage of Score Points	51%	49%		
<b>Cognitive Domain</b>				
Knowing	42 (42)	27 (34)	69 (76)	41%
Applying	38 (38)	33 (37)	71 (75)	41%
Reasoning	13 (13)	19 (20)	32 (33)	18%
<b>Total</b>	<b>93 (93)</b>	<b>79 (91)</b>	<b>172 (184)</b>	<b>100%</b>
Percentage of Score Points	51%	49%		

Score points are shown in parentheses.  
Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Appendix B.2: Distribution of Assessment Items by Content Domain, Cognitive Domain, and Item Format**

TIMSS Assessment Items	Multiple-choice Items	Constructed-response Items	Total Items	Percentage of Score Points
<b>Content Domain</b>				
Biology	38 (38)	41 (49)	79 (87)	37%
Chemistry	22 (22)	22 (25)	44 (47)	20%
Physics	29 (29)	26 (29)	55 (58)	25%
Earth Science	21 (21)	18 (21)	39 (42)	18%
Total	110 (110)	107 (124)	217 (234)	100%
Percentage of Score Points	47%	53%		
<b>Cognitive Domain</b>				
Knowing	58 (58)	15 (18)	73 (76)	32%
Applying	40 (40)	52 (63)	92 (103)	44%
Reasoning	12 (12)	40 (43)	52 (55)	24%
Total	110 (110)	107 (124)	217 (234)	100%
Percentage of Score Points	47%	53%		

Score points are shown in parentheses.  
Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



# Appendix C

## Population Coverage and Sample Participation Rates

## Appendix C.1: Information about the Students Assessed in TIMSS 2011

Reported by National Research Coordinators

Country	Grade 4		Grade 8		Information About Age of Entry, Promotion, and Retention
	Country's Name for Fourth Year of Formal Schooling*	Average Age at Time of Testing	Country's Name for Eighth Year of Formal Schooling*	Average Age at Time of Testing	
Armenia	Grade 4	10.0	Grade 8	14.6	Children must be 6 years old to begin school the following December 31st. The age of entry policy has changed within the past ten years. Promotion is automatic for Grades 1–5, but dependent on academic progress for Grades 6–8.
Australia	Year 4	10.0	Year 8	14.0	Varies by state, but children generally must begin school by age 6. Most children actually begin school at the minimum age of 4.5–5, and the age of entry policy has been revised within the past ten years. Policy on promotion and retention varies by state but, generally, there is automatic promotion for Grades 1–8.
Austria	Grade 4	10.3			Children must begin school in the September following their 6th birthday, but parents can request early admission for children who turn 6 by March 1st of the following year. Automatic promotion for Grade 1, but there is retention in Grades 2–4 for students failing one or more compulsory subjects.
Azerbaijan	Grade 4	10.2			Children must be 6 years old by the end of September to begin school on September 15 of that year, but children the Ministry of Education identifies as talented who are born before the end of November can begin school in September of the year they turn 6. Promotion is automatic for Grades 1–4, but is dependent on academic progress for Grades 5–8.
Bahrain	Grade 5	10.4	3rd Intermediate	14.4	Parents must register their children at school when they are 7 years old. Children must be 6 years old by the end of June to begin the following September. The age of entry policy has changed within the past ten years. Promotion is dependent upon passing Arabic, Mathematics, Science, and English.
Belgium (Flemish)	Grade 4	10.0			Children must begin school on September 1st of the year of their 6th birthday. Parents can keep their child in kindergarten until age 7, with approval. Promotion is decided by each school and/or parents; students not having fully attended preprimary education must pass a language qualification test to begin primary school.
Chile	Grade 4	10.1	Grade 8	14.2	Compulsory schooling begins at age 6. Children must be 6 years old by March 31st to begin in March of the same calendar year. Promotion is dependent on academic progress for all grades.
Chinese Taipei	Grade 4	10.2	Grade 8	14.2	Children must be 6 years old before September 1st to begin school in the September of the same calendar year. There is automatic promotion for Grades 1–8.
Croatia	Grade 4	10.7			The age of entry policy, which has changed within the past ten years, says that all children must begin school by 7 years old. Although children must be at least 6 years old by the end of March to begin the following September, children typically begin school at age 7. Student promotion is dependent on meeting minimum standards in Grades 1–8.
Czech Republic	Grade 4	10.4			Compulsory schooling begins at the beginning of the school year (September 1st) following the child's 6th birthday unless granted a postponement, which an increasing number of parents are seeking. Promotion is dependent on academic progress in all compulsory subjects, but is automatic for students who have repeated a year.
Denmark	Grade 4	11.0			Children begin preprimary education the year they turn 6 and primary education the following year. Delaying entry by a year requires municipal board approval, but parents can have their child begin a year early. This policy has changed within the past ten years. There is automatic promotion in Grades 1–8, though in special cases students may be promoted or retained based on individual assessments, with parental consent.
England	Year 5	10.2	Year 9	14.2	Children begin school the term (typically September, January, or April) of their 5th birthday. Many local authorities make provision for all children to begin in the September of the school year in which they will turn 5 and some have changed the discretionary time so that children can begin at a younger age, although all of this is subject to parental discretion. There is no policy on promotion and retention.
Finland	Grade 4	10.8	Grade 8	14.8	Children begin school the autumn of the year of their 7th birthday, although it is possible to enter school either one year earlier or one year later than the official policy, following discussions with an expert (e.g., school psychologist). There is automatic promotion for Grades 1–8, with retention only in extreme situations.
Georgia	Grade 4	10.0	Grade 8	14.2	Compulsory schooling begins at age 6 according to the Law on General Education, which has been updated within the past ten years. Promotion is automatic for Grades 1–4, and dependent on academic progress for Grades 5–8.
Germany	Grade 4	10.4			Compulsory schooling begins the year a child turns 6. Children must be at least 6 years old before a statutory qualifying date (which varies by state; in most states the date falls between June 30th and September 30th) to begin on August 1st. The official policy grants parents the right to request early admission or postponed enrollment, but the school administration has the final decision. The policy on age of entry has been revised within the past ten years. There is automatic promotion in Grade 1, and promotion policies differ between states for later grades.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

\* The TIMSS target population is the grade that represents four years or eight years of schooling counting from the first year of ISCED Level 1. However, IEA has a policy that students do not fall under the minimum average age of 9.5 years old (Fourth grade) or 13.5 years old (Eighth grade) at the time of testing, so England, Malta, and New Zealand assessed students in their fifth year or ninth year of formal schooling.

Country	Grade 4		Grade 8		Information About Age of Entry, Promotion, and Retention
	Country's Name for Fourth Year of Formal Schooling*	Average Age at Time of Testing	Country's Name for Eighth Year of Formal Schooling*	Average Age at Time of Testing	
Ghana			Junior High School Form Two	15.8	Children begin school the calendar year of their 6th birthday. Promotion is automatic in Grades 1–6 and dependent on academic progress for Grades 7–9. Promotion is mostly automatic in public schools.
Hong Kong SAR	Primary 4	10.1	Secondary 2	14.2	Children begin school the September after they turn 5 years, 8 months old. Representatives of the Education Bureau may prescribe a maximum rate of repetition.
Hungary	Grade 4	10.7	Grade 8	14.7	Children begin school during the calendar year they turn 6 if their birthday is before May 31st; however, children may begin during the calendar year of their 6th, 7th, or 8th birthday at parental request. Promotion is automatic in Grades 1–3, and dependent on academic progress for Grades 4–8.
Indonesia			Grade 8	14.3	Children must be 7 years old by the end of June to begin on July 12th, although parents have some choice in starting children at age 6. Promotion is dependent on academic progress for Grades 1–8.
Iran, Islamic Rep. of	Grade 4	10.2	Grade 8	14.3	Children must be 6 years old by September 22nd to begin school September 23rd, although there are few private schools that allow registration at 6.5 years. Students with failing grades in June must take a cumulative exam in September to determine promotion or retention.
Ireland	Fourth Class	10.3			The Education (Welfare) Act of 2000 requires children to attend primary schools from the time that they are 6 years old but not before they are 4. In practice, nearly half of 4-year-olds and almost all 5-year-olds are enrolled in infant classes in primary schools. Children only are allowed to repeat a year for educational reasons and in exceptional circumstances.
Israel			Grade 8	14.0	The official policy is that children begin school the calendar year of their 6th birthday, but parents have the final say if they feel their children are not ready to begin. There is retention only in exceptional cases.
Italy	Grade 4	9.7	Grade 8	13.8	Children begin school the calendar year of their 6th birthday, but parents can enroll children who will turn 6 years old by April 30th of the following calendar year in the calendar year of their 5th birthday. The age of entry policy has been revised within the past ten years. Promotion is dependent on academic progress for Grades 1–8.
Japan	Grade 4	10.5	Grade 8	14.5	Compulsory schooling begins at age 6, and children must be 6 years old by April 1st to start school. There is no policy for promotion and retention.
Jordan			Grade 8	13.9	Compulsory schooling begins at 6 years old. Children must be at least 5 years, 8 months old by September 1st to begin school. Promotion is dependent on academic progress in Arabic and mathematics for Grades 1–3, with parental consent, and dependent on academic progress for Grades 4–8. Students should not repeat a grade more than twice.
Kazakhstan	Grade 4	10.4	Grade 8	14.6	According to the Law of Education (2007), children must begin school at age 6, though parents can postpone enrollment for one year. The age of entry policy has changed within the past ten years. Promotion is dependent on academic progress for Grades 1–4, and dependent on successfully passing exams for Grades 5–8.
Korea, Rep. of	Grade 4	10.4	Grade 8	14.3	Children begin school during the calendar year of their 6th birthday, and must be 6 years old by the end of December to begin school in March of that year. Parents can decide to send their children a year later (at age 7), for health reasons, or a year early (at age 5). Promotion is dependent on academic progress and attendance for Grades 1–8.
Kuwait	Grade 4	9.7			Children must be 6 years old by March 15th to begin school that calendar year, and children typically begin primary school at age 5.5 or 6. Promotion is automatic for Grades 1–3 and dependent on academic progress for Grades 4–8.
Lebanon			Grade 8	14.3	Children must be 6 years old by the end of June to begin school the following September, although in public schools, special cases may be authorized by the Ministry of Education. Promotion is automatic for Grades 1–6 and dependent on academic progress for Grades 7–8.
Lithuania	Grade 4	10.7	Grade 8	14.7	Children must begin school by the calendar year of their 7th birthday, but parents can enroll children one year early if the child satisfies the requirements of the Ministry of Education and Science. The age of entry policy has been revised within the past ten years. There is no national policy on promotion and retention; decisions are made at the school level.
Macedonia, Rep. of			Grade 8	14.7	Since 2007, children must be 6 years old by the end of December to begin school the following September. Before 2007, children had to be 6 years old by the end of May to begin school the following September. Promotion is automatic for Grades 1–5 and dependent on academic progress for Grades 6–8.
Malaysia			Form 2	14.4	Children begin school at the beginning of January of the calendar year of their 6th birthday. There is no policy for promotion and retention.
Malta	Year 5	9.8			Children begin school in late September of the calendar year of their 5th birthday. Students repeat a class only in exceptional circumstances in primary school and on the basis of their academic performance and other factors in exceptional circumstances in secondary school. Students can be retained only once during each education cycle.

Country	Grade 4		Grade 8		Information About Age of Entry, Promotion, and Retention
	Country's Name for Fourth Year of Formal Schooling*	Average Age at Time of Testing	Country's Name for Eighth Year of Formal Schooling*	Average Age at Time of Testing	
Morocco	Grade 4	10.5	Grade 8	14.7	Children must be at least 5 years, 6 months old by the beginning of September to begin school, and parents rarely postpone the start. Promotion depends on academic progress for both primary and secondary grades.
Netherlands	Group 6	10.2			Children must begin kindergarten on the first school day of the month after their 5th birthday. Most children begin kindergarten when they turn 4 and primary education at age 6, although some children begin primary education a year later at age 7. Promotion and retention are decided by the school, dependent on academic progress.
New Zealand	Year 5	9.9	Year 9	14.1	Children must be enrolled in school by their 6th birthday but have the right to begin school at age 5, and nearly all children begin school on or soon after their 5th birthday. There is automatic promotion, with retention only in very special circumstances with school and parental input.
Northern Ireland	Year 6	10.4			Children must be 4 years old by July 1st to begin school in September. The majority of children start and continue with their age group, but some transfer to post-primary a year late or early.
Norway	Grade 4 (4. trinn)	9.7	Grade 8 (8.trinn)	13.7	Children must begin school the calendar year of their 6th birthday. There is automatic promotion for all grades.
Oman	Grade 4	9.9	Grade 8	14.1	Children begin school the year of their 6th birthday. Children must be at least 5 years, 9 months old at the start of the academic year (beginning of September), but parents can enroll their children in private schools where the official entry age is 5 years, 5 months. The age of entry policy has been revised within the past ten years. Promotion is automatic for Grades 1–4 and dependent on academic progress for Grades 5–8.
Palestinian Nat'l Auth.			Grade 8	13.9	Children must be 5 years, 9 months old by the beginning of the September in which they enroll. Parents can enroll children in private schools two months earlier than public schools. Promotion is automatic for Grades 1–3 and dependent on academic progress for Grades 4–8. A maximum of 5% of students in each class may be retained.
Poland	Grade 3	9.9			Children must begin school the calendar year of their 7th birthday, but parents can postpone the beginning of school for medical or psychological reasons. The age of entry policy has been revised within the past ten years. Parental consent is required for retention in Grades 1–6, and promotion is dependent upon academic progress in higher grades.
Portugal	Grade 4	10.0			Children must begin school the year of their 6th birthday if they turn 6 years old by September 15th. Parents can enroll children who turn 6 years old by the end of December, depending on school availability. The age of entry policy has been revised within the past ten years. Promotion is automatic for Grade 1, and dependent on academic progress for Grades 2–8.
Qatar	Grade 4	10.0	Grade 8	14.0	Children must begin school in the September of the calendar year of their 6th birthday, but parents can enroll their children in private schools where the official entry age is 5 years, 5 months. Promotion is dependent on academic progress for Grades 1–8.
Romania	Grade 4	10.9	Grade 8	14.9	According to the law of education, which has been revised within the past ten years, children must begin school at age 6, although parents can postpone enrollment for one year. Promotion is automatic for Grade 1, and dependent on academic progress for Grades 2–8.
Russian Federation	Grade 4	10.8	Grade 8	14.7	Children must be at least 6 years, 6 months old by the end of August to begin school in September but typically begin at age 7. Promotion is automatic for Grade 1 and dependent on academic progress for Grades 2–8.
Saudi Arabia	Grade 4	10.0	Intermediate Year 2	14.1	Children must begin school the calendar year of their 6th birthday. There is no policy on promotion and retention.
Serbia	Grade 4	10.8			Children must begin school between the ages of 6.5 and 7.5 years old. Schools may recommend one year of continued preparatory preschool for children not considered school ready. The age of entry policy has changed within the past ten years. Promotion is automatic for Grade 1 and generally automatic for Grades 2–3, except by parental request. In Grades 4–7, students failing 2 or more subjects must pass makeup exams.
Singapore	Primary 4	10.4	Secondary 2	14.4	According to the Compulsory Education Act, children must begin school the calendar year of their 7th birthday, although parents may seek a deferral of registration based on medical grounds. There is automatic promotion for Grades 1–4; retention is at principal's discretion for Grade 5 and dependent on academic progress for Grades 6–8.
Slovak Republic	Grade 4	10.4			Children must begin school in September if they turn 6 years old by August 31st. Children may begin school early or after an approved delay, based on psychological tests and professional recommendations. Promotion is dependent on academic progress. Students failing 1–2 required subjects must pass a makeup exam; students failing more than 2 are retained.
Slovenia	Grade 4	9.9	Grade 8	13.9	Children must begin school the calendar year of their 6th birthday, but some children who are 6 years old in January enter school in the September of the calendar year before they turn 6. The age of entry policy has been revised within the past ten years. Generally, there is automatic promotion for Grades 1–8, except for students with learning difficulties.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Appendix C.1: Information about the Students Assessed in TIMSS 2011 (Continued)

Country	Grade 4		Grade 8		Information About Age of Entry, Promotion, and Retention
	Country's Name for Fourth Year of Formal Schooling*	Average Age at Time of Testing	Country's Name for Eighth Year of Formal Schooling*	Average Age at Time of Testing	
Spain	Primary Education Year 4	9.8			Children must begin school the calendar year of their 6th birthday. Almost every child begins kindergarten at the age of 3 even though it is not compulsory. Students can be retained for 1 year during Grades 1–6, but students with special needs can be retained twice. Students that don't reach the goals in Grades 7 and 8 can be retained in both grades.
Sweden	Grade 4	10.7	Grade 8	14.8	Children begin school in the fall of the calendar year of their 7th birthday but can begin the year they turn 6 or 8 years old for special reasons. There is automatic promotion for all grades.
Syrian Arab Republic			Grade 8	13.9	Children must begin school the September following their 6th birthday. Promotion for Grades 1–8 is based on academic progress, but promotion is automatic when a student fails a grade for the second time.
Thailand	Primary 4	10.5	Middle School 2	14.3	Children must begin school by the year of their 7th birthday, but can begin at the age of 6. There is no policy for promotion and retention.
Tunisia	Year 4 of Primary Education	10.0	Year 8 of Basic Education	14.3	Children begin school in the September of the calendar year of their 6th birthday. Younger children are accepted if there are school vacancies in the area where they live. Promotion is dependent on academic progress in Arabic, French, mathematics, and science for Grades 1–6, and dependent on academic progress for Grades 7–8.
Turkey	Grade 4	10.1	Grade 8	14.0	Children begin school in September of the calendar year of their 6th birthday, although they can begin a year later, at parental discretion. Promotion is automatic for Grades 1–3 and dependent on academic progress for Grades 4–8.
Ukraine			Grade 8	14.2	Compulsory schooling begins at age 6. Children must be at least 6 years old by September 1st to begin school, and parents can decide if children begin school at age 6 or 7. Retention is decided by parents, and students can take external examinations to advance into higher grade levels.
United Arab Emirates	Grade 4	9.8	Grade 8	13.9	Children can begin school when they are 5.5 years old. Parents or guardians can decide when children begin school, but it must be by age 8. The age of entry policy has been revised within the past ten years. Students in Grades 1–5 are subject to remedial instruction for promotion, and promotion in Grades 6–8 is dependent on academic achievement.
United States	Grade 4	10.2	Grade 8	14.2	Varies by state, but children commonly begin kindergarten at age 5 (by parental choice) and typically begin primary school at age 6 (by law).
Yemen	Grade 4	11.2			Children can begin school the year of their 6th birthday, but some flexibility exists at the discretion of the school's director. Promotion is automatic for Grades 1–3 and dependent on academic progress for Grades 4–8.

Out of Grade Participants

Botswana	Standard 6	12.8	Form 2	15.8	Children must be 6 years old by the end of June to begin school in the January of the same calendar year, but children from remote areas may begin school later than age 6. There is up to 12.5% retention in each class and accelerated progression is possible after parent consultation.
Honduras	Grade 6	12.7	Grade 9	15.7	Children must be 7 years old by the end of January to begin school the following February, but about 30% of children typically begin primary school at age 6, per principals' decisions. Promotion is dependent on academic progress on exams prepared and administered by teachers.
South Africa			Grade 9	16.0	Children must be 6 years old by June 30th of the year in which they enroll and children are encouraged to begin at age 7. The age of entry policy has been revised within the past ten years. In principle, students should progress with their age cohort. The norm for repetition is one year per school phase where necessary.
Yemen	Grade 6	13.2			Children can begin school the year of their 6th birthday, but some flexibility exists at the discretion of the school's director. Promotion is automatic for Grades 1–3 and dependent on academic progress for Grades 4–8.

Country	Grade 4		Grade 8		Information About Age of Entry, Promotion, and Retention
	Country's Name for Fourth Year of Formal Schooling*	Average Age at Time of Testing	Country's Name for Eighth Year of Formal Schooling*	Average Age at Time of Testing	
<b>Benchmarking Participants</b>					
Alberta, Canada	Grade 4	9.9	Grade 8	13.9	The law requires all children who are 6 years old by September 1 to attend school, although school boards may set their own age requirements for entering school, and many allow children to enter Grade 1 if they are 6 years old by March 1 of the following year. Parental discretion or choice is allowed. School principals make promotion decisions in line with school policies.
Ontario, Canada	Grade 4	9.8	Grade 8	13.8	Children must attend school in September if they turn 6 years old by September 1 but also have the right to attend school in September if they will turn 6 by December 31 of that calendar year. Parents may choose to enroll their children in junior kindergarten at age 4 or senior kindergarten at age 5. School principals make promotion decisions, appealable to the school board.
Quebec, Canada	Grade 4	10.1	Secondary 2	14.2	Children must be 6 years old by September 30th to begin school in the September of that calendar year. School boards determine promotion and the Ministry sets rules for obtaining diplomas.
Abu Dhabi, UAE	Grade 4	9.7	Grade 8	13.8	Children must be 6 years old by October 1st of the school year in which they enroll. Parents sometimes place students in private schools that accept younger students, then transfer them to the public system. The age of entry policy has changed within the past ten years. There is automatic promotion in Grades 1–5, except in special cases and with parental consent. Promotion is dependent on academic progress in Grades 6–8.
Dubai, UAE	Grade 4	9.8	Grade 8	13.9	Children can begin school the calendar year of their 5th birthday. The policy on promotion and retention varies by school type.
Alabama, US			Grade 8	14.4	According to the code of Alabama 1875 Section 16-28-3, children must begin school at age 7, and typically children actually do begin at age 7. The age of entry policy has changed within the past ten years. There is no policy for promotion or retention.
California, US			Grade 8	14.1	California law requires a child to be 6 years old on or before December 2 for the 2011-12 school year to enter Grade 1. However, the cut-off date for entry is in the process of being moved earlier by several months (California Education Code Section 48010). Although kindergarten is not required, most parents and guardians choose to enroll their children in kindergarten. There is no policy for promotion and retention.
Colorado, US			Grade 8	14.2	Children 6 years old on or before August 1st are required to begin school during that calendar year. Parents may opt to send their children to private or parochial schools or home school them if they choose not to meet the state policy. The age of entry policy has changed within the past ten years. Promotion and retention policies are decided by local education agencies.
Connecticut, US			Grade 8	14.1	Children must begin school by the time they are 7 years old. A 4-year-old may enroll in preprimary education (kindergarten) at the beginning of a school year (August or September) if he or she will turn 5 on or before January 1 of that school year. Some parents elect to delay school enrollment for younger children, and state law allows this practice provided students are enrolled in school when they are 7 years of age. Promotion and retention decisions are made locally at the district or school level.
Florida, US	Grade 4	10.4	Grade 8	14.4	Florida law (Section 1003.21 (1) (a)) specifies that children who are 6 or who will be 6 by February 1st of that school year are required to attend school. If a child enters public school at age 6 without completing kindergarten, they will be placed in kindergarten. Children who have attained the age of 5 on or before September 1 of the school year are eligible for admission to public kindergarten during that school year based on rules prescribed by the school board. Statewide, students are retained after Grade 3 if they do not pass the state reading assessment. Otherwise, policies for promotion and retention are determined by districts, based on academic performance.
Indiana, US			Grade 8	14.4	Children are not required to be in school until the school year in which they turn 7 years old. Children must be 5 years old on or before August 1st to begin kindergarten during that calendar year. Students are retained after Grade 3 if they do not pass the state reading assessment.
Massachusetts, US			Grade 8	14.2	Each child must attend school beginning in September of the calendar year in which he or she turns 6. Each school committee may establish its own minimum permissible age for school attendance, provided that such age is not older than the state mandatory minimum age (established by state law 603CMR 8.00). There is no policy for promotion and retention.
Minnesota, US			Grade 8	14.3	Compulsory schooling begins at age 7. Children must be at least 5 years old by September 1st to begin kindergarten, or 6 years old by September 1st to begin Grade 1 (MN Statute 120A.20). Any school board may establish a policy for admission at an earlier age. There is no policy for promotion and retention.
North Carolina, US	Grade 4	10.2	Grade 8	14.2	Compulsory schooling begins at age 7. If the child is 5 years old on or before August 31st the child is eligible to begin kindergarten. The statute recognizes that some students will be presented for enrollment who can be more appropriately served at a higher grade level, and it authorizes the school principal to make such decisions. There is no policy for promotion and retention.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

## Appendix C.2: Coverage of TIMSS 2011 Target Population

Country	International Target Population		Exclusions from National Target Population		
	Coverage	Notes on Coverage	School-level Exclusions	Within-sample Exclusions	Overall Exclusions
Armenia	100%		2.0%	0.0%	2.0%
Australia	100%		2.1%	2.3%	4.4%
Austria	100%		1.3%	3.8%	5.1%
<sup>2 a</sup> Azerbaijan	100%		2.3%	4.9%	7.2%
Bahrain	100%		0.4%	0.7%	1.1%
Belgium (Flemish)	100%		0.5%	4.5%	5.0%
Chile	100%		1.8%	1.9%	3.7%
Chinese Taipei	100%		0.1%	1.4%	1.4%
<sup>2</sup> Croatia	100%		2.9%	5.0%	7.9%
Czech Republic	100%		4.1%	0.9%	5.1%
<sup>2</sup> Denmark	100%		1.6%	4.7%	6.3%
England	100%		1.7%	0.4%	2.0%
Finland	100%		1.6%	1.5%	3.1%
<sup>1 a</sup> Georgia	92%	Students taught in Georgian	1.4%	3.5%	4.9%
Germany	100%		0.9%	1.0%	1.9%
<sup>2</sup> Hong Kong SAR	100%		5.8%	2.7%	8.6%
Hungary	100%		2.2%	2.0%	4.2%
Iran, Islamic Rep. of	100%		4.4%	0.1%	4.5%
Ireland	100%		1.6%	0.9%	2.5%
Italy	100%		0.0%	3.7%	3.7%
Japan	100%		2.2%	1.0%	3.2%
<sup>2</sup> Kazakhstan	100%		3.7%	2.5%	6.3%
Korea, Rep. of	100%		1.5%	1.0%	2.5%
<sup>1</sup> Kuwait	78%	Students in public schools	0.3%	0.0%	0.3%
<sup>1 2</sup> Lithuania	93%	Students taught in Lithuanian	1.9%	3.7%	5.6%
Malta	100%		0.0%	3.6%	3.6%
Morocco	100%		2.0%	0.0%	2.0%
Netherlands	100%		3.7%	0.4%	4.0%
New Zealand	100%		2.8%	2.2%	4.9%
Northern Ireland	100%		2.6%	0.9%	3.5%
Norway	100%		0.9%	3.3%	4.3%
Oman	100%		0.8%	0.7%	1.5%
Poland	100%		2.3%	1.5%	3.8%
Portugal	100%		1.4%	1.1%	2.5%
<sup>2</sup> Qatar	100%		4.3%	1.9%	6.2%
Romania	100%		1.1%	2.9%	4.0%
Russian Federation	100%		2.9%	2.4%	5.3%
Saudi Arabia	100%		1.4%	0.2%	1.6%
<sup>2</sup> Serbia	100%		5.3%	4.1%	9.4%
<sup>2</sup> Singapore	100%		5.9%	0.4%	6.3%
Slovak Republic	100%		3.8%	0.8%	4.6%
Slovenia	100%		2.3%	0.3%	2.6%
Spain	100%		1.6%	3.6%	5.3%
Sweden	100%		1.9%	2.2%	4.1%
Thailand	100%		1.5%	0.0%	1.5%
Tunisia	100%		2.3%	0.1%	2.5%
Turkey	100%		1.0%	1.5%	2.5%
United Arab Emirates	100%		1.4%	1.8%	3.3%
<sup>2</sup> United States	100%		0.0%	7.0%	7.0%
Yemen	100%		3.0%	0.7%	3.7%

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

- 1 National Target Population does not include all of the International Target Population.
- 2 National Defined Population covers 90% to 95% of National Target Population.
- 3 National Defined population covers less than 90% of National Target population (but at least 77%).
- a Exclusion rates for Azerbaijan and Georgia are slightly underestimated as some conflict zones were not covered and no official statistics were available.

**Appendix C.2: Coverage of TIMSS 2011 Target Population (Continued)**

Country	International Target Population		Exclusions from National Target Population		
	Coverage	Notes on Coverage	School-level Exclusions	Within-sample Exclusions	Overall Exclusions
<b>Sixth Grade Participants</b>					
Botswana	100%		0.1%	0.2%	0.3%
Honduras	100%		3.8%	0.7%	4.5%
Yemen	100%		3.3%	0.7%	4.0%
<b>Benchmarking Participants</b>					
<sup>2</sup> Alberta, Canada	100%		1.5%	6.1%	7.5%
Ontario, Canada	100%		1.0%	4.3%	5.3%
Quebec, Canada	100%		2.7%	1.0%	3.7%
Abu Dhabi, UAE	100%		1.4%	1.3%	2.7%
Dubai, UAE	100%		0.4%	4.8%	5.1%
<sup>1 3</sup> Florida, US	89%	Students in public schools	0.0%	12.1%	12.1%
<sup>1 2</sup> North Carolina, US	93%	Students in public schools	0.0%	10.1%	10.1%

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

### Appendix C.3: Coverage of TIMSS 2011 Target Population

Country	International Target Population		Exclusions from National Target Population		
	Coverage	Notes on Coverage	School-level Exclusions	Within-sample Exclusions	Overall Exclusions
Armenia	100%		1.5%	0.0%	1.5%
Australia	100%		1.3%	1.9%	3.2%
Bahrain	100%		0.5%	1.1%	1.6%
Chile	100%		1.1%	1.7%	2.8%
Chinese Taipei	100%		0.1%	1.2%	1.3%
England	100%		2.2%	0.1%	2.2%
Finland	100%		2.6%	0.9%	3.4%
<sup>1 a</sup> Georgia	93%	Students taught in Georgian	0.9%	3.7%	4.5%
Ghana	100%		0.6%	0.0%	0.6%
Hong Kong SAR	100%		3.9%	1.3%	5.3%
Hungary	100%		2.3%	2.1%	4.4%
Indonesia	100%		3.2%	0.0%	3.2%
Iran, Islamic Rep. of	100%		2.2%	0.0%	2.2%
<sup>3</sup> Israel	100%		16.4%	6.1%	22.6%
Italy	100%		0.0%	4.6%	4.7%
Japan	100%		1.8%	1.0%	2.8%
Jordan	100%		0.0%	0.4%	0.4%
Kazakhstan	100%		3.8%	1.3%	5.1%
Korea, Rep. of	100%		1.0%	0.9%	1.9%
Lebanon	100%		1.4%	0.0%	1.4%
<sup>1</sup> Lithuania	93%	Students taught in Lithuanian	1.4%	3.4%	4.8%
Macedonia, Rep. of	100%		2.8%	0.6%	3.3%
Malaysia	100%		0.1%	0.0%	0.1%
Morocco	100%		0.1%	0.0%	0.1%
New Zealand	100%		2.0%	1.2%	3.2%
Norway	100%		0.5%	1.4%	1.9%
Oman	100%		0.9%	0.3%	1.2%
Palestinian Nat'l Auth.	100%		0.6%	0.9%	1.5%
Qatar	100%		4.0%	0.5%	4.5%
Romania	100%		0.0%	1.2%	1.3%
<sup>2</sup> Russian Federation	100%		2.9%	3.1%	6.0%
Saudi Arabia	100%		1.2%	0.1%	1.2%
<sup>2</sup> Singapore	100%		5.7%	0.4%	6.0%
Slovenia	100%		1.7%	0.6%	2.3%
Sweden	100%		2.2%	2.9%	5.1%
Syrian Arab Republic	100%		1.9%	0.0%	1.9%
Thailand	100%		1.4%	0.1%	1.5%
Tunisia	100%		0.3%	0.1%	0.3%
Turkey	100%		0.2%	1.2%	1.5%
Ukraine	100%		2.5%	0.4%	2.8%
United Arab Emirates	100%		1.5%	1.3%	2.8%
<sup>2</sup> United States	100%		0.0%	7.2%	7.2%

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

- 1 National Target Population does not include all of the International Target Population.
- 2 National Defined Population covers 90% to 95% of National Target Population.
- 3 National Defined population covers less than 90% of National Target population (but at least 77%).
- a Exclusion rates for Georgia are slightly underestimated as some conflict zones were not covered and no official statistics were available.

**Appendix C.3: Coverage of TIMSS 2011 Target Population (Continued)**

Country	International Target Population		Exclusions from National Target Population		
	Coverage	Notes on Coverage	School-level Exclusions	Within-sample Exclusions	Overall Exclusions
<b>Ninth Grade Participants</b>					
Botswana	100%		0.0%	0.0%	0.0%
<sup>2</sup> Honduras	100%		3.0%	2.7%	5.6%
South Africa	100%		1.4%	0.0%	1.4%
<b>Benchmarking Participants</b>					
<sup>2</sup> Alberta, Canada	100%		1.5%	5.9%	7.4%
<sup>2</sup> Ontario, Canada	100%		0.8%	4.8%	5.6%
Quebec, Canada	100%		2.0%	3.0%	4.9%
Abu Dhabi, UAE	100%		1.1%	0.6%	1.7%
Dubai, UAE	100%		0.2%	3.8%	4.0%
<sup>1</sup> Alabama, US	92%	Students in public schools	0.0%	4.6%	4.6%
<sup>1 2</sup> California, US	91%	Students in public schools	0.0%	5.6%	5.6%
<sup>1</sup> Colorado, US	94%	Students in public schools	0.0%	4.1%	4.1%
<sup>1 2</sup> Connecticut, US	90%	Students in public schools	0.0%	8.5%	8.5%
<sup>1 2</sup> Florida, US	89%	Students in public schools	0.0%	6.9%	6.9%
<sup>1 2</sup> Indiana, US	90%	Students in public schools	0.0%	6.3%	6.3%
<sup>1 2</sup> Massachusetts, US	89%	Students in public schools	0.0%	7.9%	7.9%
<sup>1</sup> Minnesota, US	90%	Students in public schools	0.0%	4.3%	4.3%
<sup>1 3</sup> North Carolina, US	93%	Students in public schools	0.0%	11.4%	11.4%

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Appendix C.4: School Sample Sizes**

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
Armenia	150	150	150	0	150
Australia	290	284	275	5	280
Austria	160	158	158	0	158
Azerbaijan	170	169	142	27	169
Bahrain	174	172	159	0	159
Belgium (Flemish)	156	150	114	28	142
Chile	203	202	169	31	200
Chinese Taipei	150	150	150	0	150
Croatia	152	152	150	2	152
Czech Republic	180	178	161	16	177
Denmark	240	235	186	30	216
England	150	150	122	3	125
Finland	150	146	141	4	145
Georgia	180	177	172	1	173
Germany	200	199	190	7	197
Hong Kong SAR	154	154	134	2	136
Hungary	150	150	146	3	149
Iran, Islamic Rep. of	250	244	244	0	244
Ireland	152	151	147	3	150
Italy	205	205	166	36	202
Japan	150	150	144	5	149
Kazakhstan	150	149	147	2	149
Korea, Rep. of	150	150	150	0	150
Kuwait	150	150	148	0	148
Lithuania	160	154	145	9	154
Malta	99	96	96	0	96
Morocco	289	287	286	0	286
Netherlands	151	148	75	53	128
New Zealand	189	189	154	26	180
Northern Ireland	160	160	100	36	136
Norway	150	145	84	35	119
Oman	338	333	327	0	327
Poland	150	150	150	0	150
Portugal	150	150	132	15	147
Qatar	175	167	166	0	166
Romania	150	148	147	1	148
Russian Federation	202	202	202	0	202
Saudi Arabia	175	171	163	8	171
Serbia	160	156	152	4	156
Singapore	176	176	176	0	176
Slovak Republic	200	198	187	10	197
Slovenia	202	201	193	2	195
Spain	152	152	147	4	151
Sweden	161	153	148	4	152
Thailand	168	168	143	25	168
Tunisia	222	222	222	0	222
Turkey	260	257	251	6	257
United Arab Emirates	478	460	459	0	459
United States	450	437	347	22	369
Yemen	223	218	216	0	216

**Sixth Grade Participants**

Botswana	150	149	149	0	149
Honduras	152	147	133	14	147
Yemen	150	147	146	0	146

**Benchmarking Participants**

Alberta, Canada	150	144	141	2	143
Ontario, Canada	150	149	145	1	146
Quebec, Canada	200	197	189	1	190
Abu Dhabi, UAE	168	165	164	0	164
Dubai, UAE	152	139	139	0	139
Florida, US	81	80	77	0	77
North Carolina, US	49	49	46	0	46

## Appendix C.5: School Sample Sizes

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
Armenia	153	153	153	0	153
Australia	290	287	276	1	277
Bahrain	97	96	95	0	95
Chile	197	196	166	27	193
Chinese Taipei	150	150	150	0	150
England	150	150	113	5	118
Finland	150	148	143	2	145
Georgia	180	175	171	1	172
Ghana	163	161	161	0	161
Hong Kong SAR	150	150	116	1	117
Hungary	150	147	144	2	146
Indonesia	154	153	153	0	153
Iran, Islamic Rep. of	250	238	237	1	238
Israel	152	151	143	8	151
Italy	204	204	166	31	197
Japan	150	150	128	10	138
Jordan	232	230	230	0	230
Kazakhstan	150	147	146	1	147
Korea, Rep. of	150	150	150	0	150
Lebanon	150	150	136	11	147
Lithuania	150	142	132	9	141
Macedonia, Rep. of	150	150	150	0	150
Malaysia	180	180	180	0	180
Morocco	285	280	279	0	279
New Zealand	162	162	141	17	158
Norway	150	150	134	0	134
Oman	338	333	323	0	323
Palestinian Nat'l Auth.	203	201	201	0	201
Qatar	113	110	109	0	109
Romania	150	147	145	2	147
Russian Federation	210	210	210	0	210
Saudi Arabia	154	153	150	3	153
Singapore	165	165	165	0	165
Slovenia	191	191	183	3	186
Sweden	159	156	152	1	153
Syrian Arab Republic	150	150	148	0	148
Thailand	172	172	160	12	172
Tunisia	217	211	207	0	207
Turkey	240	239	237	2	239
Ukraine	150	148	146	2	148
United Arab Emirates	477	460	458	0	458
United States	600	574	499	2	501

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

### Ninth Grade Participants

Botswana	150	150	150	0	150
Honduras	160	155	134	21	155
South Africa	298	285	283	2	285

### Benchmarking Participants

Alberta, Canada	150	147	133	12	145
Ontario, Canada	150	146	142	1	143
Quebec, Canada	200	198	189	0	189
Abu Dhabi, UAE	170	167	166	0	166
Dubai, UAE	143	131	130	0	130
Alabama, US	63	60	55	0	55
California, US	94	93	79	3	82
Colorado, US	60	60	50	3	53
Connecticut, US	63	62	62	0	62
Florida, US	65	64	60	0	60
Indiana, US	62	58	55	1	56
Massachusetts, US	58	56	56	0	56
Minnesota, US	60	56	51	4	55
North Carolina, US	62	60	59	0	59

## Appendix C.6: Student Sample Sizes

Country	Within-school Student Participation (Weighted Percentage)	Number of Sampled Students in Participating Schools	Number of Students Withdrawn from Class/School	Number of Students Excluded	Number of Eligible Students	Number of Students Absent	Number of Students Assessed
Armenia	98%	5,292	1	0	5,291	145	5,146
Australia	95%	6,709	103	122	6,484	338	6,146
Austria	98%	4,976	25	175	4,776	108	4,668
Azerbaijan	100%	5,098	206	0	4,892	10	4,882
Bahrain	98%	4,213	32	20	4,161	78	4,083
Belgium (Flemish)	98%	5,219	84	196	4,939	90	4,849
Chile	96%	6,010	81	79	5,850	265	5,585
Chinese Taipei	99%	4,376	18	35	4,323	39	4,284
Croatia	95%	5,097	27	245	4,825	241	4,584
Czech Republic	95%	4,895	28	35	4,832	254	4,578
Denmark	95%	4,452	54	183	4,215	228	3,987
England	94%	3,689	49	13	3,627	230	3,397
Finland	96%	4,917	23	53	4,841	203	4,638
Georgia	99%	4,958	23	56	4,879	80	4,799
Germany	96%	4,229	37	21	4,171	176	3,995
Hong Kong SAR	93%	4,330	21	65	4,244	287	3,957
Hungary	97%	5,488	40	67	5,381	177	5,204
Iran, Islamic Rep. of	99%	5,932	98	5	5,829	69	5,760
Ireland	95%	4,836	22	43	4,771	211	4,560
Italy	97%	4,529	26	153	4,350	150	4,200
Japan	97%	4,595	10	48	4,537	126	4,411
Kazakhstan	99%	4,521	37	41	4,443	61	4,382
Korea, Rep. of	98%	4,494	46	42	4,406	72	4,334
Kuwait	94%	4,431	0	0	4,431	289	4,142
Lithuania	94%	5,140	37	131	4,972	284	4,688
Malta	95%	3,958	24	142	3,792	185	3,607
Morocco	97%	8,414	273	0	8,141	300	7,841
Netherlands	97%	3,461	120	13	3,328	99	3,229
New Zealand	94%	6,172	129	96	5,947	375	5,572
Northern Ireland	93%	3,942	27	49	3,866	295	3,571
Norway	85%	3,881	21	122	3,738	617	3,121
Oman	98%	10,840	129	75	10,636	225	10,411
Poland	96%	5,316	15	71	5,230	203	5,027
Portugal	94%	4,384	18	64	4,302	260	4,042
Qatar	99%	4,394	178	70	4,146	29	4,117
Romania	98%	4,879	91	12	4,776	103	4,673
Russian Federation	98%	4,693	30	89	4,574	107	4,467
Saudi Arabia	99%	4,625	42	4	4,579	64	4,515
Serbia	97%	4,603	32	54	4,517	138	4,379
Singapore	96%	6,687	33	3	6,651	283	6,368
Slovak Republic	96%	5,933	45	46	5,842	226	5,616
Slovenia	97%	4,674	13	14	4,647	155	4,492
Spain	97%	4,461	16	156	4,289	106	4,183
Sweden	92%	5,235	75	84	5,076	413	4,663
Thailand	99%	4,556	74	0	4,482	34	4,448
Tunisia	99%	5,057	81	4	4,972	60	4,912
Turkey	98%	7,905	159	105	7,641	162	7,479
United Arab Emirates	97%	15,428	135	113	15,180	460	14,720
United States	95%	14,205	185	839	13,181	612	12,569
Yemen	97%	8,794	412	20	8,362	304	8,058

Students attending a sampled class at the time the sample was chosen but leaving the class before the assessment was administered were classified as “withdrawn.”

Students with a disability or language barrier that prevented them from participating in the assessment were classified as “excluded.”

Students not present when the assessment was administered, and not subsequently assessed in a make-up session, were classified as “absent.”

**Appendix C.6: Student Sample Sizes (Continued)**

Country	Within-school Student Participation (Weighted Percentage)	Number of Sampled Students in Participating Schools	Number of Students Withdrawn from Class/School	Number of Students Excluded	Number of Eligible Students	Number of Students Absent	Number of Students Assessed
<b>Sixth Grade Participants</b>							
Botswana	99%	4,298	39	8	4,251	53	4,198
Honduras	97%	4,186	117	0	4,069	150	3,919
Yemen	96%	5,364	212	15	5,137	208	4,929
<b>Benchmarking Participants</b>							
Alberta, Canada	96%	4,086	84	187	3,815	170	3,645
Ontario, Canada	96%	5,022	75	165	4,782	212	4,570
Quebec, Canada	95%	4,529	33	50	4,446	211	4,235
Abu Dhabi, UAE	98%	4,308	13	29	4,266	102	4,164
Dubai, UAE	96%	6,553	71	74	6,408	257	6,151
Florida, US	95%	3,121	43	265	2,813	152	2,661
North Carolina, US	95%	2,104	13	203	1,888	96	1,792

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

## Appendix C.7: Student Sample Sizes

Country	Within-school Student Participation (Weighted Percentage)	Number of Sampled Students in Participating Schools	Number of Students Withdrawn from Class/School	Number of Students Excluded	Number of Eligible Students	Number of Students Absent	Number of Students Assessed
Armenia	97%	6,057	0	0	6,057	211	5,846
Australia	90%	9,007	192	141	8,674	1,118	7,556
Bahrain	98%	4,960	185	27	4,748	108	4,640
Chile	95%	6,290	95	82	6,113	278	5,835
Chinese Taipei	99%	5,166	34	22	5,110	68	5,042
England	89%	4,382	88	3	4,291	449	3,842
Finland	95%	4,549	16	26	4,507	241	4,266
Georgia	98%	4,779	66	51	4,662	99	4,563
Ghana	97%	8,073	486	0	7,587	264	7,323
Hong Kong SAR	96%	4,261	42	55	4,164	149	4,015
Hungary	96%	5,489	28	55	5,406	228	5,178
Indonesia	96%	6,201	190	0	6,011	216	5,795
Iran, Islamic Rep. of	99%	6,264	141	0	6,123	94	6,029
Israel	92%	5,174	19	64	5,091	392	4,699
Italy	96%	4,379	23	210	4,146	167	3,979
Japan	94%	4,747	14	46	4,687	273	4,414
Jordan	96%	8,439	344	28	8,067	373	7,694
Kazakhstan	98%	4,551	70	25	4,456	66	4,390
Korea, Rep. of	99%	5,315	43	42	5,230	64	5,166
Lebanon	96%	4,231	103	0	4,128	154	3,974
Lithuania	93%	5,285	50	100	5,135	388	4,747
Macedonia, Rep. of	95%	4,360	67	23	4,270	208	4,062
Malaysia	98%	6,209	334	0	5,875	142	5,733
Morocco	94%	9,869	333	0	9,536	550	8,986
New Zealand	90%	6,079	128	41	5,910	574	5,336
Norway	94%	4,229	30	53	4,146	284	3,862
Oman	98%	9,947	140	36	9,771	229	9,542
Palestinian Nat'l Auth.	98%	8,069	120	27	7,922	110	7,812
Qatar	99%	4,641	167	18	4,456	34	4,422
Romania	99%	5,704	94	1	5,609	86	5,523
Russian Federation	98%	5,146	38	96	5,012	119	4,893
Saudi Arabia	98%	4,477	35	3	4,439	95	4,344
Singapore	95%	6,314	36	48	6,230	303	5,927
Slovenia	94%	4,722	11	29	4,682	267	4,415
Sweden	94%	6,210	114	137	5,959	386	5,573
Syrian Arab Republic	93%	4,756	0	0	4,756	343	4,413
Thailand	99%	6,404	201	0	6,203	79	6,124
Tunisia	97%	5,464	195	2	5,267	139	5,128
Turkey	97%	7,348	104	94	7,150	222	6,928
Ukraine	98%	3,491	27	14	3,450	72	3,378
United Arab Emirates	97%	14,716	106	48	14,562	473	14,089
United States	94%	11,864	302	398	11,164	687	10,477

Students attending a sampled class at the time the sample was chosen but leaving the class before the assessment was administered were classified as “withdrawn.”

Students with a disability or language barrier that prevented them from participating in the assessment were classified as “excluded.”

Students not present when the assessment was administered, and not subsequently assessed in a make-up session, were classified as “absent.”

**Appendix C.7: Student Sample Sizes (Continued)**

Country	Within-school Student Participation (Weighted Percentage)	Number of Sampled Students in Participating Schools	Number of Students Withdrawn from Class/School	Number of Students Excluded	Number of Eligible Students	Number of Students Absent	Number of Students Assessed
<b>Ninth Grade Participants</b>							
Botswana	98%	5,610	94	0	5,516	116	5,400
Honduras	96%	4,975	339	0	4,636	218	4,418
South Africa	95%	13,179	455	0	12,724	755	11,969
<b>Benchmarking Participants</b>							
Alberta, Canada	93%	5,579	96	294	5,189	390	4,799
Ontario, Canada	95%	5,198	31	143	5,024	268	4,756
Quebec, Canada	93%	6,879	91	75	6,713	564	6,149
Abu Dhabi, UAE	97%	4,513	11	4	4,498	125	4,373
Dubai, UAE	96%	5,915	57	36	5,822	251	5,571
Alabama, US	92%	2,414	27	87	2,300	187	2,113
California, US	94%	2,898	52	47	2,799	185	2,614
Colorado, US	94%	2,395	60	47	2,288	121	2,167
Connecticut, US	94%	2,356	16	115	2,225	126	2,099
Florida, US	91%	1,986	25	87	1,874	162	1,712
Indiana, US	96%	2,501	49	97	2,355	95	2,260
Massachusetts, US	96%	2,296	20	112	2,164	89	2,075
Minnesota, US	95%	2,720	32	61	2,627	127	2,500
North Carolina, US	95%	2,434	24	203	2,207	104	2,103

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Appendix C.8: Participation Rates (Weighted)

Country	School Participation		Class Participation	Student Participation	Overall Participation	
	Before Replacement	After Replacement			Before Replacement	After Replacement
Armenia	100%	100%	100%	98%	98%	98%
Australia	96%	98%	100%	95%	91%	93%
Austria	100%	100%	100%	98%	98%	98%
Azerbaijan	84%	100%	100%	100%	84%	100%
Bahrain	92%	92%	100%	98%	90%	90%
Belgium (Flemish)	76%	95%	99%	98%	75%	92%
Chile	86%	99%	100%	96%	82%	95%
Chinese Taipei	100%	100%	100%	99%	99%	99%
Croatia	99%	100%	100%	95%	94%	95%
Czech Republic	90%	99%	100%	95%	85%	94%
Denmark	79%	92%	100%	95%	75%	87%
England	81%	83%	100%	94%	76%	78%
Finland	97%	99%	100%	96%	93%	96%
Georgia	97%	98%	100%	99%	95%	96%
Germany	96%	99%	100%	96%	92%	95%
Hong Kong SAR	87%	88%	100%	93%	81%	82%
Hungary	98%	99%	100%	97%	94%	96%
Iran, Islamic Rep. of	100%	100%	100%	99%	99%	99%
Ireland	97%	99%	100%	95%	93%	95%
Italy	81%	98%	100%	97%	78%	95%
Japan	96%	99%	100%	97%	93%	97%
Kazakhstan	99%	100%	100%	99%	98%	99%
Korea, Rep. of	100%	100%	100%	98%	98%	98%
Kuwait	99%	99%	99%	94%	91%	91%
Lithuania	94%	100%	100%	94%	89%	94%
Malta	100%	100%	100%	95%	95%	95%
Morocco	100%	100%	100%	97%	96%	96%
† Netherlands	49%	82%	99%	97%	47%	79%
New Zealand	83%	96%	100%	94%	77%	90%
† Northern Ireland	62%	85%	100%	93%	58%	79%
‡ Norway	57%	82%	100%	85%	48%	70%
Oman	98%	98%	100%	98%	96%	96%
Poland	100%	100%	100%	96%	96%	96%
Portugal	87%	98%	99%	94%	81%	92%
Qatar	100%	100%	100%	99%	99%	99%
Romania	99%	100%	100%	98%	97%	97%
Russian Federation	100%	100%	100%	98%	98%	98%
Saudi Arabia	95%	100%	100%	99%	94%	99%
Serbia	97%	100%	100%	97%	94%	97%
Singapore	100%	100%	100%	96%	96%	96%
Slovak Republic	95%	99%	100%	96%	91%	96%
Slovenia	96%	97%	100%	97%	93%	94%
Spain	96%	99%	100%	97%	94%	97%
Sweden	97%	99%	100%	92%	89%	91%
Thailand	85%	100%	100%	99%	84%	99%
Tunisia	100%	100%	100%	99%	99%	99%
Turkey	97%	100%	100%	98%	95%	98%
United Arab Emirates	100%	100%	100%	97%	97%	97%
United States	79%	84%	100%	95%	76%	80%
Yemen	99%	99%	100%	97%	95%	95%

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

TIMSS guidelines for sampling participation: The minimum acceptable participation rates were 85% of both schools and students, or a combined rate (the product of school and student participation) of 75%. Participants not meeting these guidelines were annotated as follows:

† Met guidelines for sample participation rates only after replacement schools were included.

‡ Nearly satisfied guidelines for sample participation rates after replacement schools were included.

‡ Did not satisfy guidelines for sample participation rates.

**Appendix C.8: Participation Rates (Weighted) (Continued)**

Country	School Participation		Class Participation	Student Participation	Overall Participation	
	Before Replacement	After Replacement			Before Replacement	After Replacement
<b>Sixth Grade Participants</b>						
Botswana	100%	100%	100%	99%	99%	99%
Honduras	91%	100%	100%	97%	88%	97%
Yemen	99%	99%	100%	96%	96%	96%
<b>Benchmarking Participants</b>						
Alberta, Canada	98%	99%	100%	96%	93%	95%
Ontario, Canada	97%	98%	100%	96%	93%	94%
Quebec, Canada	95%	96%	100%	95%	90%	91%
Abu Dhabi, UAE	99%	99%	100%	98%	97%	97%
Dubai, UAE	100%	100%	100%	96%	96%	96%
Florida, US	96%	96%	100%	95%	91%	91%
North Carolina, US	94%	94%	100%	95%	89%	89%

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Appendix C.9: Participation Rates (Weighted)**

Country	School Participation		Class Participation	Student Participation	Overall Participation	
	Before Replacement	After Replacement			Before Replacement	After Replacement
Armenia	100%	100%	100%	97%	97%	97%
Australia	96%	98%	100%	90%	87%	88%
Bahrain	99%	99%	100%	98%	97%	97%
Chile	88%	99%	100%	95%	84%	95%
Chinese Taipei	100%	100%	100%	99%	99%	99%
‡ England	75%	79%	100%	89%	67%	70%
Finland	97%	98%	100%	95%	91%	93%
Georgia	97%	98%	100%	98%	96%	97%
Ghana	100%	100%	100%	97%	97%	97%
Hong Kong SAR	77%	78%	100%	96%	74%	75%
Hungary	98%	99%	100%	96%	94%	95%
Indonesia	100%	100%	100%	96%	96%	96%
Iran, Islamic Rep. of	100%	100%	100%	99%	98%	99%
Israel	94%	100%	100%	92%	87%	92%
Italy	83%	97%	100%	96%	80%	93%
Japan	85%	92%	100%	94%	80%	87%
Jordan	100%	100%	100%	96%	96%	96%
Kazakhstan	99%	100%	100%	98%	98%	98%
Korea, Rep. of	100%	100%	100%	99%	99%	99%
Lebanon	90%	98%	100%	96%	87%	94%
Lithuania	92%	99%	100%	93%	85%	92%
Macedonia, Rep. of	100%	100%	100%	95%	95%	95%
Malaysia	100%	100%	100%	98%	98%	98%
Morocco	100%	100%	100%	94%	94%	94%
New Zealand	87%	98%	100%	90%	78%	88%
Norway	89%	89%	100%	94%	84%	84%
Oman	99%	99%	100%	98%	97%	97%
Palestinian Nat'l Auth.	100%	100%	100%	98%	98%	98%
Qatar	99%	99%	100%	99%	99%	99%
Romania	99%	100%	100%	99%	97%	99%
Russian Federation	100%	100%	100%	98%	98%	98%
Saudi Arabia	98%	100%	100%	98%	96%	98%
Singapore	100%	100%	100%	95%	95%	95%
Slovenia	96%	98%	100%	94%	91%	92%
Sweden	97%	98%	100%	94%	91%	92%
Syrian Arab Republic	99%	99%	100%	93%	92%	92%
Thailand	92%	100%	100%	99%	90%	99%
Tunisia	99%	99%	100%	97%	97%	97%
Turkey	99%	100%	100%	97%	96%	97%
Ukraine	98%	100%	100%	98%	97%	98%
United Arab Emirates	100%	100%	100%	97%	97%	97%
United States	87%	87%	100%	94%	81%	81%

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

TIMSS guidelines for sampling participation: The minimum acceptable participation rates were 85% of both schools and students, or a combined rate (the product of school and student participation) of 75%. Participants not meeting these guidelines were annotated as follows:  
 † Met guidelines for sample participation rates only after replacement schools were included.  
 ‡ Nearly satisfied guidelines for sample participation rates after replacement schools were included.  
 ‡ Did not satisfy guidelines for sample participation rates.

Appendix C.9: Participation Rates (Weighted) (Continued)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	School Participation		Class Participation	Student Participation	Overall Participation	
	Before Replacement	After Replacement			Before Replacement	After Replacement
<b>Ninth Grade Participants</b>						
Botswana	100%	100%	100%	98%	98%	98%
Honduras	88%	100%	100%	96%	84%	96%
South Africa	100%	100%	100%	95%	94%	95%
<b>Benchmarking Participants</b>						
Alberta, Canada	91%	99%	100%	93%	85%	92%
Ontario, Canada	97%	98%	100%	95%	92%	93%
Quebec, Canada	96%	96%	99%	93%	88%	88%
Abu Dhabi, UAE	99%	99%	100%	97%	96%	96%
Dubai, UAE	99%	99%	100%	96%	95%	95%
Alabama, US	92%	92%	100%	92%	84%	84%
California, US	85%	88%	99%	94%	79%	82%
Colorado, US	84%	89%	100%	94%	79%	84%
Connecticut, US	100%	100%	100%	94%	94%	94%
Florida, US	94%	94%	98%	91%	84%	84%
Indiana, US	94%	97%	100%	96%	91%	93%
Massachusetts, US	100%	100%	100%	96%	96%	96%
Minnesota, US	91%	98%	100%	95%	86%	94%
North Carolina, US	98%	98%	100%	95%	93%	93%

## Appendix C.10: Trends in Student Populations

Country	Years of Formal Schooling*				Average Age at Time of Testing				Overall Exclusion Rates				Overall Participation Rates (After Replacement)			
	2011	2007	2003	1995	2011	2007	2003	1995	2011	2007	2003	1995	2011	2007	2003	1995
a Armenia	4		4		10.0		10.9		2.0%		2.9%		98%		90%	
Australia	4	4	4	4 or 5	10.0	9.9	9.9	10.2	4.4%	4.0%	2.7%	1.8%	93%	95%	85%	66%
Austria	4	4		4	10.3	10.3		10.5	5.1%	5.0%		2.8%	98%	97%		69%
Belgium (Flemish)	4		4		10.0		10.0		5.0%		6.3%		92%		97%	
Chinese Taipei	4	4	4		10.2	10.2	10.2		1.4%	2.8%	3.1%		99%	100%	99%	
Czech Republic	4	4		4	10.4	10.3		10.4	5.1%	4.9%		4.1%	94%	92%		86%
Denmark	4	4			11.0	11.0			6.3%	4.1%			87%	85%		
England	5	5	5	5	10.2	10.2	10.3	10.0	2.0%	2.1%	1.9%	12.1%	78%	84%	76%	83%
b Georgia	4	4			10.0	10.1			4.9%	4.8%			96%	98%		
Germany	4	4			10.4	10.4			1.9%	1.3%			95%	96%		
Hong Kong SAR	4	4	4	4	10.1	10.2	10.2	10.1	8.5%	5.4%	3.8%	2.7%	82%	81%	83%	83%
Hungary	4	4	4	4	10.7	10.7	10.5	10.4	4.2%	4.4%	8.1%	3.8%	96%	96%	93%	92%
Iran, Islamic Rep. of	4	4	4	4	10.2	10.2	10.4	10.5	4.5%	3.0%	5.7%	1.3%	99%	99%	98%	97%
Ireland	4			4	10.3			10.3	2.5%			6.9%	95%			90%
Italy	4	4	4		9.7	9.8	9.8		3.7%	5.3%	4.2%		95%	97%	97%	
Japan	4	4	4	4	10.5	10.5	10.4	10.4	3.2%	1.1%	0.8%	3.0%	96%	95%	97%	92%
Korea, Rep. of	4			4	10.4			10.3	2.5%			6.6%	98%			95%
Lithuania	4	4	4		10.7	10.8	10.9		5.6%	5.4%	4.6%		94%	94%	87%	
Morocco	4	4	4		10.5	10.6	11.0		2.0%	1.4%	2.2%		96%	77%	81%	
Netherlands	4	4	4	4	10.2	10.2	10.2	10.3	4.0%	4.8%	5.2%	4.4%	79%	91%	84%	59%
New Zealand	4.5–5.5	4.5–5.5	4.5–5.5	4.5–5.5	9.9	10.0	10.0	10.0	4.9%	5.4%	4.0%	1.3%	90%	96%	93%	95%
Norway	4	4	3	3	9.7	9.8	9.8	9.9	4.3%	5.1%	4.4%	3.1%	70%	92%	88%	91%
Portugal	4			4	10.0			10.4	2.5%			7.3%	92%			92%
Russian Federation	4	4	3 or 4		10.8	10.8	10.6		5.3%	3.6%	6.8%		98%	98%	97%	
Singapore	4	4	4	4	10.4	10.4	10.3	10.3	6.3%	1.5%	0.0%	0.0%	96%	96%	98%	98%
Slovak Republic	4	4			10.4	10.4			4.6%	3.3%			96%	97%		
Slovenia	4	4	3 or 4	3	9.9	9.8	9.8	9.9	2.6%	2.1%	1.3%	1.9%	94%	93%	91%	76%
Sweden	4	4			10.7	10.8			4.1%	3.1%			91%	97%		
Tunisia	4	4	4		10.0	10.2	10.4		2.5%	2.9%	0.9%		99%	99%	99%	
United States	4	4	4	4	10.2	10.3	10.2	10.2	7.0%	9.2%	5.1%	4.7%	80%	84%	78%	80%
Yemen	4	4			11.2	11.2			3.7%	2.0%			95%	98%		

### Benchmarking Participants

Alberta, Canada	4	4		4	9.9	9.8		9.8	7.5%	7.6%		–	95%	94%		91%
Ontario, Canada	4	4	4	4	9.8	9.8	9.8	9.8	5.3%	6.3%	4.8%	–	94%	92%	90%	92%
Quebec, Canada	4	4	4	4	10.1	10.1	10.1	10.3	3.7%	6.4%	3.6%	–	91%	84%	91%	81%
Dubai, UAE	4	4			9.8	10.0			5.1%	5.4%			96%	67%		

\* Represents years of schooling counting from the first year of ISCED Level 1.

a Age in 2011 lower due to educational reforms.

b Schools in South Ossetia and Abkhazia were excluded due to lack of access and absence of official statistics. Abkhazia refugee schools in other territories of Georgia were included in the sample frame.

A dash (–) indicates comparable data not available.

Country	Years of Formal Schooling*					Average Age at Time of Testing				
	2011	2007	2003	1999	1995	2011	2007	2003	1999	1995
<sup>a</sup> Armenia	9		8			14.6		14.9		
Australia	8	8	8		8 or 9	14.0	13.9	13.9		14.2
<sup>c</sup> Bahrain	8	8	8			14.4	14.1	14.1		
Chile	8		8	8		14.2		14.2	14.4	
Chinese Taipei	8	8	8	8		14.2	14.2	14.2	14.2	
England	9	9	9	9	9	14.2	14.2	14.3	14.2	14.0
Finland (Grade 7)	7			7		13.8			13.8	
<sup>b</sup> Georgia	8	8				14.2	14.2			
Ghana	8	8	8			15.8	15.8	15.5		
Hong Kong SAR	8	8	8	8	8	14.2	14.4	14.4	14.2	14.2
Hungary	8	8	8	8	8	14.7	14.6	14.5	14.4	14.3
Indonesia	8	8				14.3	14.3			
Iran, Islamic Rep. of	8	8	8	8	8	14.3	14.2	14.4	14.6	14.6
Italy	8	8	8	8		13.8	13.9	13.9	14.0	
Japan	8	8	8	8	8	14.5	14.5	14.4	14.4	14.4
Jordan	8	8	8	8		13.9	14.0	13.9	14.0	
<sup>c</sup> Korea, Rep. of	8	8	8	8	8	14.3	14.3	14.6	14.4	14.2
Lebanon	8	8	8			14.3	14.4	14.6		
<sup>c</sup> Lithuania	8	8	8	8.5	8	14.7	14.9	14.9	15.2	14.3
Macedonia, Rep. of	8		8	8		14.7		14.6	14.6	
Malaysia	8	8	8	8		14.4	14.3	14.3	14.4	
New Zealand	8.5–9.5		8.5–9.5	8.5–9.5	8.5–9.5	14.1		14.1	14.0	14.0
Norway	8	8	7		7	13.7	13.8	13.8		13.9
Oman	8	8				14.1	14.3			
Palestinian Nat'l Auth.	8	8	8			13.9	14.0	14.1		
Romania	8	8	8	8	8	14.9	15.0	15.0	14.8	14.6
Russian Federation	8	7 or 8	7 or 8	7 or 8	7 or 8	14.7	14.6	14.2	14.1	14.0
Singapore	8	8	8	8	8	14.4	14.4	14.3	14.4	14.5
Slovenia	8	7 or 8	7 or 8		7	13.9	13.8	13.8		13.8
Sweden	8	8	8		7	14.8	14.8	14.9		14.9
Syrian Arab Republic	8	8				13.9	13.9			
Thailand	8	8		8		14.3	14.3		14.5	
Tunisia	8	8	8	8		14.3	14.5	14.8	14.8	
Ukraine	8	8				14.2	14.2			

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Benchmarking Participants**

Alberta, Canada	8			8	8	13.9			13.9	14.0
Ontario, Canada	8	8	8	8	8	13.8	13.8	13.8	13.9	14.0
Quebec, Canada	8	8	8	8	8	14.2	14.2	14.2	14.3	14.5
<sup>c</sup> Dubai, UAE	8	8				13.9	14.2			
Connecticut, US	8			8		14.1			14.0	
Indiana, US	8		8	8		14.4		13.5	14.4	
Massachusetts, US	8	8		8		14.2	14.2		14.1	
Minnesota, US	8	8			8	14.3	14.3			14.3
North Carolina, US	8			8		14.2			14.2	

\* Represents years of schooling counting from the first year of ISCED Level 1

<sup>a</sup> Age in 2011 lower due to educational reforms.

<sup>b</sup> Schools in South Ossetia and Abkhazia were excluded due to lack of access and absence of official statistics. Abkhazia refugee schools in other territories of Georgia were included in the sample frame.

<sup>c</sup> Bahrain in 2011, Korea in 2003, Lithuania in 1999, and Dubai (UAE) in 2007 tested the same cohort of students as other countries, but later in the assessment year.

A dash (-) indicates comparable data not available.

**Appendix C.11: Trends in Student Populations (Continued)**

Country	Overall Exclusion Rates					Overall Participation Rates (After Replacement)				
	2011	2007	2003	1999	1995	2011	2007	2003	1999	1995
a Armenia	1.5%		2.9%			97%		89%		
Australia	3.2%	1.9%	1.3%		0.8%	88%	93%	83%		70%
c Bahrain	1.6%	1.5%	0.0%			97%	97%	98%		
Chile	2.8%		2.2%	2.8%		95%		99%	96%	
Chinese Taipei	1.3%	3.3%	4.8%	1.6%		99%	99%	99%	99%	
England	2.2%	2.3%	2.1%	5.0%	11.3%	70%	75%	46%	77%	77%
Finland (Grade 7)	3.8%			3.7%		96%			96%	
b Georgia	4.5%	3.9%				97%	97%			
Ghana	0.6%	0.9%	0.9%			97%	98%	93%		
Hong Kong SAR	5.3%	3.8%	3.4%	0.8%	2.0%	75%	75%	80%	74%	81%
Hungary	4.4%	3.9%	8.5%	4.3%	3.8%	95%	96%	94%	93%	87%
Indonesia	3.2%	3.4%				96%	97%			
Iran, Islamic Rep. of	2.2%	0.5%	6.5%	4.4%	0.3%	99%	98%	98%	98%	98%
Italy	4.7%	5.0%	3.6%	6.7%		93%	96%	97%	97%	
Japan	2.8%	3.5%	0.6%	1.3%	0.6%	87%	91%	93%	89%	90%
Jordan	0.4%	2.0%	1.3%	3.0%		96%	96%	96%	99%	
c Korea, Rep. of	1.9%	1.6%	4.9%	4.0%	3.8%	99%	99%	98%	100%	95%
Lebanon	1.4%	1.4%	1.4%			94%	85%	91%		
c Lithuania	4.8%	4.2%	2.6%	4.5%	6.6%	92%	90%	84%	89%	83%
Macedonia, Rep. of	3.3%		12.5%	1.1%		95%		96%	98%	
Malaysia	0.1%	3.3%	4.0%	4.6%		98%	98%	98%	99%	
New Zealand	3.2%		4.4%	2.4%	1.7%	88%		90%	91%	94%
Norway	1.9%	2.6%	2.3%		2.2%	84%	86%	85%		93%
Oman	1.2%	1.2%				97%	99%			
Palestinian Nat'l Auth.	1.5%	1.0%	0.5%			98%	98%	99%		
Romania	1.3%	1.8%	0.5%	3.7%	2.8%	99%	97%	98%	97%	89%
Russian Federation	6.0%	2.3%	5.5%	1.7%	6.3%	98%	97%	96%	97%	95%
Singapore	6.0%	1.8%	0.0%	0.0%	4.6%	95%	95%	97%	98%	95%
Slovenia	2.3%	1.9%	1.4%		2.6%	92%	92%	91%		77%
Sweden	5.1%	3.6%	2.8%		0.9%	92%	94%	87%		90%
Syrian Arab Republic	1.9%	0.6%				92%	96%			
Thailand	1.5%	3.4%		3.3%		99%	99%		99%	
Tunisia	0.3%	0.0%	1.8%	0.1%		97%	98%	98%	98%	
Ukraine	2.8%	0.2%				98%	95%			
United States	7.2%	7.9%	4.9%	3.9%	2.1%	81%	77%	73%	85%	78%

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011

**Benchmarking Participants**

Alberta, Canada	7.4%			–	–	92%			95%	92%
Ontario, Canada	5.6%	6.2%	6.0%	5.1%	–	93%	89%	89%	93%	90%
Quebec, Canada	4.9%	13.6%	4.8%	1.3%	–	88%	77%	85%	92%	89%
c Dubai, UAE	4.0%	5.0%				95%	69%			
Connecticut, US	8.5%			5.0%		94%			90%	
Indiana, US	6.3%		7.8%	6.0%		93%		94%	79%	
Massachusetts, US	7.9%	8.4%		5.0%		96%	92%		93%	
Minnesota, US	4.3%	7.5%			–	94%	93%			–
North Carolina, US	11.4%			4.0%		93%			92%	



# Appendix D

## Percentage of Students with Achievement Too Low for Estimation

Appendix D.1: Percentage of Students with Achievement Too Low for Estimation\*

Country	Percentage of Students with Achievement Too Low for Estimation	Average Percent Correct
Armenia	8 (0.7)	34 (0.6)
Australia	2 (0.3)	52 (0.5)
Austria	0 (0.1)	55 (0.6)
Azerbaijan	5 (0.5)	40 (0.9)
Bahrain	5 (0.4)	41 (0.5)
Belgium (Flemish)	1 (0.1)	49 (0.4)
Chile	3 (0.3)	45 (0.4)
Chinese Taipei	0 (0.1)	59 (0.4)
Croatia	1 (0.1)	51 (0.4)
Czech Republic	0 (0.1)	56 (0.5)
Denmark	1 (0.2)	54 (0.5)
England	2 (0.2)	54 (0.6)
Finland	0 (0.1)	63 (0.4)
Georgia	4 (0.5)	41 (0.6)
Germany	1 (0.2)	54 (0.5)
Hong Kong SAR	1 (0.4)	56 (0.7)
Hungary	2 (0.3)	56 (0.7)
Iran, Islamic Rep. of	5 (0.5)	42 (0.6)
Ireland	2 (0.3)	52 (0.6)
Italy	1 (0.2)	53 (0.5)
Japan	0 (0.1)	60 (0.3)
Kazakhstan	2 (0.3)	48 (1.0)
Korea, Rep. of	0 (0.1)	65 (0.3)
Ψ Kuwait	18 (0.8)	28 (0.5)
Lithuania	1 (0.2)	52 (0.5)
Malta	6 (0.4)	40 (0.3)
✱ Morocco	28 (0.9)	21 (0.4)
Netherlands	0 (0.1)	54 (0.4)
New Zealand	2 (0.3)	48 (0.5)
Northern Ireland	2 (0.3)	52 (0.5)
Norway	1 (0.3)	47 (0.4)
Oman	13 (0.6)	32 (0.5)
Poland	2 (0.2)	49 (0.5)
Portugal	1 (0.2)	53 (0.8)
Qatar	11 (0.6)	34 (0.6)
Romania	5 (1.0)	51 (1.0)
Russian Federation	0 (0.1)	59 (0.7)
Saudi Arabia	6 (0.5)	38 (0.8)
Serbia	2 (0.3)	52 (0.6)
Singapore	1 (0.1)	66 (0.7)
Slovak Republic	1 (0.3)	55 (0.7)
Slovenia	1 (0.2)	53 (0.4)
Spain	1 (0.2)	50 (0.5)
Sweden	1 (0.2)	55 (0.5)
Thailand	4 (0.7)	44 (0.9)
Ψ Tunisia	21 (1.1)	26 (0.6)
Turkey	4 (0.6)	43 (0.7)
United Arab Emirates	7 (0.4)	38 (0.3)
United States	1 (0.1)	57 (0.4)
✱ Yemen	39 (1.5)	17 (0.4)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

- \* Students were considered to have achievement too low for estimation if their performance on the assessment was no better than could be achieved by simply guessing on the multiple choice assessment items. However, such students were assigned scale scores (plausible values) by the achievement scaling procedure, despite concerns about their reliability.
- ✱ Average achievement not reliably measured because the percentage of students with achievement too low for estimation exceeds 25%.
- Ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.
- () Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

**Appendix D.1: Percentage of Students with Achievement Too Low for Estimation\*  
(Continued)**

Country	Percentage of Students with Achievement Too Low for Estimation	Average Percent Correct
<b>Sixth Grade Participants</b>		
Botswana	14 (0.8)	31 (0.7)
Honduras	6 (0.9)	37 (0.9)
Yemen	15 (1.3)	28 (0.7)
<b>Benchmarking Participants</b>		
Alberta, Canada	1 (0.2)	57 (0.5)
Ontario, Canada	1 (0.2)	54 (0.6)
Quebec, Canada	0 (0.1)	52 (0.5)
Abu Dhabi, UAE	8 (0.8)	36 (0.7)
Dubai, UAE	5 (0.4)	44 (0.3)
Florida, US	1 (0.1)	58 (0.7)
North Carolina, US	1 (0.2)	56 (0.9)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	Percentage of Students with Achievement Too Low for Estimation	Average Percent Correct
Armenia	7 (0.5)	35 (0.5)
Australia	2 (0.3)	49 (1.0)
Bahrain	7 (0.4)	38 (0.3)
Chile	3 (0.3)	37 (0.4)
Chinese Taipei	1 (0.2)	59 (0.5)
England	2 (0.4)	52 (1.0)
Finland	1 (0.1)	56 (0.5)
Georgia	7 (0.5)	32 (0.4)
<sup>ψ</sup> Ghana	21 (0.9)	21 (0.4)
Hong Kong SAR	1 (0.3)	52 (0.7)
Hungary	1 (0.2)	50 (0.6)
Indonesia	8 (0.8)	28 (0.5)
Iran, Islamic Rep. of	3 (0.3)	41 (0.7)
Israel	3 (0.3)	49 (0.8)
Italy	1 (0.2)	45 (0.4)
Japan	1 (0.1)	57 (0.5)
Jordan	6 (0.6)	37 (0.6)
Kazakhstan	2 (0.3)	43 (0.9)
Korea, Rep. of	0 (0.1)	58 (0.4)
Lebanon	10 (0.8)	29 (0.7)
Lithuania	1 (0.2)	48 (0.5)
Macedonia, Rep. of	10 (0.8)	32 (0.8)
Malaysia	7 (0.8)	33 (0.9)
Morocco	13 (0.5)	25 (0.2)
New Zealand	2 (0.3)	48 (0.9)
Norway	2 (0.3)	43 (0.5)
Oman	10 (0.5)	33 (0.4)
Palestinian Nat'l Auth.	9 (0.5)	33 (0.5)
Qatar	10 (0.5)	34 (0.5)
Romania	4 (0.5)	38 (0.7)
Russian Federation	1 (0.2)	54 (0.7)
Saudi Arabia	5 (0.6)	34 (0.6)
Singapore	1 (0.2)	64 (0.9)
Slovenia	1 (0.2)	54 (0.5)
Sweden	2 (0.2)	47 (0.5)
Syrian Arab Republic	6 (0.5)	32 (0.6)
Thailand	4 (0.4)	36 (0.7)
Tunisia	3 (0.3)	33 (0.4)
Turkey	3 (0.2)	43 (0.7)
Ukraine	2 (0.3)	45 (0.7)
United Arab Emirates	5 (0.2)	39 (0.4)
United States	1 (0.2)	50 (0.5)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

- \* Students were considered to have achievement too low for estimation if their performance on the assessment was no better than could be achieved by simply guessing on the multiple choice assessment items. However, such students were assigned scale scores (plausible values) by the achievement scaling procedure, despite concerns about their reliability.
- <sup>ψ</sup> Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.
- ( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

**Appendix D.2: Percentage of Students with Achievement Too Low for Estimation\*  
(Continued)**

Country	Percentage of Students with Achievement Too Low for Estimation	Average Percent Correct
<b>Ninth Grade Participants</b>		
Botswana	9 (0.4)	30 (0.4)
Honduras	12 (0.8)	24 (0.5)
ψ South Africa	20 (0.6)	22 (0.3)
<b>Benchmarking Participants</b>		
Alberta, Canada	1 (0.1)	54 (0.5)
Ontario, Canada	1 (0.2)	49 (0.5)
Quebec, Canada	1 (0.3)	48 (0.6)
Abu Dhabi, UAE	5 (0.4)	38 (0.7)
Dubai, UAE	4 (0.4)	43 (0.4)
Alabama, US	3 (0.5)	43 (1.2)
California, US	2 (0.3)	45 (0.9)
Colorado, US	1 (0.3)	53 (1.0)
Connecticut, US	1 (0.4)	52 (1.0)
Florida, US	1 (0.3)	51 (1.5)
Indiana, US	1 (0.2)	52 (1.1)
Massachusetts, US	1 (0.5)	59 (1.1)
Minnesota, US	0 (0.2)	56 (1.1)
North Carolina, US	1 (0.3)	51 (1.3)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



# Appendix E

## Average Percent Correct in the Science Content and Cognitive Domains

Country	Overall Science	Science Content Domains			Science Cognitive Domains		
		Life Science	Physical Science	Earth Science	Knowing	Applying	Reasoning
Armenia	34 (0.6)	36 (0.6)	34 (0.6)	32 (0.7)	40 (0.6)	33 (0.6)	25 (0.6)
Australia	52 (0.5)	52 (0.6)	52 (0.6)	51 (0.7)	57 (0.5)	49 (0.5)	45 (0.6)
Austria	55 (0.6)	53 (0.5)	56 (0.6)	55 (0.7)	60 (0.6)	53 (0.6)	47 (0.7)
Azerbaijan	40 (0.9)	40 (0.8)	41 (1.0)	36 (1.1)	46 (1.0)	38 (0.9)	26 (0.9)
Bahrain	41 (0.5)	41 (0.5)	43 (0.6)	39 (0.6)	47 (0.6)	39 (0.5)	32 (0.6)
Belgium (Flemish)	49 (0.4)	50 (0.4)	50 (0.4)	47 (0.5)	54 (0.5)	48 (0.4)	43 (0.5)
Chile	45 (0.4)	47 (0.4)	44 (0.4)	42 (0.5)	50 (0.4)	43 (0.4)	37 (0.5)
Chinese Taipei	59 (0.4)	56 (0.4)	64 (0.4)	58 (0.5)	62 (0.4)	58 (0.4)	57 (0.5)
Croatia	51 (0.4)	53 (0.4)	49 (0.4)	51 (0.6)	58 (0.4)	49 (0.4)	43 (0.6)
Czech Republic	56 (0.5)	58 (0.5)	53 (0.6)	55 (0.8)	63 (0.5)	53 (0.5)	45 (0.7)
Denmark	54 (0.5)	54 (0.5)	55 (0.5)	52 (0.6)	58 (0.5)	53 (0.5)	47 (0.6)
England	54 (0.6)	54 (0.6)	57 (0.6)	51 (0.8)	59 (0.6)	53 (0.6)	47 (0.8)
Finland	63 (0.4)	63 (0.5)	63 (0.4)	61 (0.6)	68 (0.5)	60 (0.4)	55 (0.6)
Georgia	41 (0.6)	42 (0.6)	40 (0.6)	40 (0.7)	48 (0.6)	39 (0.7)	28 (0.6)
Germany	54 (0.5)	53 (0.5)	57 (0.6)	52 (0.7)	58 (0.5)	53 (0.5)	47 (0.7)
Hong Kong SAR	56 (0.7)	53 (0.7)	58 (0.7)	57 (0.7)	61 (0.6)	53 (0.7)	51 (0.8)
Hungary	56 (0.7)	59 (0.6)	54 (0.7)	53 (0.8)	62 (0.7)	53 (0.7)	47 (0.8)
Iran, Islamic Rep. of	42 (0.6)	41 (0.7)	42 (0.6)	40 (0.7)	47 (0.7)	39 (0.6)	34 (0.7)
Ireland	52 (0.6)	51 (0.6)	53 (0.6)	51 (0.7)	57 (0.6)	50 (0.6)	43 (0.7)
Italy	53 (0.5)	56 (0.5)	51 (0.6)	51 (0.6)	60 (0.6)	51 (0.5)	45 (0.6)
Japan	60 (0.3)	55 (0.3)	68 (0.4)	58 (0.4)	60 (0.4)	59 (0.3)	63 (0.5)
Kazakhstan	48 (1.0)	49 (1.0)	47 (1.0)	46 (1.1)	51 (1.0)	47 (1.0)	41 (1.1)
Korea, Rep. of	65 (0.3)	61 (0.3)	69 (0.3)	68 (0.4)	67 (0.4)	64 (0.3)	66 (0.5)
Ψ Kuwait	28 (0.5)	26 (0.5)	31 (0.5)	27 (0.5)	34 (0.5)	26 (0.5)	20 (0.5)
Lithuania	52 (0.5)	52 (0.5)	53 (0.5)	48 (0.7)	55 (0.6)	51 (0.5)	44 (0.6)
Malta	40 (0.3)	39 (0.3)	42 (0.3)	38 (0.3)	43 (0.3)	39 (0.3)	34 (0.3)
* Morocco	21 (0.4)	21 (0.4)	24 (0.5)	18 (0.5)	24 (0.5)	21 (0.4)	15 (0.4)
Netherlands	54 (0.4)	55 (0.4)	54 (0.5)	52 (0.6)	58 (0.4)	52 (0.4)	48 (0.7)
New Zealand	48 (0.5)	48 (0.5)	49 (0.5)	47 (0.6)	53 (0.5)	46 (0.4)	42 (0.6)
Northern Ireland	52 (0.5)	52 (0.6)	53 (0.6)	48 (0.7)	56 (0.6)	51 (0.6)	43 (0.6)
Norway	47 (0.4)	47 (0.5)	46 (0.5)	48 (0.6)	53 (0.5)	44 (0.5)	39 (0.6)
Oman	32 (0.5)	31 (0.5)	34 (0.6)	30 (0.6)	38 (0.6)	30 (0.5)	23 (0.5)
Poland	49 (0.5)	51 (0.5)	49 (0.5)	46 (0.6)	53 (0.5)	49 (0.5)	39 (0.6)
Portugal	53 (0.8)	53 (0.8)	53 (0.9)	54 (1.0)	59 (0.9)	50 (0.8)	47 (0.9)
Qatar	34 (0.6)	33 (0.6)	37 (0.6)	34 (0.7)	39 (0.7)	33 (0.6)	27 (0.7)
Romania	51 (1.0)	51 (1.1)	52 (1.1)	49 (1.1)	57 (1.0)	49 (1.1)	42 (1.2)
Russian Federation	59 (0.7)	60 (0.7)	59 (0.8)	58 (0.9)	63 (0.7)	58 (0.8)	50 (0.9)
Saudi Arabia	38 (0.8)	37 (0.9)	40 (0.9)	37 (0.8)	44 (0.9)	36 (0.8)	27 (0.8)
Serbia	52 (0.6)	52 (0.6)	54 (0.6)	47 (0.7)	58 (0.5)	48 (0.6)	46 (0.8)
Singapore	66 (0.7)	68 (0.7)	69 (0.6)	56 (0.7)	67 (0.6)	65 (0.7)	64 (0.8)
Slovak Republic	55 (0.7)	55 (0.8)	56 (0.7)	55 (0.7)	62 (0.7)	53 (0.7)	45 (0.8)
Slovenia	53 (0.4)	54 (0.5)	54 (0.5)	48 (0.6)	57 (0.5)	51 (0.4)	48 (0.6)
Spain	50 (0.5)	52 (0.5)	49 (0.6)	47 (0.6)	57 (0.6)	47 (0.6)	41 (0.7)
Sweden	55 (0.5)	55 (0.5)	55 (0.5)	56 (0.7)	60 (0.5)	53 (0.5)	49 (0.6)
Thailand	44 (0.9)	46 (1.0)	43 (0.9)	41 (1.0)	50 (1.0)	42 (0.9)	36 (1.0)
Ψ Tunisia	26 (0.6)	26 (0.5)	28 (0.7)	23 (0.6)	30 (0.6)	25 (0.6)	19 (0.6)
Turkey	43 (0.7)	43 (0.7)	45 (0.7)	40 (0.8)	47 (0.7)	41 (0.7)	37 (0.8)
United Arab Emirates	38 (0.3)	37 (0.3)	40 (0.4)	37 (0.4)	44 (0.4)	35 (0.3)	29 (0.4)
United States	57 (0.4)	58 (0.4)	58 (0.4)	55 (0.4)	62 (0.4)	56 (0.4)	50 (0.4)
* Yemen	17 (0.4)	15 (0.4)	20 (0.5)	16 (0.5)	20 (0.6)	16 (0.4)	11 (0.4)
International Avg.	48 (0.1)	48 (0.1)	49 (0.1)	46 (0.1)	53 (0.1)	46 (0.1)	41 (0.1)

\* Average achievement not reliably measured because the percentage of students with achievement too low for estimation exceeds 25%.

Ψ Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

**Appendix E.1: Average Percent Correct in the Science Content and Cognitive Domains  
(Continued)**

Country	Overall Science	Science Content Domains			Science Cognitive Domains		
		Life Science	Physical Science	Earth Science	Knowing	Applying	Reasoning
<b>Sixth Grade Participants</b>							
Botswana	31 (0.7)	29 (0.8)	35 (0.7)	30 (0.7)	34 (0.8)	31 (0.7)	26 (0.8)
Honduras	37 (0.9)	39 (0.8)	35 (0.9)	34 (1.1)	44 (1.0)	34 (0.8)	25 (1.0)
Yemen	28 (0.7)	25 (0.7)	31 (0.7)	27 (0.8)	32 (0.8)	26 (0.7)	20 (0.6)
<b>Benchmarking Participants</b>							
Alberta, Canada	57 (0.5)	57 (0.5)	57 (0.5)	54 (0.7)	61 (0.5)	55 (0.5)	50 (0.6)
Ontario, Canada	54 (0.6)	56 (0.6)	54 (0.6)	50 (0.7)	59 (0.6)	52 (0.7)	48 (0.8)
Quebec, Canada	52 (0.5)	53 (0.5)	51 (0.5)	50 (0.6)	57 (0.5)	49 (0.5)	45 (0.6)
Abu Dhabi, UAE	36 (0.7)	35 (0.8)	38 (0.8)	34 (0.8)	41 (0.8)	33 (0.7)	28 (0.8)
Dubai, UAE	44 (0.3)	43 (0.4)	45 (0.3)	43 (0.5)	50 (0.4)	41 (0.4)	35 (0.3)
Florida, US	58 (0.7)	58 (0.8)	58 (0.7)	55 (0.9)	63 (0.7)	56 (0.7)	50 (0.9)
North Carolina, US	56 (0.9)	57 (1.0)	58 (0.9)	53 (1.1)	61 (0.9)	55 (1.0)	49 (1.1)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Appendix E.2: Average Percent Correct in the Science Content and Cognitive Domains

Country	Overall Science	Science Content Domains				Science Cognitive Domains		
		Biology	Chemistry	Physics	Earth Science	Knowing	Applying	Reasoning
Armenia	35 (0.5)	34 (0.6)	39 (0.6)	33 (0.7)	36 (0.6)	46 (0.6)	33 (0.6)	23 (0.5)
Australia	49 (1.0)	51 (1.0)	46 (1.1)	43 (1.0)	56 (1.1)	54 (0.9)	48 (1.0)	43 (1.2)
Bahrain	38 (0.3)	38 (0.3)	39 (0.4)	34 (0.4)	40 (0.4)	46 (0.4)	36 (0.3)	29 (0.3)
Chile	37 (0.4)	38 (0.5)	35 (0.4)	33 (0.4)	44 (0.5)	46 (0.4)	36 (0.4)	28 (0.5)
Chinese Taipei	59 (0.5)	57 (0.5)	64 (0.7)	53 (0.6)	63 (0.6)	64 (0.5)	60 (0.6)	49 (0.6)
England	52 (1.0)	52 (1.0)	53 (1.1)	48 (1.1)	57 (1.0)	58 (0.9)	51 (1.0)	45 (1.2)
Finland	56 (0.5)	56 (0.6)	57 (0.6)	49 (0.6)	65 (0.6)	63 (0.5)	55 (0.6)	48 (0.6)
Georgia	32 (0.4)	36 (0.5)	29 (0.5)	26 (0.4)	34 (0.6)	41 (0.5)	30 (0.4)	22 (0.5)
<sup>ψ</sup> Ghana	21 (0.4)	21 (0.4)	24 (0.6)	19 (0.4)	19 (0.5)	30 (0.5)	19 (0.5)	12 (0.4)
Hong Kong SAR	52 (0.7)	52 (0.7)	51 (0.7)	50 (0.7)	58 (0.8)	59 (0.6)	50 (0.7)	46 (0.9)
Hungary	50 (0.6)	50 (0.6)	53 (0.7)	47 (0.7)	52 (0.7)	53 (0.5)	52 (0.7)	42 (0.7)
Indonesia	28 (0.5)	30 (0.6)	25 (0.5)	26 (0.5)	33 (0.8)	36 (0.6)	27 (0.5)	20 (0.6)
Iran, Islamic Rep. of	41 (0.7)	40 (0.7)	41 (0.8)	39 (0.8)	44 (0.8)	48 (0.7)	40 (0.7)	32 (0.8)
Israel	49 (0.8)	51 (0.8)	50 (0.9)	45 (0.8)	50 (0.9)	56 (0.7)	48 (0.8)	42 (0.9)
Italy	45 (0.4)	47 (0.5)	44 (0.5)	40 (0.4)	52 (0.6)	54 (0.4)	45 (0.5)	34 (0.5)
Japan	57 (0.5)	57 (0.5)	58 (0.6)	55 (0.6)	59 (0.5)	59 (0.5)	58 (0.5)	52 (0.6)
Jordan	37 (0.6)	37 (0.6)	41 (0.7)	33 (0.6)	38 (0.7)	46 (0.7)	36 (0.6)	27 (0.6)
Kazakhstan	43 (0.9)	42 (0.9)	47 (1.0)	39 (0.9)	43 (0.9)	49 (0.9)	43 (0.9)	34 (1.0)
Korea, Rep. of	58 (0.4)	58 (0.5)	56 (0.4)	58 (0.5)	59 (0.5)	62 (0.4)	58 (0.5)	51 (0.5)
Lebanon	29 (0.7)	29 (0.7)	35 (0.9)	28 (0.7)	27 (0.7)	36 (0.7)	29 (0.7)	21 (0.8)
Lithuania	48 (0.5)	49 (0.6)	49 (0.6)	42 (0.5)	52 (0.6)	54 (0.5)	47 (0.5)	40 (0.7)
Macedonia, Rep. of	32 (0.8)	33 (0.8)	34 (0.9)	28 (0.8)	34 (0.8)	42 (0.9)	31 (0.8)	21 (0.7)
Malaysia	33 (0.9)	34 (1.0)	34 (0.9)	33 (0.9)	33 (1.0)	39 (0.9)	33 (1.0)	26 (1.0)
Morocco	25 (0.2)	26 (0.3)	26 (0.3)	20 (0.2)	28 (0.3)	32 (0.2)	24 (0.3)	16 (0.3)
New Zealand	48 (0.9)	48 (0.9)	47 (1.0)	43 (0.9)	54 (0.9)	54 (0.9)	47 (0.9)	41 (1.1)
Norway	43 (0.5)	43 (0.5)	43 (0.6)	37 (0.6)	52 (0.7)	49 (0.5)	43 (0.5)	35 (0.6)
Oman	33 (0.4)	33 (0.4)	33 (0.4)	31 (0.3)	37 (0.4)	41 (0.3)	32 (0.4)	24 (0.4)
Palestinian Nat'l Auth.	33 (0.5)	32 (0.5)	37 (0.5)	33 (0.6)	33 (0.6)	43 (0.5)	32 (0.6)	22 (0.4)
Qatar	34 (0.5)	33 (0.7)	35 (0.6)	32 (0.5)	36 (0.5)	42 (0.6)	33 (0.5)	24 (0.7)
Romania	38 (0.7)	38 (0.6)	41 (0.9)	34 (0.7)	43 (0.7)	44 (0.7)	39 (0.7)	29 (0.7)
Russian Federation	54 (0.7)	53 (0.7)	57 (0.8)	51 (0.8)	56 (0.7)	62 (0.8)	54 (0.8)	44 (0.8)
Saudi Arabia	34 (0.6)	33 (0.6)	34 (0.7)	31 (0.6)	37 (0.7)	44 (0.6)	32 (0.7)	23 (0.6)
Singapore	64 (0.9)	64 (0.9)	65 (1.0)	63 (0.9)	64 (0.9)	68 (0.9)	63 (0.9)	59 (1.0)
Slovenia	54 (0.5)	52 (0.5)	58 (0.6)	48 (0.6)	62 (0.7)	60 (0.5)	54 (0.6)	46 (0.7)
Sweden	47 (0.5)	48 (0.6)	46 (0.6)	42 (0.6)	53 (0.6)	53 (0.5)	47 (0.5)	39 (0.6)
Syrian Arab Republic	32 (0.6)	34 (0.6)	33 (0.6)	28 (0.7)	33 (0.7)	42 (0.6)	32 (0.6)	20 (0.7)
Thailand	36 (0.7)	38 (0.8)	34 (0.8)	29 (0.7)	42 (0.8)	42 (0.7)	35 (0.7)	27 (0.8)
Tunisia	33 (0.4)	36 (0.4)	32 (0.5)	29 (0.5)	32 (0.4)	38 (0.4)	32 (0.4)	26 (0.5)
Turkey	43 (0.7)	44 (0.7)	43 (0.7)	41 (0.7)	43 (0.6)	51 (0.6)	41 (0.7)	34 (0.7)
Ukraine	45 (0.7)	44 (0.6)	48 (0.8)	43 (0.9)	48 (0.8)	53 (0.7)	44 (0.7)	37 (0.8)
United Arab Emirates	39 (0.4)	40 (0.4)	41 (0.5)	35 (0.4)	43 (0.5)	48 (0.4)	38 (0.4)	29 (0.5)
United States	50 (0.5)	52 (0.5)	51 (0.6)	44 (0.5)	56 (0.5)	57 (0.5)	50 (0.5)	42 (0.6)
International Avg.	42 (0.1)	42 (0.1)	43 (0.1)	38 (0.1)	45 (0.1)	49 (0.1)	41 (0.1)	33 (0.1)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

<sup>ψ</sup> Reservations about reliability of average achievement because the percentage of students with achievement too low for estimation does not exceed 25% but exceeds 15%.

(.) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

**Appendix E.2: Average Percent Correct in the Science Content and Cognitive Domains  
(Continued)**

Country	Overall Science	Science Content Domains				Science Cognitive Domains		
		Biology	Chemistry	Physics	Earth Science	Knowing	Applying	Reasoning
<b>Ninth Grade Participants</b>								
Botswana	30 (0.4)	31 (0.5)	32 (0.4)	29 (0.4)	29 (0.5)	39 (0.4)	29 (0.4)	21 (0.5)
Honduras	24 (0.5)	25 (0.5)	24 (0.5)	21 (0.4)	29 (0.7)	34 (0.5)	23 (0.5)	14 (0.5)
<sup>ψ</sup> South Africa	22 (0.3)	22 (0.4)	23 (0.4)	22 (0.3)	22 (0.4)	30 (0.4)	21 (0.4)	14 (0.4)
<b>Benchmarking Participants</b>								
Alberta, Canada	54 (0.5)	56 (0.5)	50 (0.6)	49 (0.5)	62 (0.6)	59 (0.5)	53 (0.5)	50 (0.7)
Ontario, Canada	49 (0.5)	51 (0.5)	44 (0.6)	44 (0.5)	55 (0.7)	53 (0.5)	48 (0.6)	44 (0.7)
Quebec, Canada	48 (0.6)	49 (0.6)	49 (0.7)	41 (0.6)	57 (0.7)	54 (0.6)	48 (0.6)	42 (0.7)
Abu Dhabi, UAE	38 (0.7)	39 (0.7)	40 (0.7)	34 (0.7)	42 (0.9)	47 (0.7)	38 (0.7)	29 (0.8)
Dubai, UAE	43 (0.4)	44 (0.5)	45 (0.5)	39 (0.4)	47 (0.6)	51 (0.4)	42 (0.5)	34 (0.4)
Alabama, US	43 (1.2)	44 (1.1)	43 (1.3)	37 (1.0)	47 (1.6)	50 (1.2)	42 (1.1)	33 (1.2)
California, US	45 (0.9)	45 (1.0)	48 (1.2)	38 (0.8)	49 (0.9)	51 (0.9)	44 (0.9)	37 (1.1)
Colorado, US	53 (1.0)	55 (1.0)	52 (1.1)	47 (1.1)	60 (1.2)	59 (0.9)	53 (1.0)	47 (1.2)
Connecticut, US	52 (1.0)	54 (1.0)	51 (1.1)	45 (1.1)	58 (1.1)	59 (1.0)	51 (1.0)	45 (1.2)
Florida, US	51 (1.5)	51 (1.4)	51 (1.5)	47 (1.6)	57 (1.8)	59 (1.5)	50 (1.5)	43 (1.7)
Indiana, US	52 (1.1)	53 (1.0)	51 (1.1)	45 (1.2)	58 (1.2)	58 (1.1)	51 (1.0)	44 (1.3)
Massachusetts, US	59 (1.1)	61 (1.1)	60 (1.3)	52 (1.3)	65 (1.1)	66 (1.2)	58 (1.0)	53 (1.4)
Minnesota, US	56 (1.1)	58 (1.1)	54 (1.0)	49 (1.1)	65 (1.3)	61 (1.0)	56 (1.1)	50 (1.3)
North Carolina, US	51 (1.3)	54 (1.3)	53 (1.4)	43 (1.4)	57 (1.2)	58 (1.2)	51 (1.2)	44 (1.5)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011



# Appendix F

## The Test-Curriculum Matching Analysis—Science

TIMSS went to great lengths to ensure that comparisons of student achievement across countries would be as fair and equitable as possible. The *TIMSS 2011 Assessment Frameworks* were designed to specify the important aspects of science that participating countries agreed should be the focus of an international assessment of science achievement, and the assessment items were developed through a collaborative process with national representatives to faithfully represent the specifications in the frameworks and field tested extensively in participating countries. Finalizing the TIMSS 2011 assessments involved a series of reviews by representatives of the participating countries, experts in science, and testing specialists. At the end of this process, the National Research Coordinators (NRCs) from each country formally approved the TIMSS 2011 assessments, thus accepting them as being sufficiently fair to compare their students' science achievement with that of students from other countries.

Although the assessments were developed to represent an agreed-upon framework and were intended to have as much in common across countries as possible, it was unavoidable that the match between the TIMSS 2011 assessment (or test) and the science curriculum would not be the same in all countries. To restrict test items to just those topics included in the curricula of all participating countries and covered in the same sequence would severely limit test coverage and restrict the research questions that the study is designed to address. The tests, therefore, inevitably have some items measuring topics unfamiliar to some students in some countries.

The Test-Curriculum Matching Analysis (TCMA) was conducted to investigate the extent to which the TIMSS 2011 science assessment was relevant to each country's curriculum. The TCMA also investigates the impact on a country's performance of including only achievement items that were judged to be relevant to its own curriculum.<sup>1</sup>

To gather data about the extent to which the TIMSS 2011 tests were relevant to the curricula of the TIMSS countries and benchmarking participants, NRCs were asked to examine each achievement item and indicate whether the item was in their country's intended curriculum at the grade tested (fourth or eighth grade). The NRCs were asked to choose persons very familiar with the curriculum at these grades to make this determination. In some countries, the curriculum was prescribed for a range of grades and was not explicit about what was to be covered by the end of the fourth or eighth grades. For example, in Sweden the curriculum specifies the curricular goals to be achieved by the end of the fifth and ninth grades, but does not provide a grade-by-grade specification.

<sup>1</sup> Because there also may be curriculum areas covered in some countries that are not covered by the TIMSS 2011 tests, the TCMA does not provide complete information about how well the tests cover the curricula of the countries.

In such situations, coordinators were asked to make the best judgment possible.<sup>2</sup> Since an item might be in the curriculum for some but not all students in a country, coordinators were asked to consider an item included if it was in the intended curriculum for more than 50 percent of the students. All TIMSS 2011 participants took part in the TCMA analysis except Bahrain, Georgia, Saudi Arabia, Honduras (sixth grade participant), and the US benchmarking states at the fourth grade, and Bahrain, Georgia, Ghana, Indonesia, Saudi Arabia, Syrian Arab Republic, Honduras (ninth grade participant), and the US benchmarking states at the eighth grade.

Exhibits F.1 through F.4 present the TCMA results for the TIMSS 2011 science test at the fourth and eighth grades. Exhibits F.1 and F.2 show the average percent correct on the science items judged appropriate by each country at the fourth and eighth grades, respectively. Exhibits F.3 and F.4 show the standard errors corresponding to the percentages presented in Exhibits F.1 and F.2.

In Exhibit F.1, the bottom row of the exhibit shows the number of items, in terms of score points, identified as appropriate in each country. At the fourth grade, the maximum number of score points in the assessment was 181 points.<sup>3</sup> Reading along the bottom row, it can be seen that only eight participants—Singapore, Korea, Japan, Chinese Taipei, the Russian Federation, Chile, Tunisia, and Yemen—judged less than half of the science items to be included in their curricula, although interestingly, five of the eight were among the highest performers on the TIMSS 2011 assessment. Two countries, Thailand and Armenia, judged 100 percent of the items (all 181 score points) to be included in their curricula. A further 29 countries, including one sixth grade participant, and two benchmarking participants, judged 75 percent or more (136 score points) to be appropriate.

At the eighth grade, the percentage of items judged appropriate was somewhat higher; five countries and one benchmarking participant accepted 100 percent of the items (all 233 score points), and a further 23 countries, two ninth grade participants, and two benchmarking participants judged 75 percent or more (175 score points) to be appropriate. Only Morocco, with 116 score points, judged less than half of the score points to be appropriate.

Because most countries indicated that some items were not included in their intended curriculum at the grade tested, the data were analyzed

2 Exhibit 6 of the *TIMSS 2011 Encyclopedia* provides information on the grade-to-grade structure of the science curriculum for each TIMSS 2011 participant.

3 The TIMSS 2011 fourth grade science assessment contained 172 items, yielding 184 score points. However, following item review, three items were deleted, resulting in data for reporting on 169 items and 181 score points. Similarly, following item review, the 217 items and 234 score points in the eighth grade assessment were reduced to 216 items and 233 score points.

## Appendix F.1: Average Percent Correct for the Test-Curriculum Matching Analysis

Based on a subset of items specifically identified by each country as addressing its curriculum

Read across the row to compare that country's performance based on the test items included by each of the countries across the top. Read down the column under a country name to compare the performance of the country down the left on the items included by the country listed on the top. Read along the diagonal to compare performance for each different country based on its own decisions about the test items to include.

Country	Average Percent Correct on All Items	Singapore	Korea, Rep. of	Finland	Japan	Chinese Taipei	Russian Federation	United States	Czech Republic	Hungary	Hong Kong SAR	Slovak Republic	Sweden	Austria	England	Netherlands	Denmark	Germany	Italy	Portugal	Slovenia	Serbia	Ireland	Northern Ireland	Australia	Lithuania	Croatia	Romania	Spain	Belgium (Flemish)	Poland
Singapore	66 (0.7)	77	67	70	75	71	71	67	67	66	66	68	65	68	68	67	66	68	66	67	68	67	66	68	68	67	65	66	66	66	66
Korea, Rep. of	65 (0.3)	64	75	68	70	69	70	67	67	66	64	68	66	66	67	67	66	67	66	66	69	67	65	68	67	65	65	66	66	66	69
Finland	63 (0.4)	60	61	66	63	62	68	64	65	63	62	67	62	64	63	65	63	63	62	63	66	62	63	65	64	63	62	63	63	64	67
Japan	60 (0.3)	62	65	64	69	67	62	62	62	60	59	63	61	62	62	61	61	62	58	61	63	61	60	63	61	59	59	60	60	60	62
Chinese Taipei	59 (0.4)	58	63	63	65	64	63	61	61	60	58	64	59	61	60	61	60	60	60	60	62	60	62	60	60	57	60	60	59	59	63
Russian Federation	59 (0.7)	58	57	63	61	58	68	61	62	59	57	64	59	60	59	60	60	59	59	60	63	59	59	61	60	60	59	59	60	60	64
United States	57 (0.4)	55	57	60	58	58	65	59	60	58	56	61	57	58	58	59	58	57	57	58	60	57	57	61	59	59	56	57	58	58	62
Czech Republic	56 (0.5)	55	52	60	56	54	64	57	60	56	55	61	56	57	55	59	57	56	56	56	60	55	56	59	57	58	56	56	57	57	61
Hungary	56 (0.7)	54	53	60	56	55	65	67	59	56	55	61	56	57	55	58	57	56	56	57	59	55	56	59	57	57	56	56	57	57	62
Hong Kong SAR	56 (0.7)	56	58	60	59	56	60	57	57	56	54	59	55	56	56	57	56	55	54	56	59	55	56	58	57	57	54	56	56	56	60
Slovak Republic	55 (0.7)	53	52	60	57	53	63	57	58	56	53	61	55	56	55	57	56	56	54	56	59	54	56	58	57	57	55	56	57	56	60
Sweden	55 (0.5)	52	54	58	56	54	63	56	58	55	54	60	56	56	56	57	56	56	55	55	59	54	55	58	56	56	54	55	55	57	61
Austria	55 (0.6)	52	54	58	57	53	62	56	57	55	53	59	54	56	55	57	55	56	54	55	58	54	55	58	54	55	54	55	56	56	60
England	54 (0.6)	52	54	58	56	55	60	56	56	55	53	58	54	55	55	56	55	55	53	55	58	54	55	58	56	56	53	54	55	54	58
Netherlands	54 (0.4)	50	52	58	52	53	62	55	57	54	53	58	54	55	54	56	55	55	53	54	57	54	54	58	56	56	52	54	55	55	60
Denmark	54 (0.5)	51	51	57	54	52	60	55	56	54	53	57	54	54	53	56	55	55	53	54	57	53	54	56	54	55	53	54	55	55	59
Germany	54 (0.5)	50	53	57	55	52	60	55	56	54	52	58	53	55	54	56	55	55	53	54	57	53	54	56	55	55	52	54	54	54	58
Italy	53 (0.5)	52	51	57	53	51	62	54	57	54	52	58	52	55	53	56	54	54	55	54	57	53	53	57	55	55	54	54	55	55	58
Portugal	53 (0.8)	51	52	58	53	53	61	54	56	54	52	58	53	54	53	55	54	54	52	54	57	52	54	56	56	55	52	53	54	54	59
Slovenia	53 (0.4)	52	52	56	56	53	60	54	55	53	51	58	53	55	54	55	53	54	53	53	57	53	53	56	54	55	52	53	54	54	57
Serbia	52 (0.6)	53	51	56	54	53	60	52	54	52	51	55	51	54	52	54	52	53	52	52	55	53	52	55	53	53	51	52	53	53	56
Ireland	52 (0.6)	49	51	55	51	51	59	53	54	52	51	55	51	52	52	53	52	53	51	52	54	51	52	55	53	50	52	53	52	57	
Northern Ireland	52 (0.5)	48	51	55	50	51	59	53	54	52	50	56	51	53	52	54	52	53	51	52	55	51	52	55	53	53	50	51	53	52	57
Australia	52 (0.5)	50	50	55	50	50	59	53	54	52	50	55	51	52	52	53	52	52	52	52	54	51	52	55	53	53	50	51	52	52	57
Lithuania	51 (0.5)	49	48	55	51	50	59	53	54	52	49	55	51	52	52	53	52	52	51	52	55	51	52	54	53	54	51	51	53	52	56
Croatia	51 (0.4)	50	52	55	51	51	62	52	55	52	51	57	52	53	51	54	52	53	52	52	55	52	52	55	53	54	52	52	52	54	58
Romania	51 (1.0)	49	49	54	51	50	57	51	52	51	49	54	50	52	51	52	51	52	50	51	54	50	51	54	52	52	50	51	52	51	54
Spain	50 (0.5)	47	48	54	47	49	58	50	53	50	48	54	49	51	49	52	50	49	49	50	53	48	50	53	51	51	49	50	51	50	54
Belgium (Flemish)	49 (0.4)	46	47	53	49	49	57	51	52	50	48	54	49	51	50	52	50	50	49	50	53	49	50	53	51	51	48	49	50	51	56
Poland	49 (0.5)	45	47	52	46	47	57	50	52	49	47	53	48	50	48	51	49	50	49	49	52	48	49	52	50	51	49	49	50	50	54
New Zealand	48 (0.5)	45	46	51	47	47	55	49	51	48	46	52	48	48	48	50	49	49	48	48	51	47	48	52	50	49	47	48	49	49	53
Kazakhstan	48 (1.0)	49	46	51	50	50	55	50	50	48	47	52	48	49	47	50	48	49	47	49	50	47	48	50	49	50	48	48	49	49	51
Norway	47 (0.4)	43	45	50	44	44	55	48	49	47	45	51	47	47	46	48	48	47	46	47	50	45	47	49	48	48	46	47	48	48	54
Chile	45 (0.4)	43	42	49	43	44	54	46	48	45	43	49	45	45	44	46	46	45	44	46	48	44	45	48	47	47	44	45	46	45	50
Thailand	44 (0.9)	44	41	47	45	46	51	45	47	44	42	48	43	45	43	46	45	45	43	44	47	43	44	47	45	46	43	45	45	44	47
Turkey	43 (0.7)	45	43	46	43	43	49	44	45	43	41	46	42	44	44	44	43	44	42	44	46	42	43	46	44	45	42	43	44	44	45
Iran, Islamic Rep. of	41 (0.6)	40	40	46	43	43	49	42	43	42	39	46	41	42	42	43	42	42	40	42	44	41	42	44	43	44	40	42	43	41	45
Azerbaijan	40 (0.9)	40	38	44	40	36	46	41	41	40	37	43	39	40	39	41	40	40	38	40	42	38	40	42	40	41	39	40	41	40	42
Malta	40 (0.3)	38	40	43	42	41	46	41	41	40	38	43	40	39	41	41	40	40	39	40	43	39	40	43	41	41	38	40	40	39	44
United Arab Emirates	38 (0.3)	38	36	42	40	38	44	39	40	38	36	41	37	38	39	39	38	38	37	38	40	37	38	40	40	40	37	38	39	38	41
Armenia	34 (0.6)	34	32	37	35	32	41	36	36	35	33	37	34	35	33	36	35	35	34	35	37	33	35	36	35	36	34	35	35	36	38
Qatar	34 (0.6)	35	34	38	37	35	38	36	35	34	33	37	34	34	35	35	35	34	33	35	36	33	34	36	35	36	33	34	35	34	36
Oman	32 (0.5)	32	29	35	34	33	36	33	33	32	31	35	31	32	33	32	31	31	32	34	31	32	34	31	32	34	31	32	33	31	34
Kuwait	28 (0.5)	29	27	31	30	28	31	29	29	28	27	31	27	28	29	28	28	27	27	28	30	27	28	30	29	29	27	28	29	27	29
Tunisia	26 (0.6)	27	25	29	28	26	31	27	27	26	25	28	25	27	26	28	26	27	26	26	28	26	26	28	27	27	26	26	27	27	29
Morocco	21 (0.4)	22	22	23	23	20	23	22	22	21	20	23	20	21	21	22	21	21	21	21	22	20	21	22	22	22	21	21	22	21	21
Yemen	17 (0.4)	18	17	19	18	15	18	18	18	17	16	19	16	16	17	17	17	16	17	17	18	16	17	18	17	17	16	17	17	17	17
International Avg.	48 (0.1)	47	47	52	49	48	55	50	51	49	47	52	48	49	49	50	49	49	48	49	51	48	48	51	50	50	47	49	49	52	
Botswana (6)	31 (0.7)	33	33	34	35	33	34	32	33	31	30	34	31	32	31	32	32	32	30	32	33	31	31	33	32	32	30	32	32	31	32
Yemen (6)	28 (0.7)	28	26	31	29	27	31	29	29	28	26	31	27	28	28	28	28	27	27	28	30	27	28	29	29	28	27	28	28	27	29

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011

### Benchmarking Participants

**Appendix F.1: Average Percent Correct for the Test-Curriculum Matching Analysis (Continued)**

Read across the row to compare that country's performance based on the test items included by each of the countries across the top. Read down the column under a country name to compare the performance of the country down the left on the items included by the country listed on the top. Read along the diagonal to compare performance for each different country based on its own decisions about the test items to include.

New Zealand	Kazakhstan	Norway	Chile	Thailand	Turkey	Iran, Islamic Rep. of	Azerbaijan	Malta	United Arab Emirates	Armenia	Qatar	Oman	Kuwait	Tunisia	Morocco	Yemen	Botswana (6)	Yemen (6)	Benchmarking Participants	Alberta, Canada	Ontario, Canada	Quebec, Canada	Dubai, UAE	Abu Dhabi, UAE	Average Percent Correct on All Items	Country
68	65	66	65	66	66	66	67	68	67	66	69	66	66	70	66	65	66	68	72	68	66	66	65	66 (0.7)	Singapore	
68	66	65	63	65	65	66	67	65	66	65	65	65	65	66	66	62	65	65	69	67	66	65	62	65 (0.3)	Korea, Rep. of	
65	63	62	61	63	63	63	65	63	63	63	61	63	62	65	62	63	63	64	65	62	63	63	62	63 (0.4)	Finland	
62	60	60	55	60	60	61	61	62	61	60	59	60	60	63	61	56	61	62	61	57	60	60	58	60 (0.3)	Japan	
63	59	58	56	59	59	60	61	61	60	59	59	59	59	61	60	58	59	62	62	58	59	59	56	59 (0.4)	Chinese Taipei	
61	60	60	61	59	59	60	61	60	60	59	59	59	59	60	59	61	59	62	61	59	59	59	59	59 (0.7)	Russian Federation	
60	58	57	60	57	57	58	59	59	58	57	57	57	58	60	57	57	59	62	61	59	58	57	56	57 (0.4)	United States	
58	57	57	56	56	56	56	58	58	56	56	54	56	56	59	55	59	56	62	59	57	56	56	57	56 (0.5)	Czech Republic	
58	57	57	56	56	56	56	58	58	56	56	55	56	56	58	56	56	56	62	59	56	56	56	56	56 (0.7)	Hungary	
60	56	55	54	56	56	57	58	56	57	56	55	55	56	58	56	56	55	62	58	55	56	56	53	56 (0.7)	Hong Kong SAR	
58	56	56	56	55	55	56	58	57	56	55	54	55	55	59	55	60	56	62	57	55	56	56	55	55 (0.7)	Slovak Republic	
57	56	55	54	55	55	56	57	55	55	55	54	55	55	57	55	56	55	62	57	54	55	55	55	55 (0.5)	Sweden	
57	55	54	52	55	55	55	56	55	55	55	53	54	54	58	54	56	54	62	56	53	55	55	54	55 (0.6)	Austria	
57	54	54	55	54	54	55	56	56	55	54	54	54	54	59	54	54	54	62	57	55	55	54	53	54 (0.6)	England	
57	54	54	54	54	54	55	56	56	54	54	53	54	54	57	54	53	54	62	57	54	54	54	53	54 (0.4)	Netherlands	
55	54	54	52	54	54	55	55	54	54	54	53	53	54	57	53	53	54	62	56	56	54	54	53	54 (0.5)	Denmark	
56	54	53	52	54	54	54	56	55	54	54	52	54	53	58	54	54	53	62	56	56	54	52	54	54 (0.5)	Germany	
56	55	54	53	53	53	54	56	55	54	53	53	53	53	56	53	56	53	62	57	56	54	53	55	53 (0.5)	Italy	
56	54	53	54	53	54	54	55	55	54	53	53	53	54	56	53	56	53	62	57	55	54	53	54	53 (0.8)	Portugal	
54	54	53	52	53	53	53	54	54	54	53	52	53	53	56	52	56	53	62	57	55	53	53	53	53 (0.4)	Slovenia	
54	53	52	52	52	52	53	54	53	52	52	51	52	52	55	52	56	52	62	57	54	53	52	52	52 (0.6)	Serbia	
55	52	51	52	52	52	53	54	53	52	51	52	52	52	56	52	51	51	62	57	54	52	52	51	52 (0.6)	Ireland	
55	52	51	52	52	52	52	54	53	52	52	51	51	52	56	51	50	51	62	57	54	52	52	51	52 (0.5)	Northern Ireland	
55	52	52	53	52	51	52	53	53	52	52	51	51	51	54	51	51	51	62	57	54	52	52	51	52 (0.5)	Australia	
54	52	52	52	51	51	52	53	53	52	51	51	51	52	54	52	53	51	62	57	54	52	52	51	51 (0.5)	Lithuania	
54	54	53	51	51	51	51	52	53	52	51	49	51	51	55	51	54	51	62	57	54	52	52	51	51 (0.4)	Croatia	
53	51	51	51	51	51	52	53	53	51	51	50	51	51	53	51	53	51	62	57	54	52	52	51	51 (1.0)	Romania	
53	51	50	51	50	50	50	52	51	50	50	49	50	50	54	49	53	50	62	57	54	52	52	50	50 (0.5)	Spain	
52	50	49	49	49	50	50	51	51	50	49	49	49	49	53	49	48	49	62	57	54	52	52	49	49 (0.4)	Belgium (Flemish)	
52	50	50	49	49	49	49	51	50	50	49	48	49	49	52	49	49	49	62	57	54	52	52	49	49 (0.5)	Poland	
51	48	48	48	48	48	49	50	49	48	47	48	48	48	52	48	48	48	62	57	54	52	52	48	48 (0.5)	New Zealand	
50	49	49	50	48	48	48	49	49	48	48	48	48	48	51	48	50	48	62	57	54	52	52	48	48 (1.0)	Kazakhstan	
49	48	47	46	47	47	48	49	47	47	47	46	46	47	50	46	50	46	62	57	54	52	52	47	47 (0.4)	Norway	
48	46	46	48	45	45	46	47	47	46	45	45	45	45	49	45	48	45	62	57	54	52	52	46	45 (0.4)	Chile	
48	45	44	44	44	44	45	46	46	45	44	44	44	44	45	45	48	45	62	57	54	52	52	44	44 (0.9)	Thailand	
45	43	43	44	43	43	44	45	44	44	43	42	43	43	48	43	47	43	62	57	54	52	52	44	43 (0.7)	Turkey	
45	42	41	43	41	42	43	43	43	42	41	41	41	42	45	42	48	42	62	57	54	52	52	43	41 (0.6)	Iran, Islamic Rep. of	
42	40	40	41	40	40	41	43	41	41	40	40	39	40	44	40	44	40	62	57	54	52	52	41	40 (0.9)	Azerbaijan	
42	40	40	41	40	40	40	41	42	41	40	40	39	40	42	40	40	40	62	57	54	52	52	40	40 (0.3)	Malta	
41	38	38	39	38	38	39	40	40	39	38	38	38	38	42	38	41	38	62	57	54	52	52	39	38 (0.3)	United Arab Emirates	
37	35	35	35	34	35	35	36	36	35	34	35	34	35	37	35	38	35	62	57	54	52	52	36	34 (0.6)	Armenia	
37	34	34	35	34	35	35	36	36	35	34	35	34	35	38	34	36	34	62	57	54	52	52	36	34 (0.6)	Qatar	
35	32	31	32	32	33	34	34	34	33	32	31	32	32	35	32	33	32	62	57	54	52	52	35	32 (0.5)	Oman	
30	28	28	28	28	28	29	30	30	29	28	27	28	28	31	28	30	28	62	57	54	52	52	28	28 (0.5)	Kuwait	
28	27	26	25	26	26	27	28	27	27	26	27	26	26	30	26	27	26	62	57	54	52	52	28	26 (0.6)	Tunisia	
23	21	21	20	21	21	22	23	22	22	21	21	21	21	24	21	21	21	62	57	54	52	52	23	21 (0.4)	Morocco	
19	17	17	17	17	17	19	18	18	17	17	17	17	17	19	17	18	17	62	57	54	52	52	18	17 (0.4)	Yemen	
51	49	48	48	48	48	49	50	49	48	48	48	48	48	51	48	50	48	62	57	54	52	52	51	48 (0.1)	International Avg.	
34	31	31	31	31	31	32	33	33	33	31	31	31	31	35	32	32	32	62	57	54	52	52	31	31 (0.7)	Botswana (6)	
30	27	27	28	28	28	29	30	29	29	28	27	28	28	32	28	30	28	62	57	54	52	52	28	28 (0.7)	Yemen (6)	
<b>Benchmarking Participants</b>																										
60	57	56	57	57	57	57	58	58	57	57	55	57	57	59	56	55	56	58	61	58	57	57	56	57 (0.5)	Alberta, Canada	
57	55	54	55	54	54	55	55	56	54	54	53	54	55	57	53	53	54	58	61	58	57	57	56	54 (0.6)	Ontario, Canada	
55	53	52	53	52	52	52	53	52	52	52	51	52	52	55	51	53	52	58	61	58	57	57	56	52 (0.5)	Quebec, Canada	
47	44	44	45	44	44	45	46	46	45	44	44	43	44	47	44	45	44	58	61	58	57	57	56	44 (0.3)	Dubai, UAE	
39	36	36	37	36	36	36	37	38	37	36	36	35	36	40	36	38	36	58	61	58	57	57	56	36 (0.7)	Abu Dhabi, UAE	
<b>Benchmarking Participants</b>																										
137	141	149	74	181	175	166	159	126	164	181	106	165	162	73	158	53	166	85	109	93	174	180	113	181	Number of Items (Score Points) Identified*	

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011

## Appendix F.2: Average Percent Correct for the Test-Curriculum Matching Analysis

Based on a subset of items specifically identified by each country as addressing its curriculum

Read across the row to compare that country's performance based on the test items included by each of the countries across the top. Read down the column under a country name to compare the performance of the country down the left on the items included by the country listed on the top. Read along the diagonal to compare performance for each different country based on its own decisions about the test items to include.

Country	Average Percent Correct on All Items	Singapore	Chinese Taipei	Korea, Rep. of	Japan	Finland	Russian Federation	Slovenia	Hong Kong SAR	England	United States	Hungary	Israel	Australia	Lithuania	New Zealand	Sweden	Italy	Ukraine	Norway	Turkey	Kazakhstan	Iran, Islamic Rep. of	United Arab Emirates	Romania	Chile	Jordan	Thailand	Armenia	Qatar	Oman
Singapore	64 (0.9)	65	64	65	64	64	65	65	65	65	64	64	65	64	65	65	64	65	64	64	64	64	64	64	65	67	64	64	65	64	
Chinese Taipei	59 (0.5)	57	59	59	60	60	60	61	59	59	59	59	58	59	59	59	59	60	58	59	59	59	58	59	58	61	59	59	59	59	
Korea, Rep. of	58 (0.4)	55	58	61	59	60	59	59	58	59	58	58	56	58	58	58	58	60	57	58	58	58	57	58	59	57	60	58	58	58	
Japan	57 (0.5)	55	57	59	61	59	58	59	58	57	57	57	56	57	57	57	57	58	56	57	57	57	57	57	58	59	57	57	56	57	
Finland	56 (0.5)	53	56	57	56	58	58	58	56	56	55	56	55	56	56	56	56	57	55	56	56	56	55	56	55	58	56	56	55	56	
Russian Federation	54 (0.7)	52	54	55	55	56	57	56	54	54	54	54	54	54	54	54	54	56	53	54	54	55	54	54	55	53	57	54	54	55	
Slovenia	54 (0.5)	53	54	55	54	56	56	58	54	54	54	54	54	54	54	54	54	56	54	54	54	55	54	54	54	56	54	54	54	55	
Hong Kong SAR	52 (0.7)	51	52	53	52	54	53	54	54	53	52	52	52	52	53	53	53	52	52	52	52	52	52	52	53	52	55	52	52	53	
England	52 (1.0)	50	52	53	53	53	53	54	52	53	52	52	51	52	52	53	52	53	51	52	52	52	52	52	52	55	52	52	52	53	
United States	50 (0.5)	48	50	50	50	51	52	52	49	50	50	50	50	51	51	51	50	52	50	51	50	50	50	51	50	53	50	50	50	51	
Hungary	50 (0.6)	48	50	51	50	52	51	52	50	50	50	50	49	50	50	51	50	52	49	51	50	50	50	51	50	53	50	50	49	50	
Israel	49 (0.8)	49	49	49	49	50	51	50	50	50	49	49	49	50	49	50	50	50	48	50	49	49	49	50	49	51	52	49	49	50	
Australia	49 (1.0)	46	49	49	49	50	50	50	48	49	49	49	49	49	50	50	49	50	48	49	49	49	48	49	49	51	49	49	48	49	
Lithuania	48 (0.5)	45	48	49	48	49	49	50	47	47	48	48	47	48	48	48	48	49	47	48	48	48	47	48	47	50	48	48	47	48	
New Zealand	48 (0.9)	46	48	48	48	49	49	49	47	48	48	48	47	48	48	49	48	49	47	48	48	48	47	48	48	50	48	48	47	48	
Sweden	47 (0.5)	44	47	48	47	49	49	48	47	47	47	47	45	47	47	47	47	49	46	47	47	47	48	47	47	49	47	47	46	47	
Italy	45 (0.4)	42	45	47	44	47	48	47	45	45	45	45	45	46	46	46	45	47	45	46	45	46	45	46	46	48	45	45	44	46	
Ukraine	45 (0.7)	43	45	46	45	47	47	47	46	46	45	45	45	46	45	46	45	47	45	46	45	46	45	46	45	48	45	45	45	47	
Norway	43 (0.5)	40	43	45	43	45	45	45	42	43	43	43	42	44	44	44	44	45	43	44	43	44	43	44	43	46	43	43	42	44	
Turkey	43 (0.7)	42	43	43	41	44	44	44	44	43	43	43	43	44	43	43	44	42	43	43	43	43	43	43	43	46	43	43	44	44	
Kazakhstan	43 (0.9)	41	43	43	42	44	45	44	42	43	42	43	42	43	43	43	43	44	42	43	43	43	43	43	42	44	43	43	43	43	
Iran, Islamic Rep. of	41 (0.7)	38	41	41	41	42	43	41	41	41	40	40	40	41	41	41	41	42	40	42	41	41	40	41	40	43	41	41	42	42	
United Arab Emirates	39 (0.4)	39	39	40	40	40	42	40	40	40	39	39	39	40	40	40	39	41	39	40	39	40	39	40	40	42	39	39	40	40	
Romania	38 (0.7)	36	38	39	38	40	41	40	38	39	38	38	38	39	39	39	39	40	38	39	38	39	38	39	39	40	38	38	38	39	
Chile	37 (0.4)	34	37	37	36	39	40	39	37	38	37	37	37	37	38	38	37	39	37	38	37	38	37	38	38	40	37	37	37	38	
Jordan	37 (0.6)	36	37	37	36	38	39	39	37	38	37	37	37	38	37	38	38	39	37	38	37	37	37	37	37	41	37	37	38	38	
Thailand	36 (0.7)	33	36	37	34	37	38	37	36	36	36	36	36	36	36	36	36	37	35	36	36	36	35	36	36	39	36	36	36	36	
Armenia	35 (0.5)	32	35	34	33	36	37	36	35	35	35	35	34	35	35	35	35	37	34	36	35	35	35	36	35	37	35	35	36	37	
Qatar	34 (0.5)	33	34	34	33	35	36	35	34	35	34	34	34	34	34	35	34	35	33	34	34	34	33	34	34	37	34	34	35	35	
Oman	33 (0.4)	32	33	34	33	34	35	34	34	34	33	33	33	34	33	34	33	35	33	34	33	33	33	34	33	36	33	33	35	35	
Malaysia	33 (0.9)	32	33	34	33	34	34	34	34	34	33	33	34	34	34	34	34	35	33	34	33	34	33	33	34	36	33	33	34	34	
Palestinian Nat'l Auth.	33 (0.5)	32	33	33	33	34	34	34	34	34	33	33	33	34	33	34	34	34	32	34	33	33	33	34	33	36	33	33	34	34	
Tunisia	33 (0.4)	32	33	33	32	34	34	34	33	33	33	33	32	33	33	33	33	34	32	33	33	33	32	33	33	36	33	33	33	33	
Macedonia, Rep. of	32 (0.8)	30	32	32	31	33	34	33	32	32	32	32	31	33	32	32	32	33	31	32	32	32	32	32	32	34	32	32	32	33	
Lebanon	29 (0.7)	29	29	29	30	31	32	30	30	30	29	29	29	30	29	30	29	31	29	30	29	30	29	30	30	32	29	29	31	30	
Morocco	25 (0.2)	24	25	25	24	25	27	26	25	25	25	25	24	25	25	25	25	26	24	25	25	25	25	24	25	27	25	25	25	25	
International Avg.	44 (0.1)	42	44	44	44	45	46	45	44	44	44	44	44	43	44	44	44	45	43	44	44	44	44	44	44	47	44	44	44	45	
Botswana (9)	30 (0.4)	29	30	31	30	31	32	31	31	31	30	30	30	31	30	31	31	32	29	31	30	31	31	31	31	33	30	30	32	31	
South Africa (9)	22 (0.3)	21	22	22	21	23	24	23	23	23	22	22	22	22	22	23	22	23	21	22	22	22	22	22	23	24	22	22	23	22	
<b>Benchmarking Participants</b>																															
Alberta, Canada	54 (0.5)	52	54	56	54	55	56	56	54	54	54	54	55	55	56	54	56	54	55	54	55	54	55	55	55	56	54	54	53	55	
Ontario, Canada	49 (0.5)	47	49	50	48	49	50	50	49	49	49	49	49	49	50	49	49	50	48	49	49	49	48	49	49	51	49	49	47	49	
Quebec, Canada	48 (0.6)	46	48	49	48	50	50	50	48	48	48	48	48	49	49	49	49	50	48	49	48	49	48	49	49	51	48	48	47	49	
Dubai, UAE	43 (0.4)	43	43	44	44	44	46	44	44	44	44	43	44	44	44	44	44	45	43	44	43	44	43	44	44	46	43	43	44	44	
Abu Dhabi, UAE	38 (0.7)	38	38	39	39	39	41	39	39	39	39	38	39	39	39	39	38	40	38	39	38	39	38	39	39	41	38	38	40	39	
Number of Items (Score Points) Identified*	233	160	233	177	126	203	170	200	163	192	216	232	187	214	217	200	218	210	199	193	233	220	228	223	226	176	198	233	233	166	176

\* Of the 217 items in the Science test, some extended-response items were scored on a two-point scale, resulting in 234 score points. Following item review, one item was deleted, resulting in 216 items and 233 score points.

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011

**Appendix F.2: Average Percent Correct for the Test-Curriculum Matching Analysis (Continued)**

Read across the row to compare that country's performance based on the test items included by each of the countries across the top. Read down the column under a country name to compare the performance of the country down the left on the items included by the country listed on the top. Read along the diagonal to compare performance for each different country based on its own decisions about the test items to include.

										Benchmarking Participants					Average Percent Correct on All Items		Country
Malaysia	Palestinian Nat'l Auth.	Tunisia	Macedonia, Rep. of	Lebanon	Morocco	Botswana (9)	South Africa (9)	Alberta, Canada	Ontario, Canada	Quebec, Canada	Dubai, UAE	Abu Dhabi, UAE					
64	65	65	64	65	65	64	64	66	64	64	64	65	64	(0.9)	Singapore		
59	60	58	59	58	58	58	59	60	59	59	59	59	59	(0.5)	Chinese Taipei		
58	60	59	58	57	58	58	58	61	59	58	58	58	58	(0.4)	Korea, Rep. of		
58	57	57	57	56	57	57	57	58	55	57	57	57	57	(0.5)	Japan		
56	56	54	56	55	52	56	56	57	56	56	56	56	56	(0.5)	Finland		
54	55	54	54	54	54	54	54	55	54	54	54	54	54	(0.7)	Russian Federation		
54	55	55	54	55	54	54	54	55	54	54	54	54	54	(0.5)	Slovenia		
52	53	51	52	52	51	53	52	54	52	52	52	52	52	(0.7)	Hong Kong SAR		
52	52	50	52	52	50	52	52	54	52	52	52	52	52	(1.0)	England		
50	50	49	50	50	49	50	50	52	50	50	50	50	50	(0.5)	United States		
50	51	50	50	50	49	50	50	51	50	50	50	50	50	(0.6)	Hungary		
50	50	48	49	50	49	49	49	51	49	49	49	50	49	(0.8)	Israel		
49	48	46	49	48	47	49	49	51	49	49	49	49	49	(1.0)	Australia		
48	48	46	48	47	45	47	48	49	48	48	48	48	48	(0.5)	Lithuania		
48	47	46	48	48	47	47	48	49	48	48	48	48	48	(0.9)	New Zealand		
47	48	45	47	46	44	47	47	49	46	47	47	47	47	(0.5)	Sweden		
45	47	43	45	45	43	45	45	47	45	46	45	46	45	(0.4)	Italy		
46	46	45	45	45	45	45	45	46	45	46	45	46	45	(0.7)	Ukraine		
43	44	42	43	43	42	43	43	46	44	44	43	44	43	(0.5)	Norway		
43	45	44	43	43	42	43	42	44	43	42	43	44	43	(0.7)	Turkey		
43	44	44	43	43	44	42	43	43	43	43	43	43	43	(0.9)	Kazakhstan		
40	42	41	41	41	40	40	40	41	40	41	41	40	41	(0.7)	Iran, Islamic Rep. of		
39	40	39	39	40	40	39	39	40	39	40	39	39	39	(0.4)	United Arab Emirates		
39	39	38	38	39	38	38	38	39	38	39	38	39	38	(0.7)	Romania		
37	38	36	37	37	36	37	37	39	37	37	37	38	37	(0.4)	Chile		
37	38	37	37	38	37	37	37	37	37	37	37	38	37	(0.6)	Jordan		
36	37	35	36	36	34	36	35	38	36	36	36	36	36	(0.7)	Thailand		
35	37	36	35	37	34	35	34	38	35	35	35	35	35	(0.5)	Armenia		
34	35	34	34	35	33	34	33	35	32	34	34	34	34	(0.5)	Qatar		
33	35	33	33	34	33	33	33	35	33	33	33	33	33	(0.4)	Oman		
33	34	34	33	34	33	33	33	34	34	33	33	34	33	(0.9)	Malaysia		
34	35	34	33	35	33	33	33	33	32	33	33	34	33	(0.5)	Palestinian Nat'l Auth.		
33	34	33	33	33	33	33	32	34	32	33	33	33	33	(0.4)	Tunisia		
32	34	31	32	33	30	32	32	33	31	32	32	33	32	(0.8)	Macedonia, Rep. of		
30	31	31	29	31	30	29	29	30	28	29	29	30	29	(0.7)	Lebanon		
25	25	24	25	26	25	25	25	25	23	25	25	25	25	(0.2)	Morocco		
44	45	44	44	44	43	44	44	45	44	44	44	44	44	(0.1)	International Avg.		
31	32	31	30	31	29	31	30	31	31	30	30	31	30	(0.4)	Botswana (9)		
22	23	22	22	23	22	22	22	23	21	22	22	23	22	(0.3)	South Africa (9)		
<b>Benchmarking Participants</b>																	
54	54	51	54	53	53	54	54	59	56	54	54	54	54	(0.5)	Alberta, Canada		
49	48	46	49	48	47	49	48	52	50	49	49	49	49	(0.5)	Ontario, Canada		
48	48	47	48	48	47	48	48	51	48	48	48	48	48	(0.6)	Quebec, Canada		
44	44	43	43	44	43	44	43	45	43	43	43	44	43	(0.4)	Dubai, UAE		
39	39	38	38	39	39	38	38	40	38	39	38	39	38	(0.7)	Abu Dhabi, UAE		
220	181	124	233	162	116	219	212	154	146	205	233	200	233		Number of Items (Score Points) Identified*		

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

to determine whether the inclusion of these items had any effect on the international performance comparisons.<sup>4</sup>

The first column of data in Exhibits F.1 and F.2 show the average percent correct on all test items for each participant, together with its standard error. Subsequent columns show the performance of each participant on those items judged appropriate by the participant listed at the head of the column. Participants are presented in order of their performance based on average percent correct on all items, from highest to lowest. To interpret these exhibits, choosing a country and reading across its row provides the average percent correct for the students in that country on the items selected by each of the countries listed along the top of the exhibit. For example, at the fourth grade, Singapore, where the average percent correct was 77 percent on its own set of items, had 67 percent correct on the items selected by Korea, 70 percent on the items selected by Finland, 75 percent on the items selected by Japan, and so forth. The column for a country listed at the top shows how each of the other participants performed on the set of items selected as appropriate for that country's students. Using the set of items selected by the Russian Federation as an example, 58 percent of these items, on average, were answered correctly by students in Singapore, 57 percent by students in Korea, 63 percent by students in Finland, 61 percent by students in Japan, 58 percent by those in Chinese Taipei, and so forth. The shaded diagonal element in the exhibit shows how each country performed on the set of items that it selected based on its own curriculum. Thus, Russian students averaged 68 percent correct on the set of items identified by the Russian Federation for the analysis.

For each country's selected items, the international averages across participating countries are presented in the lower part of the exhibit. These show that the selection of items by the participating countries varied somewhat in average difficulty, ranging at the fourth grade from 47 percent correct for those chosen by Singapore, Korea, Hong Kong SAR, and Croatia to 55 percent correct for those chosen by the Russian Federation. Similarly at the eighth grade, the average percent correct ranged from 42 percent for those items chosen by Singapore to 47 percent for those chosen by Jordan.

Comparing the diagonal element for a country with the overall average percent correct shows the difference between performance on the set of items chosen as appropriate for that country and performance on the test as a whole. In general, countries performed better on their own item sets than on the

4 It should be noted that the science achievement presented in Exhibits F.1 and F.2 is based on average percent correct (the percentage of students in a country, averaged across all items), which is different from the average scale scores that are presented in Chapter 1.

items overall, although usually not by much. Singapore had one of the greatest differences. The average percent correct for Singapore across all fourth grade science items was 66 percent. The diagonal element shows that Singaporean students had a greater average percent correct (77 percent) across the set of items selected as appropriate for Singapore than they did overall. However, most participants had a difference of one or two percentage points between the two performance measures. In addition to Singapore, with a difference of eleven percentage points, other exceptions included Korea (a difference of 10 points), Japan and the Russian Federation (9 points), the Slovak Republic (6 points), and Chinese Taipei and Poland (5 points). At the eighth grade, the differences were generally less; the largest being in province of Alberta (5 points) and Japan, Slovenia, and Jordan (4 percentage points).

It is clear that the selection of items does not have a major effect on the relative performance among TIMSS participants. Participants that had relatively high or low performance across all the science items also had relatively high or low performance on each of the various sets of items selected for the TCMA. For example, at the fourth grade, Singapore had the highest average percent correct not only on the test as a whole, but also on all of the different item selections, with Korea, Finland, and Japan next in order of performance on practically all selections of items. Although there are some changes in the ordering of countries based on the items selected for the TCMA, most of these differences are within the boundaries of sampling error.<sup>5</sup>

Even when countries performed better on the items judged by them to be included in their curriculum than they did overall, their performance relative to other participants was changed little. As an example, consider the 200 score points selected by Slovenia at the eighth grade. The students in Slovenia did better on these items (58% correct) than on the test as a whole (54% correct). However, most other countries also did better on these particular items, with an international average of 46 percent correct compared with 44 percent correct overall. In general, the TIMSS participants that performed as well or better than Slovenia on the overall test also performed as well or better on the items selected by Slovenia.

The TCMA results provide evidence that the TIMSS 2011 science assessment provides a reasonable basis for comparing achievement of the participating countries and benchmarking entities. This result is not unexpected; making the assessment as fair as possible was a major consideration in test

5 Small differences in performance between adjacent countries shown in this exhibit usually are not statistically significant. The standard errors for the average percent correct statistics based on the TIMSS 2011 sample are provided in Exhibits F.3 and F.4. For any sample average shown in Exhibits F.1 and F.2, it can be said with 95 percent confidence that the corresponding value in the population falls between the sample estimate plus or minus two standard errors.



Appendix F.3: Standard Errors for the Test-Curriculum Matching Analysis (Continued)

Read across the row to compare that country's performance based on the test items included by each of the countries across the top. Read down the column under a country name to compare the performance of the country down the left on the items included by the country listed on the top. Read along the diagonal to compare performance for each different country based on its own decisions about the test items to include.

	New Zealand	Kazakhstan	Norway	Chile	Thailand	Turkey	Iran, Islamic Rep. of	Azerbaijan	Malta	United Arab Emirates	Armenia	Qatar	Oman	Kuwait	Tunisia	Morocco	Yemen	Botswana (6)	Yemen (6)	Benchmarking Participants		Average Percent Correct on All Items	Country																				
0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.7	66 (0.7)	Singapore																					
0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	65 (0.3)	Korea, Rep. of																					
0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.5	0.4	63 (0.4)	Finland																					
0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.3	60 (0.3)	Japan																					
0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	59 (0.4)	Chinese Taipei																					
0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	59 (0.7)	Russian Federation																					
0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.4	0.4	57 (0.4)	United States																					
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.6	0.5	0.5	0.5	56 (0.5)	Czech Republic																					
0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.7	0.6	0.6	0.7	0.6	0.7	0.6	0.7	0.6	0.6	0.7	0.7	0.6	0.6	56 (0.7)	Hungary																					
0.7	0.7	0.6	0.7	0.7	0.7	0.6	0.7	0.6	0.6	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	56 (0.7)	Hong Kong SAR																					
0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	55 (0.7)	Slovak Republic																					
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	55 (0.5)	Sweden																					
0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.6	0.6	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	55 (0.6)	Austria																					
0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	54 (0.6)	England																					
0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.5	0.4	54 (0.4)	Netherlands																					
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	54 (0.5)	Denmark																					
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	54 (0.5)	Germany																					
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.5	53 (0.5)	Italy																					
0.9	0.8	0.8	0.9	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.8	0.8	1.0	0.8	0.9	0.8	53 (0.8)	Portugal																					
0.5	0.4	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.4	0.5	0.5	0.4	0.5	0.4	0.4	53 (0.4)	Slovenia																					
0.6	0.5	0.6	0.6	0.6	0.5	0.6	0.6	0.5	0.5	0.6	0.5	0.6	0.6	0.5	0.6	0.6	0.5	0.6	0.6	0.5	52 (0.6)	Serbia																					
0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	52 (0.6)	Ireland																					
0.5	0.6	0.6	0.6	0.5	0.6	0.5	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	52 (0.5)	Northern Ireland																					
0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.6	0.5	0.6	0.5	52 (0.5)	Australia																					
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	51 (0.5)	Lithuania																					
0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	51 (0.4)	Croatia																					
1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.1	1.1	1.0	1.1	1.0	1.1	1.0	1.0	1.0	51 (1.0)	Romania																					
0.5	0.5	0.6	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.6	0.5	0.6	0.5	0.6	0.5	0.6	0.5	0.6	0.5	50 (0.5)	Spain																					
0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	49 (0.4)	Belgium (Flemish)																					
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	49 (0.5)	Poland																					
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	48 (0.5)	New Zealand																					
1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	48 (1.0)	Kazakhstan																					
0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.5	0.4	0.4	0.4	47 (0.4)	Norway																					
0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	45 (0.4)	Chile																					
1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	1.0	0.9	1.0	44 (0.9)	Thailand																					
0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	43 (0.7)	Turkey																					
0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.8	0.6	41 (0.6)	Iran, Islamic Rep. of																					
1.0	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.1	0.9	1.1	0.9	40 (0.9)	Azerbaijan																					
0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.4	0.3	0.3	40 (0.3)	Malta																					
0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.3	38 (0.3)	United Arab Emirates																					
0.6	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.7	0.5	0.6	0.6	34 (0.6)	Armenia																					
0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	34 (0.6)	Qatar																					
0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.6	0.5	0.6	0.5	0.6	0.5	0.6	0.5	0.6	32 (0.5)	Oman																					
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.6	0.5	28 (0.5)	Kuwait																					
0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.7	0.6	0.6	26 (0.6)	Tunisia																					
0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	21 (0.4)	Morocco																					
0.5	0.4	0.4	0.5	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.5	0.4	0.5	0.4	0.5	0.4	17 (0.4)	Yemen																					
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	48 (0.1)	International Avg.																					
0.8	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.8	0.7	31 (0.7)	Botswana (6)																					
0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.9	0.7	0.8	0.7	28 (0.7)	Yemen (6)																					
																						Benchmarking Participants																					
																						Alberta, Canada		57 (0.5)																			
																						Ontario, Canada		54 (0.6)																			
																						Quebec, Canada		52 (0.5)																			
																						Dubai, UAE		44 (0.3)																			
																						Abu Dhabi, UAE		36 (0.7)																			
																						Number of Items (Score Points) Identified*		181																			
137	141	149	74	181	175	166	159	126	164	181	106	165	162	73	158	53	166	85																									

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Appendix F.4: Standard Errors for the Test-Curriculum Matching Analysis**

Read across the row to compare that country's performance based on the test items included by each of the countries across the top. Read down the column under a country name to compare the performance of the country down the left on the items included by the country listed on the top. Read along the diagonal to compare performance for each different country based on its own decisions about the test items to include.

Country	Average Percent Correct on All Items	Singapore	Chinese Taipei	Korea, Rep. of	Japan	Finland	Russian Federation	Slovenia	Hong Kong SAR	England	United States	Hungary	Israel	Australia	Lithuania	New Zealand	Sweden	Italy	Ukraine	Norway	Turkey	Kazakhstan	Iran, Islamic Rep. of	United Arab Emirates	Romania	Chile	Jordan	Thailand	Armenia	Qatar	Oman
Singapore	64 (0.9)	1.0	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Chinese Taipei	59 (0.5)	0.6	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Korea, Rep. of	58 (0.4)	0.5	0.4	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Japan	57 (0.5)	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Finland	56 (0.5)	0.6	0.5	0.6	0.6	0.5	0.5	0.5	0.6	0.6	0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.5	0.5	0.6	0.6
Russian Federation	54 (0.7)	0.8	0.7	0.8	0.7	0.7	0.7	0.7	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8
Slovenia	54 (0.5)	0.6	0.5	0.6	0.6	0.5	0.5	0.6	0.6	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.6	0.6
Hong Kong SAR	52 (0.7)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
England	52 (1.0)	1.1	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
United States	50 (0.5)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Hungary	50 (0.6)	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Israel	49 (0.8)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Australia	49 (1.0)	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lithuania	48 (0.5)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
New Zealand	48 (0.9)	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9
Sweden	47 (0.5)	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Italy	45 (0.4)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Ukraine	45 (0.7)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Norway	43 (0.5)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Turkey	43 (0.7)	0.7	0.7	0.7	0.7	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.6	0.7	0.6	0.7	0.6	0.7	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7
Kazakhstan	43 (0.9)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Iran, Islamic Rep. of	41 (0.7)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
United Arab Emirates	39 (0.4)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Romania	38 (0.7)	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Chile	37 (0.4)	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Jordan	37 (0.6)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Thailand	36 (0.7)	0.7	0.7	0.8	0.8	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7
Armenia	35 (0.5)	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6
Qatar	34 (0.5)	0.6	0.5	0.5	0.6	0.5	0.6	0.5	0.6	0.6	0.6	0.5	0.6	0.5	0.5	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.6	0.5	0.5	0.5	0.5	0.5
Oman	33 (0.4)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Malaysia	33 (0.9)	1.0	0.9	1.0	1.0	1.0	0.9	0.9	1.0	1.0	1.0	0.9	1.0	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	0.9	0.9	1.0	1.0
Palestinian Nat'l Auth.	33 (0.5)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Tunisia	33 (0.4)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Macedonia, Rep. of	32 (0.8)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Lebanon	29 (0.7)	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Morocco	25 (0.2)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
International Avg.	44 (0.1)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Botswana (9)	30 (0.4)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
South Africa (9)	22 (0.3)	0.3	0.3	0.4	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.3	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.3	0.3	0.3

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011

**Benchmarking Participants**

Alberta, Canada	54 (0.5)	0.6	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
Ontario, Canada	49 (0.5)	0.5	0.5	0.6	0.6	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Quebec, Canada	48 (0.6)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Dubai, UAE	43 (0.4)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Abu Dhabi, UAE	38 (0.7)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Number of Items (Score Points) Identified*	233	160	233	177	126	203	170	200																							

**Appendix F.4: Standard Errors for the Test-Curriculum Matching Analysis (Continued)**

Read across the row to compare that country's performance based on the test items included by each of the countries across the top. Read down the column under a country name to compare the performance of the country down the left on the items included by the country listed on the top. Read along the diagonal to compare performance for each different country based on its own decisions about the test items to include.

Malaysia	Palestinian Nat'l Auth.	Tunisia	Macedonia, Rep. of	Lebanon	Morocco	Botswana (9)	South Africa (9)	Benchmarking Participants								Average Percent Correct on All Items	Country
								Alberta, Canada	Ontario, Canada	Quebec, Canada	Dubai, UAE	Abu Dhabi, UAE					
0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9	1.0	0.9	0.9	0.9	0.9	64 (0.9)	Singapore			
0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	59 (0.5)	Chinese Taipei			
0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.4	58 (0.4)	Korea, Rep. of			
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	57 (0.5)	Japan			
0.5	0.6	0.6	0.5	0.6	0.6	0.5	0.5	0.6	0.6	0.5	0.5	0.5	56 (0.5)	Finland			
0.7	0.8	0.8	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	54 (0.7)	Russian Federation			
0.5	0.6	0.6	0.5	0.6	0.6	0.5	0.5	0.6	0.6	0.5	0.5	0.5	54 (0.5)	Slovenia			
0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	52 (0.7)	Hong Kong SAR			
1.0	1.0	1.1	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	52 (1.0)	England			
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	50 (0.5)	United States			
0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	50 (0.6)	Hungary			
0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	49 (0.8)	Israel			
1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	49 (1.0)	Australia			
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	48 (0.5)	Lithuania			
0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	48 (0.9)	New Zealand			
0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	47 (0.5)	Sweden			
0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	45 (0.4)	Italy			
0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	45 (0.7)	Ukraine			
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	43 (0.5)	Norway			
0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	43 (0.7)	Turkey			
0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	43 (0.9)	Kazakhstan			
0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	41 (0.7)	Iran, Islamic Rep. of			
0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	39 (0.4)	United Arab Emirates			
0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.6	0.6	0.6	0.6	0.6	38 (0.7)	Romania			
0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	37 (0.4)	Chile			
0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	37 (0.6)	Jordan			
0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	36 (0.7)	Thailand			
0.5	0.6	0.6	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	35 (0.5)	Armenia			
0.6	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.5	0.6	0.6	0.6	0.6	34 (0.5)	Qatar			
0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	33 (0.4)	Oman			
0.9	1.0	1.0	0.9	0.9	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	33 (0.9)	Malaysia			
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	33 (0.5)	Palestinian Nat'l Auth.			
0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.4	33 (0.4)	Tunisia			
0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	32 (0.8)	Macedonia, Rep. of			
0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	29 (0.7)	Lebanon			
0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	25 (0.2)	Morocco			
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	44 (0.1)	International Avg.			
0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	30 (0.4)	Botswana (9)			
0.3	0.3	0.4	0.3	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	22 (0.3)	South Africa (9)			
<b>Benchmarking Participants</b>																	
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	54 (0.5)	Alberta, Canada			
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	49 (0.5)	Ontario, Canada			
0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	48 (0.6)	Quebec, Canada			
0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	43 (0.4)	Dubai, UAE			
0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	38 (0.7)	Abu Dhabi, UAE			
220	181	124	233	162	116	219	212	154	146	205	233	200	233	Number of Items (Score Points) Identified*			

SOURCE: IEA's Trends in International Mathematics and Science Study—TIMSS 2011

development. The fact that the majority of countries indicated that most items were appropriate for their students means that the different average percent correct estimates were based on many of the same items. Insofar as countries rejected items that would be difficult for their students, these items tended to be difficult for students in other countries as well. The analysis shows that omitting such items tends to improve the results for that country, but also tends to improve the results for all other countries, so that the overall pattern of relative performance is largely unaffected.





# Appendix G

## Percentiles and Standard Deviations of Science Achievement

Country	5th Percentile	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile	95th Percentile
Armenia	270 (10.5)	300 (4.9)	355 (5.7)	419 (4.6)	477 (5.1)	529 (3.9)	559 (7.8)
Australia	371 (9.0)	407 (5.9)	466 (4.3)	521 (2.3)	571 (3.0)	614 (3.3)	638 (5.3)
Austria	408 (4.8)	438 (6.1)	485 (4.2)	535 (3.6)	581 (2.0)	619 (3.0)	640 (2.5)
Azerbaijan	274 (7.6)	307 (6.2)	369 (6.1)	439 (8.7)	509 (7.2)	565 (6.4)	598 (11.3)
Bahrain	259 (9.7)	305 (9.0)	382 (6.1)	458 (3.4)	525 (2.9)	578 (5.5)	611 (5.1)
Belgium (Flemish)	411 (3.5)	432 (4.5)	471 (2.0)	511 (1.9)	548 (2.4)	581 (3.6)	600 (2.4)
Chile	345 (3.1)	376 (5.5)	428 (2.7)	483 (2.3)	535 (2.4)	579 (2.9)	604 (4.4)
Chinese Taipei	420 (6.5)	455 (7.7)	506 (4.3)	557 (2.6)	603 (2.6)	641 (2.8)	664 (4.2)
Croatia	411 (4.7)	435 (4.6)	475 (3.0)	518 (2.0)	559 (3.5)	594 (2.5)	615 (2.0)
Czech Republic	412 (9.3)	442 (5.0)	491 (2.3)	539 (3.0)	586 (3.8)	625 (2.8)	648 (3.8)
Denmark	401 (7.0)	434 (5.6)	483 (3.7)	531 (5.2)	578 (3.1)	617 (2.3)	640 (4.3)
England	384 (6.3)	420 (8.1)	476 (5.1)	535 (3.8)	586 (3.5)	629 (4.0)	653 (3.0)
Finland	456 (6.8)	485 (4.3)	529 (3.4)	574 (2.6)	615 (2.2)	651 (2.6)	674 (2.8)
Georgia	299 (6.5)	336 (7.5)	401 (7.2)	462 (3.4)	516 (3.7)	560 (4.2)	585 (2.9)
Germany	406 (7.1)	435 (3.9)	482 (3.6)	532 (3.1)	577 (2.8)	614 (2.0)	636 (4.9)
Hong Kong SAR	406 (16.3)	443 (7.2)	493 (3.3)	541 (3.9)	585 (2.7)	622 (2.8)	644 (5.1)
Hungary	377 (8.7)	420 (7.2)	484 (6.4)	542 (4.0)	594 (4.0)	637 (3.5)	662 (4.2)
Iran, Islamic Rep. of	274 (6.7)	317 (9.7)	390 (5.6)	460 (3.8)	523 (3.7)	575 (4.5)	604 (6.0)
Ireland	379 (3.3)	412 (3.9)	466 (4.5)	521 (2.7)	571 (4.2)	613 (5.5)	637 (3.6)
Italy	397 (8.3)	429 (3.1)	477 (3.4)	527 (4.0)	573 (3.1)	615 (2.1)	641 (3.3)
Japan	449 (4.1)	476 (4.2)	519 (2.6)	561 (1.7)	601 (1.9)	637 (4.5)	658 (2.8)
Kazakhstan	345 (6.7)	375 (8.2)	431 (5.9)	496 (6.9)	558 (6.7)	610 (4.9)	642 (8.6)
Korea, Rep. of	476 (2.5)	502 (3.2)	545 (2.0)	589 (2.3)	632 (1.8)	669 (2.3)	690 (3.5)
Kuwait	130 (10.6)	176 (7.1)	258 (6.7)	355 (6.3)	441 (4.7)	504 (5.4)	541 (4.3)
Lithuania	397 (6.0)	426 (4.4)	471 (2.9)	518 (2.3)	561 (2.0)	598 (3.1)	620 (5.0)
Malta	271 (9.6)	314 (4.1)	384 (2.5)	453 (2.1)	514 (2.9)	565 (3.2)	594 (2.2)
Morocco	59 (7.0)	100 (7.6)	171 (7.0)	257 (5.1)	351 (5.1)	440 (5.2)	487 (7.3)
Netherlands	439 (8.2)	461 (5.2)	497 (2.2)	534 (2.4)	568 (1.8)	597 (4.4)	613 (2.2)
New Zealand	345 (6.9)	381 (4.8)	442 (3.2)	503 (2.6)	558 (2.3)	602 (3.2)	626 (2.8)
Northern Ireland	388 (8.0)	425 (5.2)	473 (1.7)	522 (3.3)	566 (2.7)	603 (4.9)	625 (4.4)
Norway	383 (6.1)	411 (4.1)	453 (2.4)	497 (2.5)	538 (3.7)	573 (3.8)	593 (3.7)
Oman	162 (7.0)	208 (6.0)	291 (5.8)	385 (4.4)	467 (3.4)	532 (3.8)	568 (7.0)
Poland	369 (4.7)	402 (3.6)	455 (2.6)	509 (3.0)	558 (2.7)	601 (2.3)	627 (3.0)
Portugal	397 (10.7)	429 (6.2)	476 (6.0)	524 (3.7)	571 (3.8)	613 (4.5)	637 (5.4)
Qatar	176 (7.4)	222 (6.4)	304 (6.2)	401 (7.1)	488 (7.1)	554 (3.3)	590 (4.9)
Romania	302 (20.1)	356 (14.3)	444 (8.7)	517 (5.1)	580 (5.2)	631 (3.7)	659 (5.3)
Russian Federation	430 (5.2)	458 (3.4)	505 (3.6)	554 (3.5)	603 (2.9)	643 (3.3)	667 (4.8)
Saudi Arabia	245 (13.0)	287 (6.7)	359 (5.3)	435 (3.9)	502 (6.5)	560 (9.3)	593 (9.1)
Serbia	366 (10.7)	407 (5.5)	467 (4.7)	520 (3.0)	570 (4.2)	615 (5.4)	642 (4.1)
Singapore	427 (6.7)	469 (6.0)	531 (5.8)	590 (3.9)	644 (4.1)	689 (3.8)	713 (4.0)
Slovak Republic	390 (13.9)	430 (5.5)	486 (4.3)	539 (4.6)	586 (2.7)	625 (3.6)	648 (5.4)
Slovenia	388 (4.9)	421 (2.6)	474 (2.8)	525 (3.7)	572 (4.2)	612 (3.6)	636 (4.1)
Spain	378 (8.3)	407 (4.2)	458 (4.3)	509 (2.7)	556 (3.5)	595 (4.6)	620 (3.0)
Sweden	403 (6.2)	434 (4.6)	486 (3.1)	539 (2.1)	586 (2.6)	625 (5.2)	648 (4.2)
Thailand	305 (10.2)	343 (7.9)	410 (8.8)	479 (4.8)	538 (5.2)	585 (4.6)	613 (6.7)
Tunisia	143 (5.6)	187 (6.5)	266 (7.0)	351 (8.8)	432 (5.4)	495 (5.0)	525 (3.6)
Turkey	283 (14.3)	332 (8.6)	403 (5.6)	471 (3.9)	531 (4.0)	581 (3.6)	611 (5.1)
United Arab Emirates	238 (3.1)	279 (3.6)	350 (3.0)	433 (3.4)	507 (2.1)	569 (2.5)	604 (2.6)
United States	406 (3.9)	440 (2.6)	494 (2.4)	549 (2.0)	599 (2.5)	641 (2.3)	666 (2.3)
Yemen	25 (7.1)	60 (5.3)	122 (10.4)	200 (9.3)	288 (7.3)	369 (7.8)	418 (14.5)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.  
Note: Percentiles are defined in terms of percentages of students at or below a point on the scale.

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Appendix G.1: Percentiles of Science Achievement (Continued)**

Country	5th Percentile	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile	95th Percentile
<b>Sixth Grade Participants</b>							
Botswana	149 (6.9)	190 (4.2)	271 (6.3)	375 (6.7)	466 (6.0)	535 (7.0)	572 (10.8)
Honduras	291 (10.2)	321 (11.8)	375 (7.3)	435 (5.6)	491 (6.5)	539 (7.0)	568 (6.4)
Yemen	144 (15.5)	187 (11.5)	264 (8.5)	351 (6.7)	432 (5.5)	494 (7.1)	529 (5.9)
<b>Benchmarking Participants</b>							
Alberta, Canada	419 (5.7)	450 (4.6)	496 (3.6)	545 (2.5)	590 (3.2)	628 (3.0)	650 (4.5)
Ontario, Canada	393 (5.8)	427 (5.9)	479 (3.3)	532 (3.0)	581 (3.7)	622 (4.0)	646 (3.3)
Quebec, Canada	417 (6.2)	441 (4.9)	478 (3.5)	517 (2.9)	556 (4.6)	591 (3.8)	611 (3.2)
Abu Dhabi, UAE	226 (7.9)	264 (5.6)	333 (8.0)	417 (6.4)	491 (6.1)	550 (5.9)	583 (3.1)
Dubai, UAE	260 (5.7)	305 (5.7)	386 (3.4)	470 (3.2)	544 (2.9)	600 (2.8)	631 (2.6)
Florida, US	419 (3.3)	447 (4.1)	494 (3.1)	546 (5.4)	596 (3.4)	641 (5.0)	667 (8.6)
North Carolina, US	403 (6.5)	435 (4.8)	487 (5.2)	542 (5.3)	591 (3.0)	634 (3.8)	660 (6.9)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

Country	5th Percentile	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile	95th Percentile
Armenia	273 (3.8)	309 (4.5)	373 (4.5)	441 (3.3)	506 (3.7)	557 (3.1)	585 (6.2)
Australia	381 (7.1)	412 (4.5)	463 (6.4)	519 (4.7)	575 (6.6)	628 (6.6)	658 (12.6)
Bahrain	275 (5.1)	313 (5.2)	384 (2.7)	460 (2.6)	525 (2.5)	579 (2.2)	610 (3.2)
Chile	341 (3.4)	367 (3.7)	410 (3.3)	461 (2.5)	511 (2.4)	557 (4.6)	583 (3.8)
Chinese Taipei	415 (7.5)	452 (5.5)	510 (3.5)	571 (2.6)	623 (3.0)	665 (2.6)	689 (4.2)
England	385 (10.9)	419 (10.6)	477 (5.8)	538 (5.3)	594 (6.2)	639 (5.2)	664 (5.1)
Finland	444 (3.9)	470 (2.5)	509 (2.6)	555 (3.3)	597 (3.0)	634 (3.6)	656 (4.7)
Georgia	258 (5.3)	296 (8.7)	363 (3.8)	429 (3.3)	483 (3.4)	528 (5.7)	555 (4.2)
Ghana	121 (5.0)	159 (5.2)	226 (6.8)	306 (7.7)	388 (7.3)	452 (4.8)	488 (7.8)
Hong Kong SAR	398 (10.9)	434 (5.3)	492 (4.8)	544 (2.5)	587 (2.9)	622 (4.7)	643 (4.6)
Hungary	376 (8.6)	412 (4.6)	475 (4.7)	530 (2.6)	579 (3.9)	621 (3.1)	645 (3.3)
Indonesia	272 (8.0)	303 (10.9)	353 (6.6)	408 (4.4)	461 (3.3)	505 (4.3)	530 (4.3)
Iran, Islamic Rep. of	325 (4.1)	357 (6.1)	412 (4.2)	476 (4.5)	537 (3.1)	590 (3.8)	621 (6.8)
Israel	347 (6.7)	386 (5.2)	456 (6.1)	524 (4.3)	582 (4.4)	630 (4.7)	656 (5.7)
Italy	369 (6.1)	400 (5.5)	452 (2.6)	505 (3.8)	554 (3.2)	594 (3.1)	618 (4.1)
Japan	422 (5.8)	458 (4.2)	511 (2.7)	563 (2.0)	610 (2.5)	649 (3.8)	674 (3.9)
Jordan	258 (10.2)	307 (10.9)	388 (4.8)	463 (4.4)	522 (3.6)	568 (2.8)	595 (3.2)
Kazakhstan	358 (5.3)	386 (5.0)	435 (5.4)	493 (4.8)	546 (5.5)	590 (4.2)	616 (4.5)
Korea, Rep. of	425 (3.3)	459 (3.8)	510 (2.8)	564 (1.5)	614 (1.9)	656 (2.0)	681 (2.5)
Lebanon	243 (6.6)	276 (6.6)	337 (5.8)	409 (6.4)	475 (6.2)	532 (5.4)	562 (5.9)
Lithuania	383 (3.9)	413 (3.2)	464 (3.2)	518 (3.0)	567 (2.8)	607 (2.7)	632 (4.4)
Macedonia, Rep. of	214 (8.0)	256 (6.7)	327 (8.4)	411 (10.0)	492 (5.3)	552 (6.5)	586 (8.9)
Malaysia	250 (7.7)	288 (9.8)	358 (9.4)	432 (7.0)	499 (6.4)	553 (6.5)	584 (7.9)
Morocco	235 (3.9)	266 (3.6)	317 (3.3)	376 (3.0)	435 (2.6)	488 (2.1)	518 (2.6)
New Zealand	365 (8.9)	399 (4.9)	455 (5.8)	515 (5.2)	572 (4.3)	621 (4.5)	647 (5.1)
Norway	368 (10.0)	399 (6.7)	447 (2.8)	499 (2.0)	544 (2.4)	584 (3.1)	609 (3.8)
Oman	225 (6.3)	268 (3.9)	343 (6.1)	429 (4.1)	502 (3.2)	556 (1.6)	586 (4.3)
Palestinian Nat'l Auth.	237 (6.2)	278 (5.8)	351 (4.2)	426 (4.0)	497 (4.6)	551 (4.0)	580 (5.3)
Qatar	212 (4.8)	255 (5.3)	334 (4.7)	426 (3.1)	507 (5.3)	571 (6.4)	606 (5.6)
Romania	316 (7.9)	351 (4.8)	408 (5.0)	468 (3.5)	523 (2.8)	572 (5.3)	601 (6.5)
Russian Federation	410 (6.3)	442 (6.5)	493 (2.8)	547 (4.0)	596 (2.8)	638 (3.7)	661 (4.4)
Saudi Arabia	295 (5.7)	328 (4.7)	382 (5.9)	439 (3.4)	494 (4.1)	541 (3.9)	567 (4.3)
Singapore	409 (8.8)	453 (8.5)	530 (7.6)	602 (4.6)	660 (3.4)	705 (2.4)	730 (4.6)
Slovenia	412 (5.5)	444 (4.0)	494 (4.2)	547 (3.4)	595 (3.2)	637 (2.1)	661 (3.5)
Sweden	368 (5.5)	403 (3.2)	458 (2.9)	515 (2.5)	566 (3.4)	608 (2.6)	633 (5.1)
Syrian Arab Republic	282 (4.2)	315 (5.4)	369 (4.9)	430 (5.0)	487 (3.9)	533 (4.3)	558 (5.0)
Thailand	317 (4.7)	346 (4.3)	397 (4.9)	453 (4.0)	504 (4.7)	551 (6.7)	581 (9.6)
Tunisia	329 (3.0)	352 (3.4)	393 (3.0)	438 (3.3)	484 (2.9)	526 (3.7)	550 (4.1)
Turkey	312 (3.3)	349 (4.8)	413 (4.4)	485 (5.1)	554 (4.4)	614 (6.5)	648 (6.4)
Ukraine	356 (8.0)	390 (6.1)	448 (5.7)	506 (4.1)	559 (5.3)	603 (4.3)	630 (4.9)
United Arab Emirates	299 (4.8)	335 (3.2)	399 (2.8)	468 (3.5)	532 (2.6)	587 (2.5)	619 (3.3)
United States	384 (5.6)	416 (3.2)	470 (3.0)	529 (2.9)	582 (2.8)	625 (2.5)	651 (5.7)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

## Ninth Grade Participants

Botswana	218 (6.5)	260 (5.1)	336 (3.9)	415 (3.2)	479 (4.4)	530 (4.2)	561 (3.8)
Honduras	239 (3.9)	267 (3.6)	314 (3.6)	368 (4.3)	422 (6.2)	469 (5.7)	500 (11.4)
South Africa	162 (5.9)	193 (5.8)	251 (4.5)	323 (3.9)	401 (4.5)	483 (7.2)	541 (7.9)

## Benchmarking Participants

Alberta, Canada	430 (6.9)	458 (4.7)	502 (3.6)	547 (2.6)	591 (3.1)	631 (2.5)	655 (4.1)
Ontario, Canada	405 (4.1)	432 (3.8)	476 (3.2)	524 (2.8)	569 (3.0)	606 (3.0)	629 (3.9)
Quebec, Canada	404 (4.5)	433 (4.1)	477 (3.0)	522 (3.5)	566 (2.8)	604 (3.0)	624 (3.1)
Abu Dhabi, UAE	304 (5.8)	339 (6.3)	398 (4.8)	463 (3.3)	526 (5.2)	581 (4.1)	614 (7.3)
Dubai, UAE	302 (7.0)	344 (5.6)	418 (4.3)	494 (3.1)	558 (3.7)	611 (2.7)	640 (3.6)
Alabama, US	335 (11.2)	370 (8.7)	428 (6.1)	489 (7.3)	547 (6.8)	596 (5.3)	624 (15.2)
California, US	355 (12.0)	389 (10.5)	443 (7.4)	501 (5.3)	557 (3.7)	603 (4.0)	632 (5.0)
Colorado, US	410 (9.6)	439 (4.4)	489 (4.6)	545 (5.4)	599 (4.0)	640 (5.9)	662 (6.1)
Connecticut, US	376 (9.6)	413 (5.7)	472 (4.3)	539 (6.4)	594 (6.5)	641 (3.7)	666 (6.4)
Florida, US	389 (12.0)	420 (13.3)	472 (9.0)	531 (7.7)	589 (9.2)	639 (7.0)	669 (10.9)
Indiana, US	401 (6.9)	432 (4.7)	483 (6.2)	537 (5.9)	585 (4.0)	627 (4.2)	652 (5.5)
Massachusetts, US	422 (12.2)	460 (7.5)	518 (6.7)	574 (8.2)	624 (6.4)	664 (6.8)	687 (4.4)
Minnesota, US	426 (7.9)	453 (10.2)	506 (6.3)	557 (4.3)	605 (5.9)	644 (6.1)	665 (4.3)
North Carolina, US	395 (15.6)	423 (6.7)	475 (8.1)	534 (5.6)	589 (6.0)	635 (8.6)	662 (8.6)

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.  
Note: Percentiles are defined in terms of percentages of students at or below a point on the scale.

Appendix G.3: Standard Deviations of Science Achievement

Country	Overall		Girls		Boys	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Armenia	416 (3.8)	88 (1.8)	419 (4.0)	86 (2.0)	414 (4.3)	90 (2.1)
Australia	516 (2.8)	81 (2.1)	516 (3.1)	77 (2.3)	516 (3.7)	84 (2.6)
Austria	532 (2.8)	70 (1.4)	525 (2.8)	68 (1.8)	538 (3.6)	72 (1.6)
Azerbaijan	438 (5.6)	98 (2.6)	442 (6.3)	99 (2.7)	434 (5.7)	98 (2.9)
Bahrain	449 (3.5)	106 (2.1)	461 (5.5)	97 (3.1)	438 (4.6)	114 (3.1)
Belgium (Flemish)	509 (2.0)	58 (1.0)	503 (2.6)	57 (1.3)	514 (2.3)	58 (1.2)
Chile	480 (2.4)	78 (1.4)	474 (2.8)	75 (1.6)	486 (2.8)	81 (1.8)
Chinese Taipei	552 (2.2)	74 (1.3)	548 (2.6)	72 (1.8)	555 (2.4)	75 (1.5)
Croatia	516 (2.1)	62 (1.3)	514 (2.5)	60 (1.2)	518 (2.5)	65 (1.9)
Czech Republic	536 (2.5)	72 (2.0)	529 (2.9)	70 (2.1)	544 (2.7)	73 (2.6)
Denmark	528 (2.8)	73 (1.9)	527 (3.3)	72 (2.4)	529 (3.1)	73 (2.1)
England	529 (2.9)	82 (1.9)	529 (3.3)	78 (2.0)	528 (3.3)	85 (2.5)
Finland	570 (2.6)	67 (1.5)	570 (2.9)	64 (1.9)	570 (3.0)	68 (2.0)
Georgia	455 (3.8)	87 (2.2)	459 (3.2)	82 (2.3)	451 (5.1)	91 (2.6)
Germany	528 (2.9)	70 (1.3)	522 (3.0)	69 (1.8)	534 (3.2)	71 (2.0)
Hong Kong SAR	535 (3.8)	74 (4.3)	532 (3.6)	69 (3.9)	538 (4.3)	78 (4.9)
Hungary	534 (3.7)	86 (2.5)	532 (4.0)	84 (3.2)	537 (3.9)	89 (2.8)
Iran, Islamic Rep. of	453 (3.7)	99 (2.5)	452 (5.8)	98 (3.5)	454 (5.7)	101 (3.0)
Ireland	516 (3.4)	79 (1.8)	516 (4.0)	76 (2.0)	516 (4.6)	82 (2.4)
Italy	524 (2.7)	74 (1.7)	520 (3.2)	73 (2.1)	528 (3.0)	75 (1.9)
Japan	559 (1.9)	64 (1.3)	556 (2.7)	61 (1.3)	561 (2.1)	66 (2.0)
Kazakhstan	495 (5.1)	91 (2.5)	490 (5.1)	86 (2.4)	498 (5.5)	94 (3.0)
Korea, Rep. of	587 (2.0)	66 (0.8)	583 (2.4)	62 (1.1)	590 (2.3)	69 (1.1)
Kuwait	347 (4.7)	126 (1.6)	371 (5.5)	119 (2.0)	319 (7.1)	128 (2.9)
Lithuania	515 (2.4)	68 (1.3)	514 (2.4)	66 (1.7)	515 (3.0)	69 (2.0)
Malta	446 (1.9)	98 (1.2)	443 (2.2)	94 (1.6)	449 (2.8)	101 (1.8)
Morocco	264 (4.5)	128 (2.9)	268 (5.1)	127 (2.8)	259 (4.9)	129 (3.5)
Netherlands	531 (2.2)	53 (1.2)	526 (2.4)	52 (1.3)	537 (2.6)	53 (1.4)
New Zealand	497 (2.3)	86 (1.7)	496 (3.0)	83 (1.9)	497 (2.6)	88 (2.3)
Northern Ireland	517 (2.6)	71 (1.5)	517 (3.2)	69 (2.0)	516 (3.2)	74 (1.8)
Norway	494 (2.3)	63 (1.3)	492 (2.5)	62 (1.6)	496 (3.2)	65 (1.7)
Oman	377 (4.3)	124 (1.9)	394 (4.7)	116 (2.7)	360 (4.6)	129 (2.2)
Poland	505 (2.6)	78 (1.2)	502 (3.0)	75 (1.7)	508 (2.9)	81 (1.4)
Portugal	522 (3.9)	73 (2.1)	519 (4.6)	71 (2.9)	524 (3.8)	74 (2.2)
Qatar	394 (4.3)	127 (2.8)	408 (5.1)	120 (3.4)	382 (5.7)	131 (4.1)
Romania	505 (5.9)	107 (4.2)	505 (6.9)	107 (5.6)	506 (5.7)	106 (3.8)
Russian Federation	552 (3.5)	72 (1.5)	553 (3.5)	70 (1.8)	552 (3.8)	74 (1.9)
Saudi Arabia	429 (5.4)	107 (3.4)	453 (4.7)	91 (2.8)	405 (9.9)	118 (6.3)
Serbia	516 (3.1)	84 (2.1)	514 (3.6)	81 (3.0)	517 (3.7)	86 (2.4)
Singapore	583 (3.4)	87 (1.9)	581 (3.7)	84 (2.0)	585 (3.7)	89 (2.3)
Slovak Republic	532 (3.8)	79 (2.8)	528 (4.3)	79 (3.3)	536 (3.6)	79 (2.7)
Slovenia	520 (2.7)	76 (1.2)	517 (2.8)	74 (1.8)	523 (3.4)	77 (1.9)
Spain	505 (3.0)	73 (1.7)	500 (2.8)	72 (2.0)	510 (3.7)	74 (1.9)
Sweden	533 (2.7)	75 (1.3)	532 (3.0)	74 (2.3)	535 (3.2)	75 (1.5)
Thailand	472 (5.6)	94 (3.3)	476 (5.7)	88 (3.4)	467 (6.6)	100 (4.1)
Tunisia	346 (5.3)	117 (2.2)	359 (5.6)	112 (2.4)	334 (5.6)	120 (2.7)
Turkey	463 (4.5)	99 (3.5)	465 (5.0)	97 (4.3)	461 (4.7)	101 (3.5)
United Arab Emirates	428 (2.5)	112 (1.4)	437 (3.4)	103 (1.8)	419 (3.8)	119 (2.2)
United States	544 (2.1)	79 (1.2)	539 (2.3)	77 (1.2)	549 (2.1)	80 (1.5)
Yemen	209 (7.3)	117 (2.6)	225 (7.3)	115 (2.6)	198 (8.8)	117 (3.7)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Appendix G.3: Standard Deviations of Science Achievement (Continued)

Country	Overall		Girls		Boys	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
<b>Sixth Grade Participants</b>						
Botswana	367 (5.5)	131 (2.9)	374 (5.8)	125 (2.9)	360 (6.4)	136 (3.4)
Honduras	432 (5.8)	85 (3.4)	429 (6.1)	83 (3.7)	436 (6.3)	87 (3.8)
Yemen	345 (7.0)	117 (2.7)	355 (8.8)	114 (4.4)	338 (8.4)	119 (2.9)
<b>Benchmarking Participants</b>						
Alberta, Canada	541 (2.4)	71 (1.8)	537 (2.9)	71 (2.4)	545 (2.8)	70 (1.9)
Ontario, Canada	528 (3.0)	77 (1.5)	525 (3.1)	73 (1.5)	530 (3.8)	80 (2.1)
Quebec, Canada	516 (2.7)	59 (1.1)	512 (3.0)	57 (1.4)	520 (3.0)	60 (1.3)
Abu Dhabi, UAE	411 (4.9)	109 (2.4)	427 (5.8)	99 (2.9)	396 (6.8)	117 (3.1)
Dubai, UAE	461 (2.3)	113 (1.8)	462 (3.8)	105 (2.4)	461 (4.7)	120 (2.3)
Florida, US	545 (3.7)	75 (1.7)	540 (3.8)	73 (1.9)	549 (4.3)	77 (2.3)
North Carolina, US	538 (4.6)	77 (2.2)	534 (5.1)	76 (2.5)	543 (4.9)	78 (2.5)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

**Appendix G.4: Standard Deviations of Science Achievement**

Country	Overall		Girls		Boys	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Armenia	437 (3.1)	95 (1.4)	446 (3.5)	92 (1.7)	428 (3.6)	97 (1.7)
Australia	519 (4.8)	84 (3.0)	511 (4.5)	80 (2.7)	527 (6.5)	87 (3.9)
Bahrain	452 (2.0)	102 (1.8)	482 (2.2)	86 (1.7)	423 (3.6)	109 (2.3)
Chile	461 (2.5)	73 (1.4)	454 (3.2)	73 (2.0)	470 (2.9)	73 (1.6)
Chinese Taipei	564 (2.3)	84 (1.4)	564 (2.7)	78 (1.6)	564 (2.8)	88 (1.7)
England	533 (4.9)	85 (3.2)	534 (5.0)	80 (3.0)	532 (6.2)	88 (3.9)
Finland	552 (2.5)	65 (1.6)	555 (2.4)	62 (1.8)	550 (3.1)	68 (1.9)
Georgia	420 (3.0)	90 (1.6)	425 (3.3)	83 (1.8)	415 (3.5)	94 (2.1)
Ghana	306 (5.2)	112 (2.6)	290 (5.7)	111 (2.7)	320 (5.4)	112 (2.9)
Hong Kong SAR	535 (3.4)	75 (3.3)	536 (4.5)	72 (3.9)	534 (3.7)	78 (3.2)
Hungary	522 (3.1)	83 (2.0)	513 (3.5)	82 (2.7)	531 (3.7)	83 (3.0)
Indonesia	406 (4.5)	79 (2.6)	409 (5.1)	77 (3.0)	402 (4.5)	80 (2.8)
Iran, Islamic Rep. of	474 (4.0)	90 (1.8)	477 (5.3)	87 (2.5)	472 (5.3)	93 (2.8)
Israel	516 (4.0)	94 (2.2)	519 (3.7)	87 (2.0)	512 (5.2)	101 (2.9)
Italy	501 (2.5)	76 (1.6)	493 (3.1)	74 (1.7)	508 (2.6)	76 (2.2)
Japan	558 (2.4)	76 (1.5)	554 (2.9)	72 (1.6)	562 (2.9)	79 (2.0)
Jordan	449 (4.0)	103 (2.8)	471 (4.3)	87 (2.5)	428 (6.4)	112 (3.5)
Kazakhstan	490 (4.3)	79 (1.9)	492 (4.6)	76 (2.0)	488 (4.6)	82 (2.4)
Korea, Rep. of	560 (2.0)	77 (1.0)	558 (2.6)	74 (1.0)	563 (2.4)	81 (1.6)
Lebanon	406 (4.9)	98 (2.0)	404 (5.4)	94 (2.3)	408 (6.5)	101 (2.8)
Lithuania	514 (2.6)	76 (1.7)	518 (3.0)	73 (2.2)	510 (3.1)	79 (2.1)
Macedonia, Rep. of	407 (5.4)	114 (2.6)	417 (5.6)	112 (2.8)	399 (6.1)	115 (3.3)
Malaysia	426 (6.3)	101 (2.9)	434 (6.3)	95 (2.8)	419 (7.3)	107 (3.7)
Morocco	376 (2.2)	86 (1.1)	378 (2.6)	85 (1.4)	374 (2.7)	86 (1.5)
New Zealand	512 (4.6)	85 (2.0)	501 (4.6)	82 (2.6)	522 (5.1)	87 (2.2)
Norway	494 (2.6)	73 (1.5)	495 (3.2)	71 (1.9)	494 (3.0)	75 (1.8)
Oman	420 (3.2)	111 (2.0)	458 (2.9)	92 (1.6)	380 (4.4)	116 (2.2)
Palestinian Nat'l Auth.	420 (3.2)	105 (1.9)	434 (3.8)	97 (2.2)	406 (5.4)	111 (2.7)
Qatar	419 (3.4)	121 (2.5)	432 (7.0)	120 (2.8)	406 (5.4)	121 (3.4)
Romania	465 (3.5)	86 (2.1)	466 (3.8)	85 (2.2)	464 (4.0)	87 (2.5)
Russian Federation	542 (3.2)	77 (1.3)	539 (3.6)	74 (1.3)	546 (3.5)	79 (2.2)
Saudi Arabia	436 (3.9)	82 (1.8)	450 (3.5)	72 (1.4)	424 (6.4)	89 (2.7)
Singapore	590 (4.3)	97 (2.9)	589 (4.2)	90 (2.7)	591 (5.3)	103 (3.6)
Slovenia	543 (2.7)	76 (1.3)	541 (3.0)	73 (1.6)	545 (3.4)	78 (1.7)
Sweden	509 (2.5)	81 (1.2)	511 (2.7)	78 (1.5)	508 (3.1)	83 (1.6)
Syrian Arab Republic	426 (3.9)	84 (1.6)	424 (4.4)	83 (1.9)	429 (4.9)	85 (2.4)
Thailand	451 (3.9)	80 (2.3)	458 (3.9)	74 (2.5)	443 (5.2)	85 (2.6)
Tunisia	439 (2.5)	67 (1.4)	431 (2.6)	66 (1.5)	447 (2.9)	67 (1.7)
Turkey	483 (3.4)	103 (2.5)	491 (3.2)	99 (2.6)	475 (4.3)	106 (2.8)
Ukraine	501 (3.4)	83 (1.9)	499 (3.7)	78 (2.4)	503 (4.3)	88 (2.6)
United Arab Emirates	465 (2.4)	97 (1.3)	477 (2.9)	87 (1.3)	452 (3.3)	105 (2.0)
United States	525 (2.6)	81 (1.5)	519 (2.8)	79 (1.6)	530 (2.9)	83 (1.8)

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2011

( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Country	Overall		Girls		Boys	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
<b>Ninth Grade Participants</b>						
Botswana	404 (3.6)	104 (1.7)	410 (4.3)	100 (2.1)	399 (3.7)	107 (2.2)
Honduras	369 (4.0)	79 (2.2)	360 (4.6)	78 (2.5)	380 (4.1)	79 (2.2)
South Africa	332 (3.7)	114 (2.3)	335 (4.1)	111 (2.9)	328 (4.5)	116 (2.8)
<b>Benchmarking Participants</b>						
Alberta, Canada	546 (2.4)	68 (1.4)	542 (2.8)	67 (1.6)	549 (2.5)	69 (1.7)
Ontario, Canada	521 (2.5)	69 (1.5)	521 (2.6)	66 (1.5)	522 (3.0)	71 (2.1)
Quebec, Canada	520 (2.5)	67 (1.8)	518 (3.0)	65 (2.2)	522 (3.0)	68 (1.8)
Abu Dhabi, UAE	461 (4.0)	94 (2.3)	465 (4.5)	84 (2.4)	458 (6.0)	102 (3.1)
Dubai, UAE	485 (2.5)	103 (2.1)	500 (4.6)	88 (2.5)	472 (5.8)	113 (2.8)
Alabama, US	485 (6.2)	88 (2.7)	482 (6.3)	84 (2.5)	489 (6.8)	91 (3.5)
California, US	499 (4.6)	84 (2.5)	493 (5.0)	82 (2.4)	504 (5.0)	86 (3.1)
Colorado, US	542 (4.4)	78 (2.1)	537 (4.7)	75 (2.8)	548 (5.2)	80 (2.2)
Connecticut, US	532 (4.6)	88 (2.9)	530 (4.5)	83 (3.0)	533 (5.9)	92 (3.6)
Florida, US	530 (7.3)	85 (3.1)	522 (8.5)	81 (3.4)	537 (7.6)	88 (3.5)
Indiana, US	533 (4.8)	76 (2.0)	526 (4.9)	75 (2.3)	541 (5.4)	75 (2.6)
Massachusetts, US	567 (5.1)	81 (2.4)	564 (5.8)	81 (2.8)	570 (5.1)	81 (2.6)
Minnesota, US	553 (4.6)	72 (2.7)	548 (4.9)	70 (3.0)	559 (5.3)	74 (2.9)
North Carolina, US	532 (6.3)	82 (3.4)	526 (5.7)	79 (3.1)	537 (7.7)	85 (4.5)

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2011





# Appendix H

## Organizations and Individuals Responsible for TIMSS 2011

## Introduction

TIMSS 2011 was a collaborative effort involving hundreds of individuals around the world. This appendix acknowledges the individuals and organizations for their contributions. Given that work on TIMSS 2011 has spanned approximately four years and has involved so many people and organizations, this list may not include all who contributed. Any omission is inadvertent. TIMSS 2011 also acknowledges the students, parents, teachers, and school principals who contributed their time and effort to the study. This report would not be possible without them.

### *Management and Coordination*

TIMSS is a major undertaking of IEA, and together with the Progress in International Reading Literacy Study (PIRLS) comprises the core of IEA's regular cycles of studies. The TIMSS assessment at the fourth grade complements PIRLS, which regularly assesses reading achievement at fourth grade.

The TIMSS & PIRLS International Study Center at Boston College has responsibility for the overall direction and management of the TIMSS and PIRLS projects. Headed by Executive Directors Drs. Ina V.S. Mullis and Michael O. Martin, the study center is located in the Lynch School of Education. In carrying out the project, the TIMSS & PIRLS International Study Center worked closely with the IEA Secretariat in Amsterdam, which managed country participation, was responsible for verification of all translations produced by the participating countries, and coordinated the school visits by International Quality Control Monitors. The IEA Data Processing and Research Center in Hamburg was responsible for processing and verifying the data submitted by the participants; Statistics Canada in Ottawa was responsible for school and student sampling activities; and Educational Testing Service in Princeton, New Jersey consulted on psychometric methodology, provided software for scaling the achievement data, and replicated the achievement scaling for quality assurance.

The Project Management Team, comprising the study directors and representatives from the TIMSS & PIRLS International Study Center, IEA Secretariat and IEA Data Processing and Research Center, Statistics Canada, and ETS met twice a year throughout the study to discuss the study's progress, procedures, and schedule. In addition, the study directors met with members of IEA's Technical Executive Group twice yearly to review technical issues.

To work with the international team and coordinate within-country activities, each participating country designates an individual to be the TIMSS

National Research Coordinator (NRC). The NRCs have the challenging task of implementing TIMSS in their countries in accordance with the TIMSS guidelines and procedures. In addition, the NRCs provide feedback and contributions throughout the development of the TIMSS assessment. The quality of the TIMSS assessment and data depends on the work of the NRCs and their colleagues in carrying out the complex sampling, data collection, and scoring tasks involved. Continuing the tradition of exemplary work established in previous cycles of TIMSS, the TIMSS 2011 NRCs performed their many tasks with dedication, competence, energy, and goodwill, and have been commended by the IEA Secretariat, the TIMSS & PIRLS International Study Center, the IEA Data Processing and Research Center, and Statistics Canada for their commitment to the project and the high quality of their work.

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