TIMSS 2003: International science report : findings from IEA's Trends in International Mathematics and Science Study at the fourth and eighth grades

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TIMSS

TIMSS 2003 International Science Report

Findings From IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades

International Association for the Evaluation of Educational Achievement

TIMSS & PIRLS International Study Center
Lynch School of Education, Boston College

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Executive Summary

Executive Summary

TIMSS 2003 is the third in a continuing cycle of international mathematics and science assessments conducted every four years. TIMSS assesses achievement in countries around the world and collects a rich array of information about the educational contexts for learning mathematics and science, with TIMSS 2003 involving more than 50 participants. This report contains the science results for 46 countries and four benchmarking participants at the eighth grade and for 25 countries and three benchmarking participants at the fourth grade. Trend data are provided at the eighth and fourth grades for those countries that also participated in 1995 and 1999 (please see the Introduction for more information about TIMSS 2003.)

Students' Science Achievement in 2003

- At the eighth grade, Singapore and Chinese Taipei were the top-performing countries having significantly higher average science achievement than the rest of the participating countries. The Republic of Korea also performed very well, with average achievement significantly higher than all of the other participating countries except Singapore, Chinese Taipei, and Hong Kong, SAR.
- At the fourth grade, Singapore was the top-performing country with higher average science achievement than all other participating countries. Chinese Taipei had significantly higher performance

than all countries except Singapore, and, in turn, Japan, Hong Kong SAR, and England outperformed the rest of countries except Singapore and Chinese Taipei.

Trends in Science Achievement

- At the eighth grade, several countries showed significantly higher average science achievement in 2003 compared to the previous assessments in 1995 and 1999. Korea, Hong Kong SAR, the United States, and Lithuania as well as the benchmarking Canadian province of Ontario, showed a pattern of improvement from assessment to assessment with significant change over the 8-year period from 1995 to 2003. Of the countries with results only from the 1999 and 2003 assessments, Malaysia, Israel, Jordan, Moldova, and the Philippines showed significant improvement.
- At the eighth grade, countries showing a decrease in average achievement in 2003 compared to previous assessments (1995, 1999, or both) included Hungary, Sweden, the Slovak Republic, Belgium (Flemish), the Russian Federation, Norway, Bulgaria, Iran, Cyprus, Indonesia, and Tunisia.
- At the fourth grade, many countries showed significant gains in average achievement between 1995 and 2003, including Singapore, Hong Kong SAR, England, Hungary, Latvia (LSS)[1], New Zealand, Slovenia, Cyprus, and Iran, as well as the benchmarking province of Ontario. The only significant declines were found in Japan, Scotland, Norway, and Quebec province.

Gender Differences in Science Achievement

- In the majority of participants at the eighth grade (33 out of 49), boys outperformed girls in science, often by a substantial margin. This was attributable mainly to higher performance by boys in

1 Trend data for Latvia are annotated LSS because they include Latvian-speaking schools only.

physics and earth science, although girls had, on average, higher achievement in life science. In eleven countries, including Egypt, Iran, Chinese Taipei, Botswana, South Africa, Lebanon, Singapore, Estonia, Cyprus, the Philippines, and New Zealand, the gender difference was not significant. In a further seven countries – Macedonia, Moldova, Armenia, the Palestinian National Authority, Saudi Arabia, Jordan, and Bahrain – the gender difference favored girls.

- The trend results at the eighth grade show that girls had greater improvement, on average, since 1999 than boys. Fifteen participants showed significant improvements for girls, and just eight for boys. Both girls and boys improved over previous assessments in nine countries and Ontario province. Reflecting declines in achievement across assessments, both genders had lower achievement in TIMSS 2003 in seven countries. In Indonesia, Macedonia, and the Russian Federation, the boys but not the girls had a significant decrease.
- At the fourth grade, the average gender difference in science achievement was negligible, although girls had significantly higher average achievement in Armenia, Moldova, the Philippines, and Iran, and boys had higher average achievement in the United States, Chinese Taipei, Cyprus, the Netherlands, and Scotland.
- The fourth-grade trend results show that average science achievement improved for both boys and girls since 1995. Both boys and girls improved in eight countries and Ontario province; in England only girls improved; and in Japan, Norway, and Quebec, both boys and girls showed a decline. Boys but not girls showed a decline in the Netherlands and the United States.

Performance at the International Benchmarks in TIMSS 2003

TIMSS identified four benchmark levels to describe what students know and can do in science and demonstrate the range of performance internationally–advanced, high, intermediate, and low. There were large

differences across countries in the percentages of students reaching the various benchmarks.

At the eighth grade, students reaching the **advanced benchmark** demonstrated a grasp of some complex and abstract science concepts. At the other end of the performance continuum, those reaching the **low benchmark** recognized some basic facts from the life and physical sciences.

- The highest performing countries –Singapore and Chinese Taipei – had one-third to one-fourth of their students reaching the advanced benchmark. Next came Korea (17%), England and Japan (15%), Hungary (14%), Hong Kong SAR and Estonia (13% each), and the United States (11%.) All other countries had less than 10 percent of their students reaching the advanced benchmark, including 17 of the lowest-performing countries with one percent or less.
- Fifteen countries, the US state of Indiana, and the two Canadian provinces had 95 percent or more of their students reaching the low benchmark whereas seven countries had less than half their students reaching the low benchmark.

At the fourth grade, students reaching the **advanced benchmark** could apply knowledge and understanding in beginning scientific inquiry. Those reaching the **low benchmark** demonstrated some elementary knowledge of the earth, life, and physical sciences.

- With fewer and less variable countries at the fourth grade, Singapore had 25 percent of its students reaching the advanced benchmark. This was followed by England (15%), Chinese Taipei (14%), the United States (13%), Japan (12%), the Russian Federation (11%), and Hungary (10%.) Three of the lowest-performing countries had one percent or less of their students reaching the advanced benchmark.
- Eight countries as well as the US state of Indiana and Ontario province had 95 percent or more of their students reaching the low

benchmark and all except five countries had at least three-fourths of their students reaching this level. In the Philippines, Tunisia, and Morocco, less than half the students reached the low benchmark.

Students' Home Context for Learning Science

- At the eighth grade, students were asked about the level of their parents' schooling and their own expectations. Higher levels of parents' education were associated with higher student achievement in science in almost all countries. Also, students expecting to finish university had substantially greater average science achievement than those without university expectations.
- At both the eighth and fourth grades, in general, students from homes where the language of the test was always or almost always spoken had higher average science achievement than those who spoke it less frequently.
- At both the eighth and fourth grades, across countries on average, there was a clear-cut relationship between number of books in the home and science achievement.
- Science achievement was positively related to computer usage, particularly at eighth grade, with average achievement highest among students reporting using computers at home and at school. Next highest was achievement among students using computers at home but not school, followed by students using computers at school but not home, and then those using computers at other places or not using them at all. At both grades, the percentages of students reporting that they did not use a computer at all varied dramatically across countries – from one percent or less to as many as two-thirds at the eighth grade and three-fourths at the fourth grade.

The Science Curriculum

- Most countries had science curricula defined at the national level (except Australia and the United States) and often supported by ministry directives, instructional guides, school inspections, and recommended textbooks. In 23 countries, science was taught as a single general subject. In other countries, separate courses were offered in the different science subjects.
- At both the eighth and fourth grades, most participants emphasized understanding science concepts and knowing basic science facts. Considerable emphasis also was placed on writing explanations about what was observed and why it happened. Less emphasis was placed on experimental work.
- In relation to the TIMSS 2003 assessment at the eighth grade, on average, participants reported that a great deal of the science content was included in their curricula (71% of assessment topics intended for all or almost all students), with each of the five science content areas included in about equal proportions. About three-fourths of the physics and life science topics (75% and 73%, respectively) were included in their curricula, 70 percent of the chemistry topics, 69 percent of the environmental science topics, and 66 percent of the earth science topics.
- At the fourth grade, on average, 56 percent of the science topics were included in the curriculum. In life science, 60 percent of the topics assessed were included in the participants' curricula, 57 percent of the physical science topics, and 50 percent of the earth science topics.
- Although the relationship was not consistent across all countries, it appears that having at least moderate coverage of the science topics in the curriculum is a prerequisite for high performance, but that high coverage in the intended curriculum does not of itself necessarily lead to high student achievement.

- At the eighth grade, across countries on average, teachers reported that 70 percent of the students had been taught the life science and chemistry topics, 66 percent the physics topics, 61 percent the earth science topics, and 49 percent the environmental science topics.
- At the fourth grade, across countries on average, teachers reported that 69 percent of the students had been taught the life science topics, 58 percent the earth science topics, and 56 percent the physical science topics.

Teachers of Science

- Science teachers reported considerable teaching experience. At the eighth and fourth grade, on average, students were taught by teachers with 15 and 16 years of experience, respectively.
- On average, 79 percent of the eighth-grade students and 65 percent of the fourth-grade students were taught by teachers with at least a university degree.
- Most eighth-grade students (82% on average) had science teachers with a science subject major (biology, physics, chemistry, or earth science) and more than one-third (37%) with a major in science education or both. Biology was the most popular science major, followed by chemistry, physics, and earth science. At the fourth grade, teachers typically studied primary or elementary education (80% of the students with such teachers, on average).
- At both grades, schools reported that their professional development programs emphasized improving content knowledge and teaching skills. More than 80 percent of students were taught science by teachers having at least some professional development training in these areas.
- Across the science content areas assessed, teachers reported being ready to teach nearly all the major topics tested by TIMSS. Almost

all of the eighth-grade students were taught by such teachers – 90 percent or more for 16 out of 21 topics (all but three earth science and two environmental science topics). At the fourth grade, teachers reported being less well-prepared. In only 8 of the 19 topics were 90 percent or more of the fourth-grade students taught by teachers reporting readiness for teaching (2 of 6 life science topics, 2 of 7 physical science topics, and 4 of 6 earth science topics).

Classroom Instruction

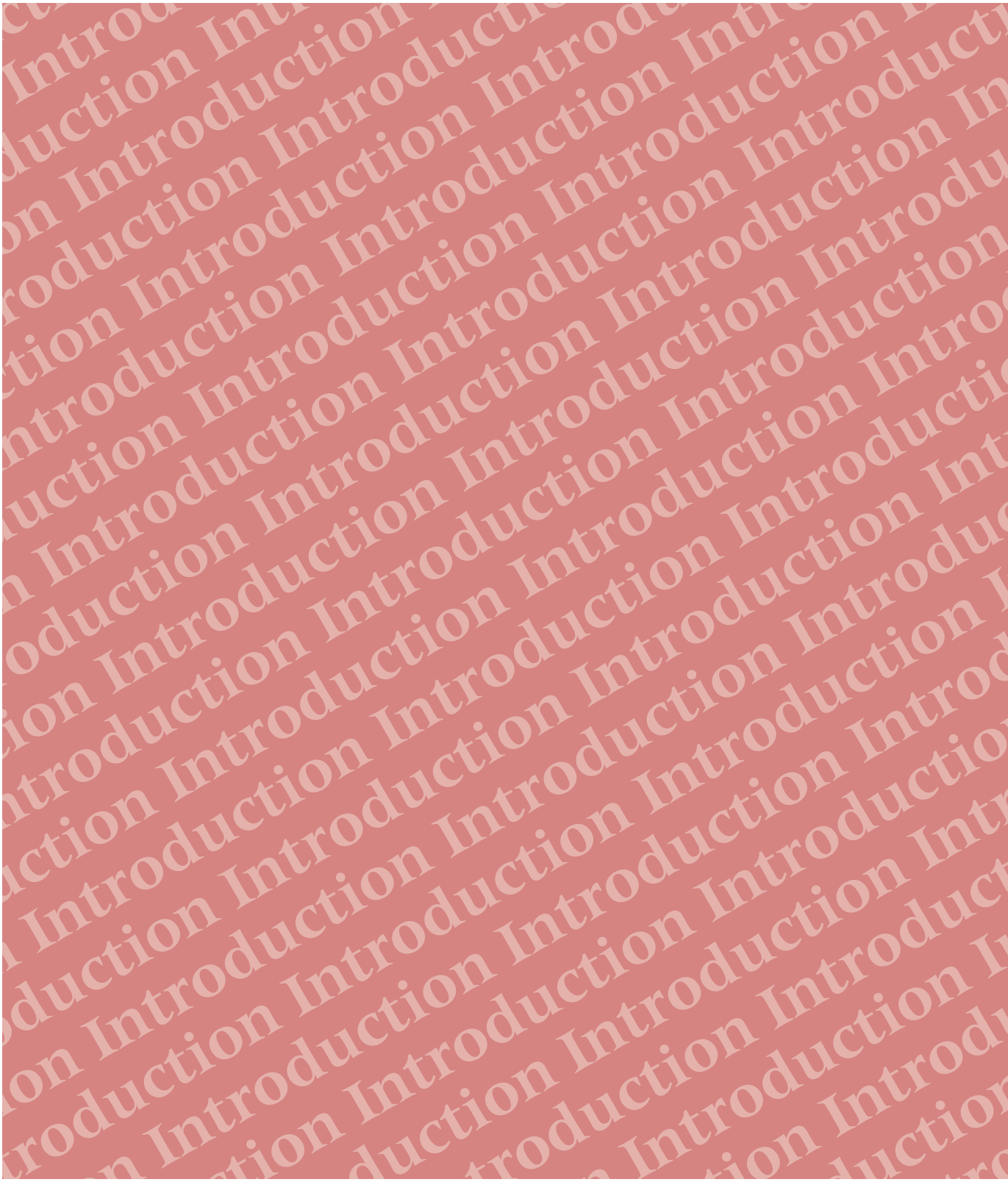
- In general at the eighth grade, students in countries with separate science subjects had more instructional hours in the sciences. Annual hours of science instruction ranged from 284 hours in the Slovak Republic, where students take biology, chemistry, physics, and earth science simultaneously, to 69 hours in Italy, where science is taught as a single, integrated subject. There was less instructional time for science at the fourth grade, with annual hours ranging from 176 in the Philippines (the most by far) to 33 hours in the Russian Federation.
- At the eighth grade, on average, teachers reported that 27 percent of the instructional time was devoted to life science, 24 percent to physics, 21 percent to chemistry, 13 percent to earth science, 9 percent to environmental science, and 5 percent to other. At fourth grade, with fewer content areas, the profile was different. Life science received 41 percent of the instructional time, earth science 28 percent, physical science 24 percent, and other 8 percent.
- At the eighth grade, on average, students reported a moderate degree of emphasis on a range of activities related to science investigations. For example, in integrated-science countries, about two-thirds of students, on average, said that, in at least half of their lessons, they were asked to write explanations about what they had observed and why it happened (66%) or watch the teacher demonstrate an experiment

or investigation (64%). At the fourth grade, most students reported that they watch the teacher do a science experiment, and write or give an explanation for something they are studying in science, once or twice a month or more (69% of students for each activity).

- At both eighth and fourth grades, the textbook was often the foundation of science instruction. On average, more than half of students at both grades (56%) had teachers who reported using a textbook as the primary basis for their lessons, and many more as a supplementary resource (39% at eighth grade and 26% at fourth grade).
- On average, the three most common instructional activities in science classes (totaling 57% of class time) were teacher lecture (24% of class time), teacher-guided student practice (19%), and students working on problems on their own (14%).
- Although the curriculum contained statements about computer use in science in about half of the countries, access to computers remains a challenge in many countries. Teachers reported that, on average, internationally, computers were not available for 62 percent of the eighth-grade students and 54 percent of the fourth-grade students. Even in countries with high availability, using computers in science class was extremely rare at either grade.
- At the eighth grade, on average, almost all students (88%) were taught by teachers who used only or mostly constructed-response tests (28%) or an equal mixture of constructed-response and multiple-choice tests (60%). Very few students (13%, on average) had teachers who used only multiple-choice tests, and these students had lower average achievement than did students whose teachers used only constructed-response tests or a combination.

School Contexts for Learning and Instruction

- At the eighth grade, average science achievement was 51 points higher for students in schools with few students from economically disadvantaged homes than for students attending schools with more than half their students from disadvantaged homes. At fourth grade, the difference was 43 points.
- At both eighth and fourth grades, there was a strong positive relationship between the principals' perception of school climate (based on seven questions about behaviors of teachers, parents, and students) and average science achievement. Asked the same seven questions, teachers had a somewhat more gloomy view of school climate than principals, but the relationship with achievement still was positive.
- Teachers were asked about the safety of their schools' neighborhoods, how safe they felt in their schools, and the sufficiency of security policies and practices. On average, 70 percent of eighth-grade students and 76 percent of fourth-grade students attended school characterized as safe by their teachers. At both grades, there was a positive relationship between school safety and science achievement.


Introduction

Introduction

What is TIMSS?

TIMSS 2003 is the most recent in a very ambitious series of international assessments conducted in nearly 50 countries to measure trends in mathematics and science learning. The aim of TIMSS, the Trends in International Mathematics and Science Study, is to improve the teaching and learning of mathematics and science by providing data about students' achievement in relation to different types of curricula, instructional practices, and school environments. The variation across the nearly 50 participating countries provides a unique opportunity to study different approaches to educational practices and how these can improve achievement.

TIMSS is a project of the International Association for the Evaluation of International Achievement (IEA), an independent international cooperative of national research institutions and government agencies that has been conducting studies of cross-national achievement since 1959. Conducted first in 1995 and then in 1999, the regular four-year cycle of TIMSS studies provides countries with an unprecedented opportunity to obtain comparative information about their students' achievement in mathematics and science.

Even more important, TIMSS also collects a rich array of contextual information about how mathematics and science learning takes place in each country. TIMSS asks students, their teachers, and their school principals to complete questionnaires about the curriculum,

schools, classrooms, and instruction. This data gives policy makers, curriculum specialists, and researchers a dynamic picture of implementation of educational policies and practices around the world, providing an invaluable perspective from which to consider educational reform and improvement. TIMSS results, which were first reported in 1996, have stirred debate and spurred reform efforts around the world.[1]

TIMSS 1995 compared the mathematics and science achievement of students in 41 countries at five grade levels. TIMSS 1999 was designed to provide trends in eighth-grade mathematics and science achievement. Also, 1999 represented four years since the first TIMSS, and the population of students originally assessed as fourth-graders had advanced to the eighth grade. Thus, TIMSS 1999 also provided information about whether the relative performance of these students had changed in the intervening years. TIMSS 2003 was administered at the eighth and fourth grades. For countries that participated in previous assessments, TIMSS 2003 provides three-cycle trends at the eighth grade (1995, 1999, 2003) and data over two points in time at the fourth grade (1995 and 2003). In countries new to the study, the 2003 results can help policy makers and practitioners assess their comparative standing and gauge the rigor and effectiveness of the mathematics and science programs.

Who Conducts TIMSS?

TIMSS is a major undertaking of the IEA, and together with PIRLS, comprises the core of IEA's regular cycle of studies.[2] The IEA delegated responsibility for the overall direction and management of the project to the TIMSS & PIRLS International Study Center at Boston College. Headed by Michael O. Martin and Ina V.S. Mullis, the study center is located in the Lynch School of Education. In carrying out the project, the TIMSS & PIRLS International Study Center works closely with the IEA Secretariat in Amsterdam, the IEA Data Processing Center in Hamburg, Statistics Canada in Ottawa, and Educational Testing Service in Princeton, New Jersey.

1 Robitaille, D.F., Beaton, A.E., and Plomp, T., eds. (2000), The Impact of TIMSS on the Teaching and Learning of Mathematics and Science, Vancouver, BC: Pacific Educational Press.

2 PIRLS is the IEA's Progress in International Reading Literacy Study developed to assess students' reading achievement at fourth grade. Thirty-five countries participated in PIRLS 2001, and nearly 50 countries are participating in PIRLS 2006.

To coordinate the TIMSS project nationally and to work with the international team, each participating country designates an individual to be the National Research Coordinator (NRC). The NRCs have the formidable task of implementing the TIMSS study in their countries in accordance with the TIMSS guidelines and procedures. The quality of the assessments depends on the work of the NRCs and their colleagues in carrying out the very complex sampling, data collection, and scoring tasks involved. Continuing the tradition of superlative work established in 1995 and 1999, the TIMSS 2003 NRCs performed their many tasks with great dedication, competence, and energy, and should be commended for their commitment to the project and the high quality of their work (see Appendix G for a list of the TIMSS 2003 NRCs).

Which Countries Participated in TIMSS 2003?

Exhibit 1 shows the 49 countries that participated in TIMSS 2003. The decision to participate in any 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 that 23 countries also participated in TIMSS 1995 and TIMSS 1999. For these participants, trend data across three-points in time are included in this report. Eleven countries participated in TIMSS 2003 and TIMSS 1999 only, while three countries participated in TIMSS 2003 and TIMSS 1995. These countries have trend data for two points in time. TIMSS 2003 is proud to welcome 12 new participating countries to the study. TIMSS 2003 is equally proud of its fledgling benchmarking program, whereby regions or localities of countries can participate in the study to compare to international standards. TIMSS 2003 included four benchmarking participants (one US state, two Canadian provinces, and Spain's Basque Country) in addition to its 49 countries.

At the eighth grade, results are presented for 46 countries and 4 benchmarking participants. At the fourth grade, results are presented for 25 countries and three benchmarking participants. Argentina was unable to complete the steps necessary to have its data available for

Exhibit 1: Countries Participating in TIMSS

2003, 1999, and 1995

Australia
Belgium (Flemish)
Bulgaria
Cyprus
England
Hong Kong, SAR
Hungary
Iran, Islamic Rep. of
Israel
Italy
Japan
Korea, Rep. of
Latvia
Lithuania
Netherlands
New Zealand
Romania
Russian Federation
Singapore
Slovak Republic
Slovenia
South Africa
United States
Ontario Province, Can.
Quebec Province, Can.

2003 and 1999

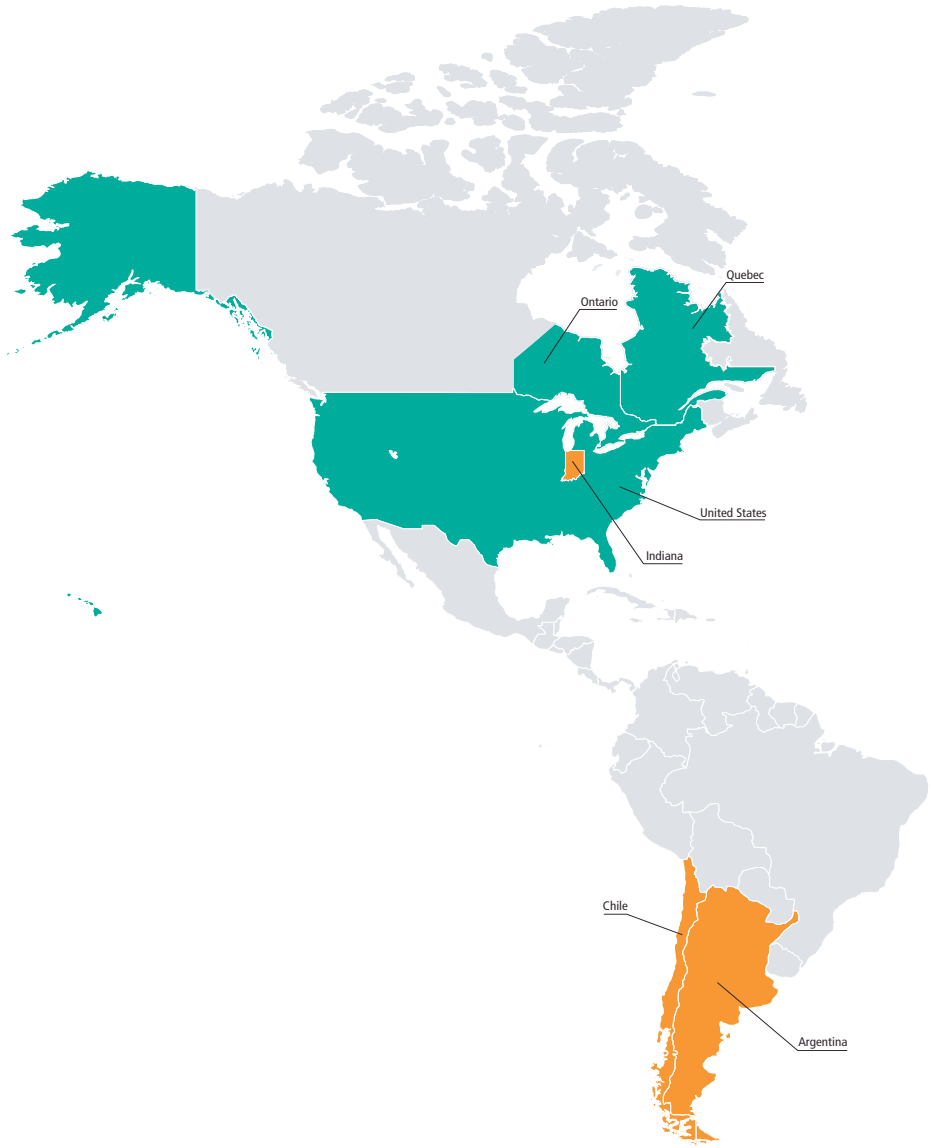
Argentina
Chile
Chinese Taipei
Indonesia
Jordan
Macedonia, Rep. of
Malaysia
Moldova, Rep. of
Morocco
Philippines
Tunisia
Indiana State, US

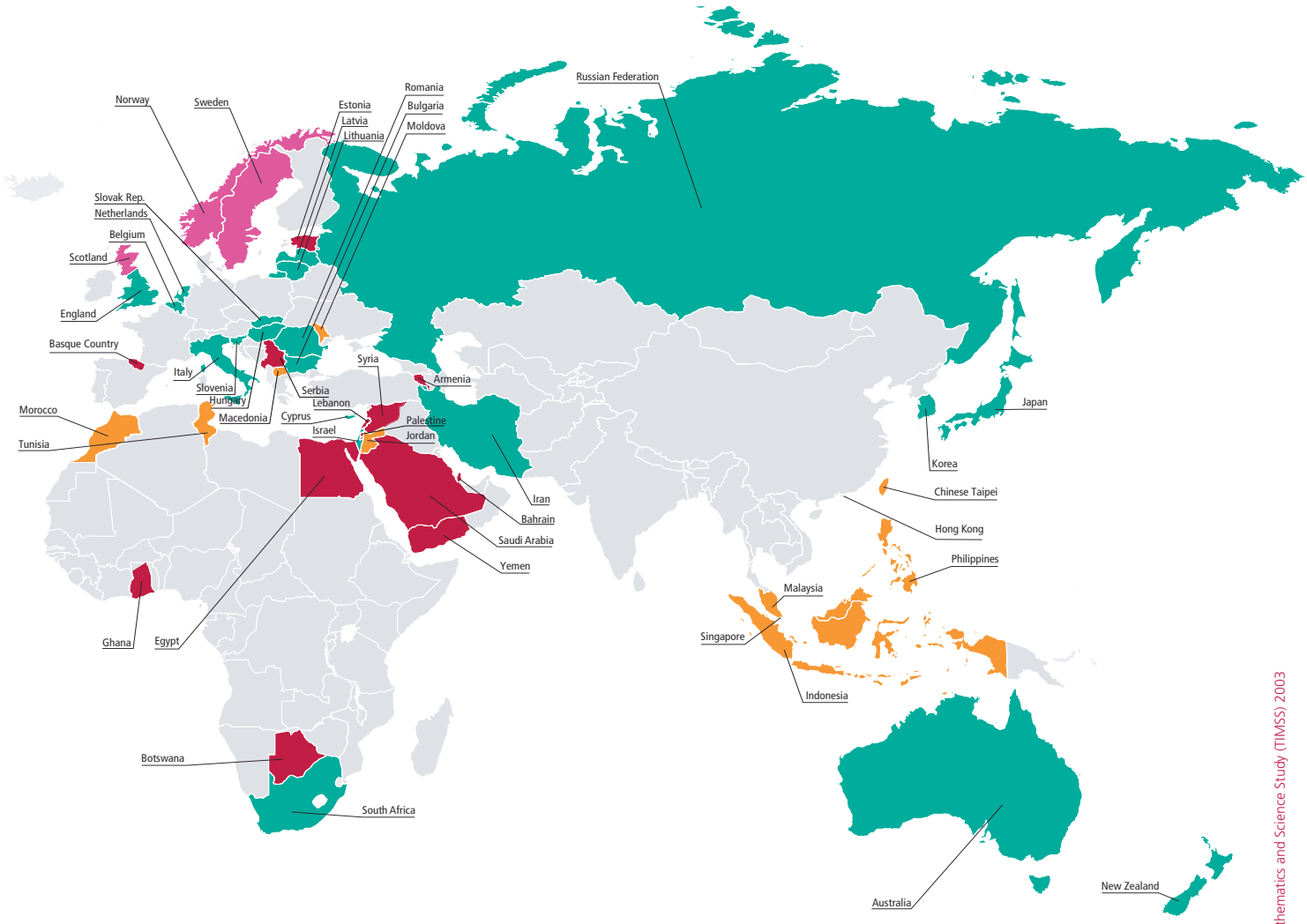
2003 and 1995

Norway
Scotland
Sweden

2003

Armenia
Bahrain
Botswana
Egypt
Estonia
Ghana
Lebanon
Palestinian National Authority
Saudi Arabia
Serbia
Syrian Arab Republic
Yemen
Basque Country, Spain





SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Argentina administered the TIMSS 2003 data collection one year late, and did not score and process its data in time for inclusion in this report.
Because the characteristics of their samples are not completely known, achievement data for Syria and Yemen are presented in Appendix F of this report.

analysis for this report. Because the characteristics of their samples are not completely known, the results for Syrian Arab Republic and Yemen are presented in Appendix F.

For the sake of comparability across countries and across assessments, all testing was conducted at the end of the school year, except in Korea. As noted in the Exhibits in this report, Korea tested the same cohort of students as other countries, but later in 2003 at the beginning of the next school year. The seven countries on a Southern Hemisphere school schedule (Australia, Botswana, Chile, Malaysia, New Zealand, Singapore, and South Africa) tested in October through December of 2002, which was the end of the school year there. The remaining countries tested towards the end of the 2002-2003 school year, most often in April, May, or June of 2003.

What Is the Comparability Across the Grades and Ages Tested?

Exhibit 2 contains information about the grade(s) tested in each country. Because TIMSS studies the effectiveness of curriculum and instruction on student learning, it is designed to assess mathematics and science achievement at the same point in schooling across countries. More specifically, TIMSS tries to assess students at two points – at the end of four years of formal schooling and at the end of eight years of formal schooling.

Exhibit 2 reveals that, with few exceptions, the grade(s) tested in each country represented the eighth year of formal schooling and the fourth year of formal schooling. Thus, solely for convenience, the report usually refers to the grade tested as the eighth or the fourth grade, respectively.

As can be seen from the first two columns in Exhibit 2, countries have different policies and practices about the age of entry to primary school. This information is extremely valuable and important in considering the achievement results, since differences in these policies can affect achievement through the grades. Everything else being equal,

students who start their formal schooling at a younger age will be younger than their counterparts at the grades assessed and those who start their schooling at an older age will be older. Again, everything else being equal, students who are older may be considered more mature. In many countries, students must be 6 years old to start school and they do start school at that age. In several countries, students must be six, but they do not need to start school at that age and can wait. In this case, students or their parents may wait, most often for economic reasons, so that the older students may come from disadvantaged backgrounds. Also, in a number of countries children must be 7 years old. On the other hand, in several countries some or all of the students are younger than six when they start school, including Australia, Cyprus, England, Jordan, Scotland, and Tunisia.

Besides the age of entry, policies on promotion and retention also can effect how old students are when they reach a particular grade. If students have been retained, they will be older when they are assessed. Most often, it is the lower achievers who are retained and consequently the older students have lower achievement. Consistent with most educational endeavors, the interaction between grade and age in school is complicated. As can be seen from Exhibit 2, the variation in policies and practices across the countries assessed resulted in a considerable range in the average age of the students assessed. At the eighth grade, for example, Scotland with an additional year of schooling because they start school at such a comparatively early age (4.5 to 5.5 years old), had the youngest students assessed – 13.7 years old on average. At the other end of the spectrum, students in Ghana start school closer to age 7 and may be retained because of attendance problems; as a result they were the oldest students assessed at 15.5 years old. Despite this wide range, however, eighth grade students in most countries were between 14 and 15 years old. Similarly, fourth grade students averaged between 10 and 11 years old, even though those in Scotland were 9.7 years old and those in Latvia had an average age of 11.1.

Exhibit 2: Information About the Students Tested in TIMSS 2003

Countries	Policy on Age of Entry to Primary School[1]	Practice on Age of Entry to Primary School	Policy on Promotion / Retention	Country's Name for Grade Tested	Years of Schooling[2]	Average Age at Time of Testing
Armenia	Children must be 7 years old	6.5 to 7	Automatic	Grade 8	8	14.9
Australia	Children must be 5 or 6 years old, depending on state or territory	5 or 6	Automatic	Year 8	8 or 9	13.9
Bahrain	Children must be 6 years old	6	Automatic in grade 1, students in grades 2-8 must demonstrate a certain amount of academic progress	Second intermediate	8	14.1
Belgium (Flemish)	Children begin school during the calendar year in which they become 6 years old	6	Students must show progress, based on exam by teachers	Second grade of secondary education	8	14.1
Botswana	Children must be 6 years old by June	6 to 7	Students can be retained if found to be extremely deficient, after consultation with parents and teachers; students can repeat a maximum of 3 grades	Form 1	8	15.1
Bulgaria	Children must be 6 years old by the end of June to begin school the following September	7	Students must demonstrate basic knowledge and skills	Grade 8	8	14.9
Chile	Children must be 6 years old in March or before	6	Automatic in grades 1-4, dependent on marks and approval in grades 5-8	Eighth grade of basic education	8	14.2
Chinese Taipei	Children must be 6 years old	6	Automatic	Junior high school, grade 2	8	14.2
Cyprus	Children must be 5 years, 6 months old	5 years, 6 months to 6 years, 5 months	Automatic in grades 1-6, dependent on progress in grades 7-8	2nd grade - gymnasium	8	13.8
Egypt	Children must be 6 years old, space permitting (otherwise 7)	6 to 7	Students in grades 1-5 must pass an exam but if retained are automatically promoted the following year, students in grades 6-8 must pass an exam and are not automatically promoted the following year	Preparatory 3	8	14.4
England	Children must begin school at the start of the term following their 5th birthday	5	Automatic	Year 9	9	14.3
Estonia	Children must be 7 years old by October 1	7	Students must have positive marks, and in grades 7-8 must also pass a school exam	Grade 8	8	15.2
Ghana	Children must be 6 years old	6 to 7	Students are retained with parental consent if fail to satisfy certain conditions such as adequate attendance	Junior secondary school II (JSS II)	8	15.5
Hong Kong, SAR	Children must be 6 years old	6	Determined by schools but retention rate cannot exceed 3%; in practice 99% of students are promoted	Secondary 2 (S2)	8	14.4
Hungary	Children must be 6 years old	6 or older	Automatic	Grade 8	8	14.5
Indonesia	Children must be 6 years old	6	Based on student achievement, usually small number are retained	2nd grade of junior secondary school	8	14.5
Iran, Islamic Rep. of	Children must be 6 years old	6	Students must pass a final examination	Third grade of guidance school	8	14.4
Israel	Children must be 6 years old	6	Mostly automatic, but students diagnosed as having difficulties are transferred to remedial classes	Grade 8	8	14.0
Italy	Children may begin school when 5 years old if their birth date is before April 30 of the academic year, otherwise 6	6	Students must demonstrate a certain amount of academic progress	Grade 8 (III media)	8	13.9
Japan	Children must be 6 years old	6	Automatic	2nd grade at the lower secondary school	8	14.4
Jordan	Children must be 5 years, 8 months old	5 years, 8 months	Retention rate cannot exceed 5%	Grade 8	8	13.9
◆◆ Korea, Rep. of	Children must be 6 years old	6	Automatic	Middle school, 2nd grade	8	14.6
Latvia	Children must be 7 years old in the calendar year	7	Automatic	Grade 8	8	15.0

Background data provided by National Research Coordinators.

1 Age of entry to primary school based on the beginning of ISCED Level 1 in UNESCO's International Standard Classification of Education (Operational Manual for ISCED-97).

2 Represents years of schooling counting from the first year of ISCED Level 1.

◆◆ Korea tested the same cohort of students as other countries, but later in 2003, at the beginning of the next school year.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 2: Information About the Students Tested in TIMSS 2003 *(Continued...)*

Countries	Policy on Age of Entry to Primary School[1]	Practice on Age of Entry to Primary School	Policy on Promotion / Retention	Country's Name for Grade Tested	Years of Schooling[2]	Average Age at Time of Testing
Lebanon	Children must be 6 or 7 years old	6 or 7	Dependent on final exams	Grade 8	8	14.6
Lithuania	Children must be 6 or 7 years old, depending on child's development and parents' wishes	7 or older	Students must have sufficient marks (at least 4 on a scale of 1-10) in all subjects, and approval by the School Teachers' Board	Grade 8	8	14.9
Macedonia, Rep. of	Children must be 7 years old by September 1	6.5 to 7	Automatic in grades 1-4; students in grades 5-8 must have marks of at least 3 (on a scale 1-5) in all subjects, but if do not finish grade 8 by age 17 are transferred to schools for adults	Grade 8	8	14.6
Malaysia	Children must be 6 years old by January 1 of the academic year	6 or older	Automatic	Form 2	8	14.3
Moldova, Rep. of	Children must be 6 or 7 years old, parents decide	6 or 7	If students fail any subjects they are promoted with negative marks for those subjects, students with more than 5 negative marks are retained	Grade VIII	8	14.9
Morocco	Children must be 7 years old	7	Automatic except for students in grade 6 who must pass provincial exams	2° secondary	8	15.2
Netherlands	Children must be 6 years old	6	Essentially automatic, but students can be retained if have serious learning difficulties or fall behind because of illness	Grade 8	8	14.3
New Zealand	Children must attend primary school from their 6th birthday, but have the right to be enrolled from age 5	Almost all start on or near 5th birthday	Automatic	Year 9	8.5 - 9.5	14.1
Norway	Children begin school the year they become 7 years old	7	Automatic	Grade 8 (these students started in Grade 2)	7	13.8
Palestinian Nat'l Auth.	Children must be 6 years old for governmental schools, 5.5 years old for special schools	6	Automatic in grades 1-4, students in grades 5-8 must have at least 50% passing marks in all subjects and if do not must pass exams in the relevant subjects	Grade 8	8	14.1
Philippines	Children must be 6 years old	6 to 7	Students must repeat and pass any subjects they failed before being promoted	Second year high school	8	14.8
Romania	Children must be 7 years old	7	Students in grades 1-4 must receive a "satisfactory" grade in all subjects, students in grades 5-8 must receive grades of at least 5 (on a scale of 1-10) in all subjects	Grade 8	8	15.0
Russian Federation	For 4-year primary schools, children must be 6 years old by September 1 but require special medical confirmation; for 3-year primary schools, children must be 7 years old by September 1 but parents have a right to keep children at home until age 8	6 or 7	Automatic	Eighth grade	7 or 8	14.2
Saudi Arabia	Children must be 6 years old	6	Students must achieve a satisfactory level in all subjects	Second year of middle school	8	14.1
Scotland	Children can begin school between the ages of 4.5 and 6; those with a March-August birth date automatically begin school in September following their 5th birthday; parents of children with a September-December birth date can defer school entry until the following year (most choose not to defer)	4.5 to 5.5	Automatic	Secondary 2 (S2)	9	13.7
Serbia	Children begin school during the calendar year in which they turn 7, but may enter school earlier with parental consent if mature enough and ready for school	7	Students must have marks of at least 2 (on a scale 1-5) in all subjects	8th grade of primary school	8	14.9
Singapore	Children must be 6 years old	6	Automatic in grades 1-5, students in grade 6 must satisfy basic requirements on national exam to be promoted to grade 7	Secondary 2	8	14.3

Background data provided by National Research Coordinators.

1 Age of entry to primary school based on the beginning of ISCED Level 1 in UNESCO's International Standard Classification of Education (Operational Manual for ISCED-97).

2 Represents years of schooling counting from the first year of ISCED Level 1.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 2: Information About the Students Tested in TIMSS 2003 *(...Continued)*

Countries	Policy on Age of Entry to Primary School[1]	Practice on Age of Entry to Primary School	Policy on Promotion / Retention	Country's Name for Grade Tested	Years of Schooling[2]	Average Age at Time of Testing
Slovak Republic	Children must be 6 years old	6	Automatic	Grade 8	8	14.3
Slovenia	For 8-year elementary schools, children must be 7 years old in the calendar year; for 9-year elementary schools, children must be 7 years old in the calendar year, but are promoted from grade 5 of 8-year elementary school directly to grade 7 of 9-year elementary school	6.5	Automatic	Grade 7 of 8-year elementary school; Grade 8 of 9-year elementary school	7 or 8	13.8
South Africa	Children must be 6 years old by June 30 of the academic year, which begins in January	7	Automatic in grades 1-3, students in grades 4-8 must pass an exam	Grade 8	8	15.1
Syrian Arab Republic	--	--	--	Grade 8	8	14.0
Sweden	Children begin school during the calendar year of their 7th birthday	7	Automatic	Year 8	8	14.9
Tunisia	Children must be 6 years old	5.5 to 6	Students must demonstrate a certain amount of academic progress	8th year of basic school	8	14.8
United States	Varies by state; 6 or 7, depending on birth date	6 or 7	Automatic	Grade 8	8	14.2
International Avg.					8	14.5
Benchmarking Participants						
Basque Country, Spain	Children must be 6 years old	6	At the end of each cycle of 2 years, students with low achievement may be retained upon teachers' decision	2nd year of compulsory secondary education	8	14.1
Indiana State, US	No official state policy	6 to 7	Promotion/retention decisions are made by individual schools	Grade 8	8	15.1
Ontario Province, Can.	Children must be 6 years old by December 31	6	Automatic	Grade 8	8	13.8
Quebec Province, Can.	Children must be 7 years old by October 1	6	Automatic	Secondary II	8	14.2

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

1 Age of entry to primary school based on the beginning of ISCED Level 1 in UNESCO's International Standard Classification of Education (Operational Manual for ISCED-97).

2 Represents years of schooling counting from the first year of ISCED Level 1.

A dash (–) indicates comparable data are not available.

Exhibit 2: Information About the Students Tested in TIMSS 2003 *(Continued...)*

Countries	Policy on Age of Entry to Primary School[1]	Practice on Age of Entry to Primary School	Policy on Promotion / Retention	Country's Name for Grade Tested	Years of Schooling[2]	Average Age at Time of Testing
Armenia	Children must be 7 years old	6.5 to 7	Automatic	Grade 4	4	10.9
Australia	Children must be 5 or 6 years old, depending on state or territory	5 or 6	Automatic	Year 4	4 or 5	9.9
Belgium (Flemish)	Children begin school during the calendar year in which they become 6 years old	6	Students must show progress, based on exam by teachers	Fourth grade of primary education	4	10.0
Chinese Taipei	Children must be 6 years old	6	Automatic	Elementary school, grade 4	4	10.2
Cyprus	Children must be 5 years, 8 months old	5 years, 8 months to 6 years, 7 months	Automatic	4th grade - primary	4	9.9
England	Children must begin school at the start of the term following their 5th birthday	5	Automatic	Year 5	5	10.3
Hong Kong, SAR	Children must be 6 years old	6	Determined by schools but retention rate cannot exceed 3%; in practice 99% of students are promoted	Primary 4 (P4)	4	10.2
Hungary	Children must be 6 years old	6 or older	Automatic	Grade 4	4	10.5
Iran, Islamic Rep. of	Children must be 6 years old	6	Students must pass a final examination	Fourth grade of primary school	4	10.4
Italy	Children may begin school when 5 years old if their birth date is before April 30 of the academic year, otherwise 6	6	Students must demonstrate a certain amount of academic progress	Grade 4 (IV elementare)	4	9.8
Japan	Children must be 6 years old	6	Automatic	4th grade at the elementary school	4	10.4
Latvia	Children must be 7 years old in the calendar year	7	Automatic	Grade 4	4	11.1
Lithuania	Children must be 6 or 7 years old, depending on child's development and parents' wishes	7 or older	Students must have sufficient marks (at least 4 on a scale of 1-10) in all subjects, and approval by the School Teachers' Board	Grade 4	4	10.9
Moldova, Rep. of	Children must be 6 or 7 years old, parents decide	6 or 7	If students fail any subjects they are promoted with negative marks for those subjects, students with more than 5 negative marks are retained	Grade IV	4	11.0
Morocco	Children must be 7 years old	7	Automatic	4° primary	4	11.0
Netherlands	Children must be 6 years old	6	Essentially automatic, but students can be retained if have serious learning difficulties or fall behind because of illness	Grade 4	4	10.2
New Zealand	Children must attend primary school from their 6th birthday, but have the right to be enrolled from age 5	Almost all start on or near 5th birthday	Automatic	Year 5	4.5 - 5.5	10.0
Norway	Children begin school the year they become 6 years old, but the first year is called "Grade 1/Preschool"	6	Automatic	Grade 4	4	9.8
Philippines	Children must be 6 years old	6 to 7	Students must repeat and pass any subjects they failed before being promoted	Grade 4	4	10.8
Russian Federation	For 4-year primary schools, children must be 6 years old by September 1 but require special medical confirmation; for 3-year primary schools, children must be 7 years old by September 1 but parents have a right to keep children at home until age 8	6 or 7	Automatic	Fourth grade for 4-year primary school; Third grade for 3-year primary school	3 or 4	10.6

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

1 Age of entry to primary school based on the beginning of ISCED Level 1 in UNESCO's International Standard Classification of Education (Operational Manual for ISCED-97).

2 Represents years of schooling counting from the first year of ISCED Level 1.

Exhibit 2: Information About the Students Tested in TIMSS 2003 *(…Continued)*

SCIENCE Grade 4

Countries	Policy on Age of Entry to Primary School[1]	Practice on Age of Entry to Primary School	Policy on Promotion / Retention	Country's Name for Grade Tested	Years of Schooling[2]	Average Age at Time of Testing
Scotland	Children can begin school between the ages of 4.5 and 6; those with a March-August birth date automatically begin school in September following their 5th birthday; parents of children with a September-December birth date can defer school entry until the following year (most choose not to defer)	4.5 to 5.5	Automatic	Primary 5 (P5)	5	9.7
Singapore	Children must be 6 years old	6	Automatic	Primary 4	4	10.3
Slovenia	For 8-year elementary schools, children must be 7 years old in the calendar year; for 9-year elementary schools, children must be 6 years old in the calendar year	5.5 or 6.5	Automatic	Grade 3 of 8-year elementary school; Grade 4 of 9-year elementary school	3 or 4	9.8
Tunisia	Children must be 6 years old	5.5 to 6	Students must demonstrate a certain amount of academic progress	4th year of basic school	4	10.4
United States	Varies by state; 6 or 7, depending on birth date	6 or 7	Automatic	Grade 4	4	10.2
Yemen	Children must be 6 years old	6 or older	Automatic	Grade 4	4	10.9
International Avg.					4	10.3
Benchmarking Participants						
Indiana State, US	No official state policy	6 to 7	Promotion/retention decisions are made by individual schools	Grade 4	4	11.0
Ontario Province, Can.	Children must be 6 years old by December 31	6	Automatic	Grade 4	4	9.8
Quebec Province, Can.	Children must be 7 years old by October 1	6	Automatic	Second year of the second cycle	4	10.1

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

1 Age of entry to primary school based on the beginning of ISCED Level 1 in UNESCO's International Standard Classification of Education (Operational Manual for ISCED-97).

2 Represents years of schooling counting from the first year of ISCED Level 1.

Having valid and efficient samples in each country is crucial to the quality and integrity of the study. The accuracy of the survey results depends on the quality of the sampling information available, and particularly on the quality of the samples. TIMSS developed procedures and guidelines to ensure that the national samples were of the highest quality possible. Standards were established and well documented for coverage of the target population and participation rates. For the most part, the national samples were drawn in accordance with the TIMSS standards, and achievement results can be compared with confidence. Countries that deviated from the guidelines are specially noted in this report.

What Was the Nature of the Science Test and Background Questionnaires?

A particular challenge for TIMSS 2003 was updating the set of frameworks underlying the assessments. The publication entitled *TIMSS Assessment Frameworks and Specifications 2003* serves as the basis of TIMSS 2003 and beyond.[3] It describes in some detail the mathematics and science content to be assessed in mathematics and science. Content areas are elaborated with objectives specific to the eighth and fourth grades. In general, the science content areas are life science, chemistry, physics, earth science, and environmental science.

Developing the TIMSS tests for 2003 was a cooperative venture involving all of the NRCs during the entire process. The TIMSS & PIRLS International Study Center began the process with an item-writing workshop for NRCs and their colleagues. Through a series of efforts, countries then submitted items that were reviewed by science subject-matter specialists. Participating countries field-tested the items with representative samples of students, and all of the potential new items were reviewed by the Science and Mathematics Item Review Committee. The NRCs had several opportunities to review the items and scoring criteria. The resulting TIMSS 2003 science tests contained 189 items at the eighth grade and 152 items at the fourth grade.[4]

3 Mullis, I.V.S., Martin, M.O., Smith, T.A., Garden, R.A., Gregory, K.D., Gonzalez, E.J., Chrostowski, S..J, and O'Connor, K.M. (2003), *TIMSS Assessment Frameworks and Specifications 2003 (2nd Edition),* Chestnut Hill, MA: Boston College.

The TIMSS frameworks developed 1995 also were used for 1999. See, Robitaillle, D.F., McKnight, C.C., Schmidt, W.H., Britton, E.D., Raisen, S.A., and Nicol, C. (1993), *TIMSS Monograph No. 1: Curriculum Frameworks for Mathematics and Science,* Vancouver, BC: Pacific Educational Press.

4 For more detail, see Appendix A.

At both fourth and eighth grades, about two-fifths of the questions were in the constructed-response format, requiring students to generate and write their answers. These questions, some of which required extended responses, were allotted almost half of the testing time. Chapter 2 of this report contains example items illustrating the range of science concepts and processes covered in the TIMSS 2003 tests. Appendix A contains more information about test development for TIMSS 2003.

To guide questionnaire development, the TIMSS frameworks document also describes the contextual factors associated with students' learning in mathematics and science. A special effort was made for TIMSS 2003 to reduce burden for students, teachers, and schools and to address emerging policy concerns. In particular, TIMSS worked to examine curricular goals; the educational resources and facilities provided; the teaching force and how it is educated, equipped, and supported; classroom activities and characteristics; home support and involvement; and the experiences and attitudes that students themselves bring to the educational enterprise.

How Do Country Characteristics Differ?

International studies of student achievement provide valuable comparative information about student performance, instructional practice, and curriculum. It is important, however, to consider the results in light of country-wide demographic and economic factors. Some selected demographic characteristics of the TIMSS 2003 countries are presented in Exhibit 3. As can be seen, countries range widely in population size and in geographic area. Countries also vary widely on indicators of health, such as life expectancy at birth and infant mortality rate. The economic indicators, such as gross national income per capita, reveal there is great disparity in the economic resources available to countries. Finally, there are differences in enrollment rates and pupil-teacher ratios. For the enrollment rates, figures only were available for primary and secondary school and not specifically for fourth and

eighth grades. For the fourth grade, it can be seen that the countries generally had 90 percent or more of their children enrolled in primary school. The figures pertinent to the eighth grade in particular were not available, but they most certainly would be higher than those provided for the secondary school.

Exhibit 3: Selected Characteristics of TIMSS 2003 Countries

Countries	Population Size[1] (in Millions)	Area of Country[2] (1000 Square Kilometers)	Life Expectancy at Birth[3] (Years)	Infant Mortality Rate[4] (per 1000 Live Births)	Gross National Income per Capita[5] (in U.S. Dollars)
Argentina	36.5	2780	74	16	4220
Armenia	3.1	30	75	30	790
Australia	19.7	7741	79	6	19530
[12] Bahrain	0.7	1	74	18	10500
[10] Belgium (Flemish)	9.8	31	79	5	22940
Botswana	1.7	582	38	80	3010
Bulgaria	8.0	111	72	14	1770
Chile	15.6	757	76	10	4250
[9] Chinese Taipei	23.0	36	76	5	11627
[12] Cyprus	0.8	9	77	7	12320
Egypt	66.4	1001	69	33	1470
[11] England	59.2	243	77	5	25510
Estonia	1.4	45	71	10	4190
Ghana	20.3	239	55	60	270
Hong Kong, SAR	6.8	1	80	–	24690
Hungary	10.2	93	72	8	5290
Indonesia	211.7	1905	67	32	710
Iran, Islamic Rep. of	65.5	1648	69	34	1720
Israel	6.6	21	79	6	16020
Italy	57.7	301	78	4	19080
Japan	127.2	378	82	3	34010
Jordan	5.2	89	72	27	1760
Korea, Rep. of	47.6	99	74	5	9930
Latvia	2.3	65	70	17	3480
Lebanon	4.4	10	71	28	3990
Lithuania	3.5	65	73	8	3670
Macedonia, Rep. of	2.0	26	73	22	1710
Malaysia	24.3	330	73	8	3540
Moldova, Rep. of	4.3	34	67	27	460
Morocco	29.6	447	68	39	1170
Netherlands	16.1	42	78	5	23390
New Zealand	3.9	271	78	6	13260
Norway	4.5	324	79	4	38730
[12] Palestinian Nat'l Auth.	–	–	72	–	–
Philippines	79.9	300	70	28	1030
Romania	22.3	238	70	19	1870
Russian Federation	144.1	17075	66	18	2130
Saudi Arabia	21.9	2150	73	23	8530
[11] Scotland	59.2	243	77	5	25510
Serbia	8.2	102	73	16	1400
Singapore	4.2	1	78	3	20690
Slovak Republic	5.4	49	73	8	3970
Slovenia	2.0	20	76	4	10370
South Africa	45.3	1221	46	52	2500
Sweden	8.9	450	80	3	25970
Syrian Arab Republic	17.0	185	70	23	1130
Tunisia	9.8	164	73	21	1990
United States	288.4	9629	77	7	35400
Yemen	18.6	528	57	83	490

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

1 Estimates are for mid-year 2002, includes all residents regardless of legal status or citizenship except refugees not permanently settled in the country of asylum as they are generally considered to be part of their country of origin. World Bank's *2004 World Development Indicators*, p. 38-41.

2 Area is the total surface area in square kilometers, comprising all land area, inland bodies of waters, and some coastal water ways. World Bank's *2004 World Development Indicators*, p. 14-17.

3 Number of years a newborn infant would live if prevailing patterns of mortality at its birth were to stay the same throughout its life. World Bank's *2004 World Development Indicators*, p. 108-111.

4 Infant mortality rate is the number of deaths of infants under one year of age during 2002 per 1,000 live births in the same year. World Bank's *2004 World Development Indicators*, p. 108-111.

5 GNI per Capita in U.S. dollars is converted using the World Bank Atlas method. World Bank's *2004 World Development Indicators*, p. 14-17.

6 An international dollar has the same purchasing power over GNI as a U.S. dollar in the United States. World Bank's *2004 World Development Indicators*, p. 14-17.

7 Ratio of the children of official school age who are enrolled in school to the population of the corresponding official school age. Based on the International Classification of Education 1997. World Bank's *2004 World Development Indicators*, p. 76-79.

8 Primary pupil-teacher ratio is the number of pupils enrolled in primary school divided by the number of primary school teachers (regardless of their assignment). World Bank's *2004 World Development Indicators*, p. 72-75 and *Global Education Digest 2004* by UNESCO Institute for Statistics.

9 Data provided by the NRC of Chinese Taipei.

10 Figures for Belgium (Flemish) are for the whole country of Belgium.

11 Figures for England and Scotland are for the whole region of United Kingdom.

12 Data for Bahrain, Cyprus and Palestinian Nat'l Auth. was obtained from *Global Education Digest 2004* by UNESCO Institute for Statistics and *The World Fact Book 2004*.

A dash (–) indicates data are not available.

Exhibit 3: Selected Characteristics of TIMSS 2003 Countries

GNI per Capita[6] (Purchasing Power Parity)	Net Enrollment Ratio in Education[7] (% of Relevant Group)		Primary Pupil-Teacher Ratio[8]	Countries
	Primary	Secondary		
10190	100	81	20.0	Argentina
3230	85	85	18.8	Armenia
27440	96	88	18.1	Australia
–	91	81	16.4	[12] Bahrain
28130	100	–	12.1	[10] Belgium (Flemish)
7740	81	55	26.6	Botswana
7030	90	87	16.8	Bulgaria
9420	89	75	32.2	Chile
–	98	93	18.6	[9] Chinese Taipei
–	95	88	17.2	[12] Cyprus
3810	90	78	22.3	Egypt
26580	100	95	18.2	[11] England
11630	98	92	14.1	Estonia
2080	60	30	32.1	Ghana
27490	98	72	20.0	Hong Kong, SAR
13070	90	87	10.5	Hungary
3070	92	47	20.9	Indonesia
6690	87	–	24.3	Iran, Islamic Rep. of
19000	100	88	12.2	Israel
26170	100	88	10.7	Italy
27380	100	100	20.4	Japan
4180	91	80	20.2	Jordan
16960	99	91	32.1	Korea, Rep. of
9190	91	89	15.0	Latvia
4600	90	–	16.8	Lebanon
10190	97	92	16.0	Lithuania
6420	93	82	18.0	Macedonia, Rep. of
8500	95	69	19.6	Malaysia
1600	78	68	19.5	Moldova, Rep. of
3730	88	31	28.3	Morocco
28350	99	90	9.8	Netherlands
20550	98	92	14.8	New Zealand
36690	100	95	–	Norway
–	95	81	–	[12] Palestinian Nat'l Auth.
4450	93	56	35.4	Philippines
6490	93	80	19.6	Romania
8080	–	–	17.1	Russian Federation
12660	59	53	12.3	Saudi Arabia
26580	100	95	18.2	[11] Scotland
–	75	–	–	Serbia
23730	–	–	25.4	Singapore
12590	89	75	19.0	Slovak Republic
18480	93	96	12.6	Slovenia
9810	90	62	37.1	South Africa
25820	100	96	11.4	Sweden
3470	98	39	24.0	Syrian Arab Republic
6440	97	68	21.9	Tunisia
36110	94	87	15.4	United States
800	67	35	29.8	Yemen

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

1 Estimates are for mid-year 2002, includes all residents regardless of legal status or citizenship except refugees not permanently settled in the country of asylum as they are generally considered to be part of their country of origin. World Bank's *2004 World Development Indicators*, p. 38-41.

2 Area is the total surface area in square kilometers, comprising all land area, inland bodies of waters, and some coastal water ways. World Bank's *2004 World Development Indicators*, p. 14-17.

3 Number of years a newborn infant would live if prevailing patterns of mortality at its birth were to stay the same throughout its life. World Bank's *2004 World Development Indicators*, p. 108-111.

4 Infant mortality rate is the number of deaths of infants under one year of age during 2002 per 1,000 live births in the same year. World Bank's *2004 World Development Indicators*, p. 108-111.

5 GNI per Capita in U.S. dollars is converted using the World Bank Atlas method. World Bank's *2004 World Development Indicators*, p. 14-17.

6 An international dollar has the same purchasing power over GNI as a U.S. dollar in the United States. World Bank's *2004 World Development Indicators*, p. 14-17.

7 Ratio of the children of official school age who are enrolled in school to the population of the corresponding official school age. Based on the International Classification of Education 1997. World Bank's *2004 World Development Indicators*, p. 76-79.

8 Primary pupil-teacher ratio is the number of pupils enrolled in primary school divided by the number of primary school teachers (regardless of their assignment). World Bank's *2004 World Development Indicators*, p. 72-75 and *Global Education Digest 2004* by UNESCO Institute for Statistics.

9 Data provided by the NRC of Chinese Taipei.

10 Figures for Belgium (Flemish) are for the whole country of Belgium.

11 Figures for England and Scotland are for the whole region of United Kingdom.

12 Data for Bahrain, Cyprus and Palestinian Nat'l Auth. was obtained from *Global Education Digest 2004* by UNESCO Institute for Statistics and *The World Fact Book 2004*.

A dash (–) indicates data are not available.

Chapter 1

International Student Achievement in Science

Chapter 1 summarizes achievement for eighth- and fourth-grade students on the TIMSS 2003 science assessment for each of the participating countries. It also shows trends in student performance at the eighth grade for those countries that also participated in TIMSS 1995 and 1999. At the fourth grade, trends are presented for those countries that participated in the 1995 assessment (no assessment was conducted at the fourth grade in 1999). Achievement differences by gender at both grades also are provided.

How Do Countries Differ in Science Achievement?

The first page of Exhibit 1.1 presents the distribution of student achievement[1] for the 46 countries and four benchmarking entities that participated at the eighth grade in TIMSS 2003 and the second page presents the distribution of student achievement for the 25 countries and three benchmarking entities that participated at the fourth grade.[2] Countries are shown in decreasing order of average (mean) scale score, together with an indication of whether the country average is

1 TIMSS used item response theory (IRT) methods to summarize the achievement results on a scale with a mean of 500 and a standard deviation of 100. Given the matrix-sampling approach, scaling averages students' responses in a way that accounts for differences in the difficulty of different subsets of items. It allows students' performances to be summarized on a common metric even though individual students responded to different items in the science test. For more detailed information, see the "IRT Scaling and Data Analysis" section of Appendix A.

2 Argentina was unable to complete the necessary steps on schedule for their data to appear in this report. Because the characteristics of their samples are not completely known, achievement results for Syria at the eighth grade and Yemen at the fourth grade are presented in Appendix F.

significantly higher or lower than the international average. The international average of 474 at the eighth grade was obtained by averaging across the mean scores for each of the 46 participating countries. The mean scores for the four benchmarking participants were not included in calculating the average.[3] At the fourth grade, the international average of 489 was obtained by averaging across the mean scores for the 25 participating countries. It should be noted that the results for the eighth and fourth grades are not directly comparable. While the scales for the two grades are expressed in the same numerical units, they are not directly comparable in terms of being able to say how much achievement or learning at one grade equals how much achievement or learning at the other grade. Comparisons only can be made in terms of relative performance.[4]

At the eighth grade, with such a large number of participating countries, it is not surprising that the results reveal substantial differences in science achievement between the highest- and lowest-performing countries, from an average of 578 for Singapore to 244 for South Africa. Twenty-four countries (including England) and the four benchmarking participants had average science achievement that was significantly above the international average and 18 countries had average achievement below the international average. Bulgaria, Jordan, Moldova, and Romania performed about the same as the international average. At the fourth grade, the range in achievement was from 565 in Singapore to 304 in Morocco. Sixteen countries and the three benchmarking participants performed above the international average. Moldova and Slovenia performed at about the international average. Seven countries had achievement below the international average.

For both the eighth and fourth grades, Exhibit 1.1 illustrates the broad range of achievement both within and across the countries assessed. It shows a graphical representation of the distribution of student performance within each country. Achievement for each country is shown for the 25th and 75th percentiles as well as for the 5th and 95th percentiles.[5] Each percentile point indicates the percent-

3 Even though England worked very hard to meet the TIMSS sampling requirements and adjustments were made to make the results representative, it did not meet the school participation rates as specified in the guidelines and consequently its results are shown below a line.

4 Since the TIMSS scales were developed using IRT technology, like all such scales, the eighth- and fourth-grade scales cannot be described in absolute terms.

5 Tables of the percentile values and standard deviations for all countries are presented in Appendix D.

age of students performing below and above that point on the scale. For example, 25 percent of the eighth-grade students in each country performed below the 25th percentile for that country, and 75 percent performed above the 25th percentile. The range between the 25th and 75th percentiles represents performance by the middle half of the students. In most countries, the range of performance for the middle group was between 80 and 120 scale-score points. In contrast, performance at the 5th and 95th percentiles represents the extremes in both lower and higher achievement. The range of performance between these two score points, which includes 90 percent of the population, is more variable and is between 200 and 300 points in most countries. The dark boxes at the midpoints of the distributions show the 95 percent confidence intervals around the average achievement in each country.[6]

As well as showing the wide spread of student achievement within each country, the percentiles also provide a perspective on the size of the differences among countries. Even though average performance generally differed very little between one country and the next higher- or lower-performing country, the range in performance across the participating countries was very large at both grades. For example, Singaporean students had the highest average achievement at both grades, with their average eighth-grade performance exceeding performance at the 95th percentile in the lower-performing countries such as Botswana, Ghana, and South Africa. Similarly at the fourth grade, average performance in Singapore exceeded performance at the 95th percentile in Tunisia and Morocco. This means that only the most proficient students in the lower-performing countries approached the level of achievement of Singaporean students of average proficiency.

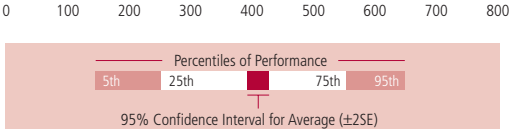
To aid in interpretation, Exhibit 1.1 also includes the years of formal schooling and average age of the students in each country. Equivalence of chronological age does not necessarily mean that students have received the same number of years of formal schooling or studied the same curriculum. For example, as described in the introduction, countries have different policies about the age at which

6 See the "IRT Scaling and Data Analysis" section of Appendix A for more details about calculating standard errors and confidence intervals for the TIMSS statistics.

Exhibit 1.1: Distribution of Science Achievement

SCIENCE Grade 8

Countries	Years of Schooling*	Average Age	Science Achievement Distribution	Average Scale Score	Human Development Index**
Singapore	8	14.3		578 (4.3) ▲	0.884
Chinese Taipei	8	14.2		571 (3.5) ▲	–
◆◆ Korea, Rep. of	8	14.6		558 (1.6) ▲	0.879
† Hong Kong, SAR	8	14.4		556 (3.0) ▲	0.889
Estonia	8	15.2		552 (2.5) ▲	0.833
Japan	8	14.4		552 (1.7) ▲	0.932
Hungary	8	14.5		543 (2.8) ▲	0.837
† Netherlands	8	14.3		536 (3.1) ▲	0.938
‡ United States	8	14.2		527 (3.1) ▲	0.937
Australia	8 or 9	13.9		527 (3.8) ▲	0.939
Sweden	8	14.9		524 (2.7) ▲	0.941
Slovenia	7 or 8	13.8		520 (1.8) ▲	0.881
New Zealand	8.5 - 9.5	14.1		520 (5.0) ▲	0.917
1 Lithuania	8	14.9		519 (2.1) ▲	0.824
Slovak Republic	8	14.3		517 (3.2) ▲	0.836
Belgium (Flemish)	8	14.1		516 (2.5) ▲	0.937
Russian Federation	7 or 8	14.2		514 (3.7) ▲	0.779
Latvia	8	15.0		512 (2.6) ▲	0.811
† Scotland	9	13.7		512 (3.4) ▲	0.930
Malaysia	8	14.3		510 (3.7) ▲	0.790
Norway	7	13.8		494 (2.2) ▲	0.944
Italy	8	13.9		491 (3.1) ▲	0.916
2 Israel	8	14.0		488 (3.1) ▲	0.905
Bulgaria	8	14.9		479 (5.2)	0.795
Jordan	8	13.9		475 (3.8)	0.743
International Avg.	8	14.5		474 (0.6)	–
Moldova, Rep. of	8	14.9		472 (3.4)	0.700
Romania	8	15.0		470 (4.9)	0.773
1 Serbia	8	14.9		468 (2.5) ▼	–
Armenia	8	14.9		461 (3.5) ▼	0.729
Iran, Islamic Rep. of	8	14.4		453 (2.3) ▼	0.719
2 Macedonia, Rep. of	8	14.6		449 (3.6) ▼	0.784
Cyprus	8	13.8		441 (2.0) ▼	0.891
Bahrain	8	14.1		438 (1.8) ▼	0.839
Palestinian Nat'l Auth.	8	14.1		435 (3.2) ▼	0.731
Egypt	8	14.4		421 (3.9) ▼	0.648
1 Indonesia	8	14.5		420 (4.1) ▼	0.682
Chile	8	14.2		413 (2.9) ▼	0.831
Tunisia	8	14.8		404 (2.1) ▼	0.740
Saudi Arabia	8	14.1		398 (4.0) ▼	0.769
1 ‡ Morocco	8	15.2		396 (2.5) ▼	0.606
Lebanon	8	14.6		393 (4.3) ▼	0.752
Philippines	8	14.8		377 (5.8) ▼	0.751
Botswana	8	15.1		365 (2.8) ▼	0.614
Ghana	8	15.5		255 (5.9) ▼	0.567
South Africa	8	15.1		244 (6.7) ▼	0.684
‡ England	9	14.3		544 (4.1) ▲	0.930
Benchmarking Participants					
Basque Country, Spain	8	14.1		489 (2.7) ▲	–
Indiana State, US	8	14.5		531 (4.8) ▲	–
Ontario Province, Can.	8	13.8		533 (2.7) ▲	–
Quebec Province, Can.	8	14.2		531 (3.0) ▲	–



▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

* Represents years of schooling counting from the first year of ISCED Level 1.

** Taken from United Nations Development Programme's *Human Development Report 2003*, p. 237-240.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

2 National Defined Population covers less than 90% of National Desired Population (see Exhibit A.6).

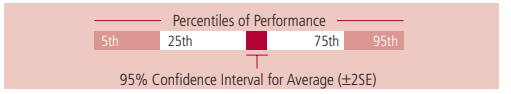
◆◆ Korea tested the same cohort of students as other countries, but later in 2003, at the beginning of the next school year.

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

A dash (–) indicates comparable data are not available.

Exhibit 1.1: Distribution of Science Achievement

Countries	Years of Schooling*	Average Age	Average Scale Score	Human Development Index**
Singapore	4	10.3	565 (5.5) ▲	0.884
Chinese Taipei	4	10.2	551 (1.7) ▲	—
Japan	4	10.4	543 (1.5) ▲	0.932
† Hong Kong, SAR	4	10.2	542 (3.1) ▲	0.889
† England	5	10.3	540 (3.6) ▲	0.930
† United States	4	10.2	536 (2.5) ▲	0.937
Latvia	4	11.1	532 (2.5) ▲	0.811
Hungary	4	10.5	530 (3.0) ▲	0.837
Russian Federation	3 or 4	10.6	526 (5.2) ▲	0.779
† Netherlands	4	10.2	525 (2.0) ▲	0.938
† Australia	4 or 5	9.9	521 (4.2) ▲	0.939
New Zealand	4.5 - 5.5	10.0	520 (2.5) ▲	0.917
Belgium (Flemish)	4	10.0	518 (1.8) ▲	0.937
Italy	4	9.8	516 (3.8) ▲	0.916
1 Lithuania	4	10.9	512 (2.6) ▲	0.824
† Scotland	5	9.7	502 (2.9) ▲	0.930
Moldova, Rep. of	4	11.0	496 (4.6)	0.700
Slovenia	3 or 4	9.8	490 (2.5)	0.881
International Avg.	4	10.3	489 (0.9)	—
Cyprus	4	9.9	480 (2.4) ▼	0.891
ø Norway	4	9.8	466 (2.6) ▼	0.944
Armenia	4	10.9	437 (4.3) ▼	0.729
Iran, Islamic Rep. of	4	10.4	414 (4.1) ▼	0.719
Philippines	4	10.8	332 (9.4) ▼	0.751
Tunisia	4	10.4	314 (5.7) ▼	0.740
Morocco	4	11.0	304 (6.7) ▼	0.606
Benchmarking Participants				
Indiana State, US	4	9.5	553 (3.7) ▲	—
Ontario Province, Can.	4	9.8	540 (3.7) ▲	—
Quebec Province, Can.	4	10.1	500 (2.5) ▲	—



▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

* Represents years of schooling counting from the first year of ISCED Level 1.

** Taken from United Nations Development Programme's *Human Development Report 2003*, p. 237-240.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

ø Norway: 4 years of formal schooling, but First Grade is called "First grade/Preschool."

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

A dash (–) indicates comparable data are not available.

students begin formal schooling and different policies about promotion and retention from grade to grade.

At the eighth grade, the aim was that the students assessed would have had eight years of formal schooling. Most notably, students in Norway, most of Slovenia, and parts of the Russian Federation had fewer years of formal schooling than their counterparts in other countries, while those in England, Scotland, New Zealand, and parts of Australia had more years of schooling. Even though the students assessed at the eighth grade typically averaged between 14 and 15 years old, the variety of countries assessed and their situations also resulted in a considerable range in the average age of the students assessed. To illustrate how education policies can affect the interaction between age and number of years of schooling, it is interesting to note that Scotland, one of the few countries with an additional year of schooling, starts formal schooling at an early age and had the youngest students assessed – 13.7 years old on average. Other countries assessing students younger than 14 years old included Slovenia, Norway, and Cyprus with 13.8 and Australia, Jordan, and Italy with 13.9. Students in the Balkans and some Eastern European countries start school later and tended to be older, particularly in Estonia with an average of 15.2. Students also were older in several African countries including Botswana and South Africa both averaging 15.1, Morocco averaging 15.2, and Ghana averaging 15.5. In these countries, it is not unusual for students to start school at an older age and also, perhaps, to find it necessary to interrupt their schooling.

At the fourth grade, the aim was to assess students having had four years of formal schooling and this was the case for the most part. However, some students in Slovenia and parts of the Russian Federation had only three years of formal schooling, and students in England and Scotland as well as some in Australia and New Zealand had five years. In terms of chronological age, students in most countries averaged between 10 and 11 years old. Consistent with the patterns at the eighth grade, students were somewhat younger in Scotland, averaging

9.7 years old; Italy, Slovenia, and Norway, averaging 9.8; and Australia, and Cyprus, averaging 9.9. The students in the Balkan and Eastern European countries were somewhat older, especially in Latvia with an average age of 11.1.

As a reminder that not all countries are equally well equipped to meet the challenge of educating their young people, Exhibit 1.1 includes the value for each country on the Human Development Index provided by the United Nations Development Programme (UNDP).[7] The index has a minimum value of 0 and a maximum of 1.0. Countries with high values on the index enjoy long life expectancy, high levels of school enrollment and adult literacy, and a good standard of living as measured by per capita GDP. For example, TIMSS countries with index values greater than 0.9 included Australia, Belgium (Flemish), England, Israel, Italy, Japan, New Zealand, Norway, The Netherlands, Scotland, Sweden, and the United States. All have average eighth-grade science achievement above the international average. However, not all countries above the international average had an index value as high as this.

Exhibit 1.2 shows how a country's average achievement in science compares to achievement in the other countries. This figure shows whether or not the differences in average achievement between pairs of countries are statistically significant. Selecting a country of interest and reading across the table, a circle with a triangle pointing up indicates significantly higher performance than the comparison country listed across the top; absence of a symbol indicates no significant difference in performances; and a circle with triangle pointing down indicates significantly lower performance.

The data in Exhibit 1.2 reinforce the point that, when ordered by average achievement, adjacent countries usually did not significantly differ from each other, although the differences in achievement between the high-performing and low-performing countries were very large. Because of this wide range in performance, the pattern for a

7 *Human Development Report 2003*, p. 237-240.

Exhibit 1.2: Multiple Comparisons of Average Science Achievement

SCIENCE Grade 8

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.

Countries	Singapore	Chinese Taipei	Korea, Rep. of	Hong Kong, SAR	Estonia	Japan	England	Hungary	Netherlands	United States	Australia	Sweden	Slovenia	New Zealand	Lithuania	Slovak Republic	Belgium (Flemish)	Russian Federation	Latvia	Scotland	Malaysia	Norway	Italy	Israel	Bulgaria	Jordan	Moldova, Rep. of	Romania	Serbia	Armenia
Singapore			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Korea, Rep. of	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong, SAR	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Estonia	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
England	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hungary	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Netherlands	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
United States	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Australia	▼	▼	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Sweden	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovenia	▼	▼	▼	▼	▼	▼	▼	▼	▼										▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
New Zealand	▼	▼	▼	▼	▼	▼	▼	▼	▼													▲	▲	▲	▲	▲	▲	▲	▲	▲
Lithuania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovak Republic	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼											▲	▲	▲	▲	▲	▲	▲	▲	▲
Belgium (Flemish)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼										▲	▲	▲	▲	▲	▲	▲	▲	▲
Russian Federation	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼										▲	▲	▲	▲	▲	▲	▲	▲	▲
Latvia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼							▲	▲	▲	▲	▲	▲	▲	▲	▲
Scotland	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼							▲	▲	▲	▲	▲	▲	▲	▲	▲
Malaysia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼							▲	▲	▲	▲	▲	▲	▲	▲	▲
Norway	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲
Italy	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲
Israel	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲
Bulgaria	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲
Jordan	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲
Moldova, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲
Romania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					
Serbia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					
Armenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			
Iran, Islamic Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	
Macedonia, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Bahrain	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Palestinian Nat'l Auth.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Egypt	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Indonesia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Chile	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Saudi Arabia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Lebanon	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Botswana	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Ghana	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
South Africa	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Benchmarking Participants																														
Basque Country, Spain	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲
Indiana State, US	▼	▼	▼	▼	▼	▼	▼	▼					▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Ontario Province, Can.	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Quebec Province, Can.	▼	▼	▼	▼	▼	▼	▼	▼					▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲

Note: 5% of these comparisons would be statistically significant by chance alone.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 1.2: Multiple Comparisons of Average Science Achievement

SCIENCE Grade 8

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.

Countries	Iran, Islamic Rep. of	Macedonia, Rep. of	Cyprus	Bahrain	Palestinian Nat'l Auth.	Egypt	Indonesia	Chile	Tunisia	Saudi Arabia	Morocco	Lebanon	Philippines	Botswana	Ghana	South Africa	Basque Country, Spain	Indiana State, US	Ontario Province, Can.	Quebec Province, Can.
Singapore	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Korea, Rep. of	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong, SAR	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Estonia	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
England	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hungary	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Netherlands	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			
United States	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			
Australia	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			
Sweden	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	
Slovenia	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼
New Zealand	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	
Lithuania	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼
Slovak Republic	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼
Belgium (Flemish)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼
Russian Federation	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼
Latvia	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼
Scotland	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼
Malaysia	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼
Norway	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼
Italy	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼
Israel	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼
Bulgaria	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼
Jordan	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Moldova, Rep. of	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Romania	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Serbia	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Armenia		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Iran, Islamic Rep. of			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Macedonia, Rep. of				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Cyprus	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Bahrain	▼	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Palestinian Nat'l Auth.	▼	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Egypt	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Indonesia	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Chile	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Saudi Arabia	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▼	▼	▼	▼
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▼	▼	▼	▼
Lebanon	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▼	▼	▼	▼
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲	▲	▼	▼	▼	▼
Botswana	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲	▼	▼	▼	▼
Ghana	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▼	▼	▼	▼
South Africa	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▼	▼	▼	▼
Benchmarking Participants																				
Basque Country, Spain	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼
Indiana State, US	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			
Ontario Province, Can.	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			
Quebec Province, Can.	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			

▲ Average achievement significantly higher than comparison country

▼ Average achievement significantly lower than comparison country

Note: 5% of these comparisons would be statistically significant by chance alone.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 1.2: 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.

Countries	Singapore	Chinese Taipei	Japan	Hong Kong, SAR	England	United States	Latvia	Hungary	Russian Federation	Netherlands	Australia	New Zealand	Belgium (Flemish)	Italy	Lithuania	Scotland	Moldova, Rep. of	Slovenia	Cyprus	Norway	Armenia	Iran, Islamic Rep. of	Philippines	Tunisia	Morocco	Indiana State, US	Ontario Province, Can.	Quebec Province, Can.
Singapore		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▲
Chinese Taipei	▼		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▲
Japan	▼	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼		▲
Hong Kong, SAR	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼		▲
England	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼		▲
United States	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼		▲
Latvia	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼		▲
Hungary	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
Russian Federation	▼	▼	▼	▼	▼										▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
Netherlands	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
Australia	▼	▼	▼	▼	▼	▼	▼									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
New Zealand	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
Belgium (Flemish)	▼	▼	▼	▼	▼	▼	▼	▼		▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
Italy	▼	▼	▼	▼	▼	▼	▼	▼		▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
Lithuania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼	▼		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
Scotland	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	
Moldova, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▲	▼	▼	
Slovenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▼	▼	▼
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲	▲	▲	▲	▲	▼	▼	▼
Norway	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲	▲	▲	▲	▼	▼	▼
Armenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲	▲	▲	▼	▼	▼
Iran, Islamic Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲	▲	▼	▼	▼
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▼	▼	▼
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▼	▼	▼
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▼	▼	▼
Benchmarking Participants																												
Indiana State, US			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▲
Ontario Province, Can.	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼		▲
Quebec Province, Can.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	

▲ Average achievement significantly higher than comparison country

▼ Average achievement significantly lower than comparison country

Note: 5% of these comparisons would be statistically significant by chance alone.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

number of countries was one of having lower mean achievement than some countries, about the same mean achievement as other countries, and higher mean achievement than a third group of countries.

At the eighth grade, Singapore and Chinese Taipei were the top-performing countries having significantly higher mean achievement than the rest of the participating countries. The Republic of Korea also performed very well, with mean science achievement higher than all of the other participating countries except Singapore, Chinese Taipei, and Hong Kong SAR. Hong Kong SAR, Estonia and Japan had significantly higher achievement than most other participating countries, as did England, Hungary, and the Netherlands. Singapore was the top-performing country at the fourth grade, with higher average science achievement than all other participants. With the exception of Singapore, Chinese Taipei had higher average achievement than the rest of the participating countries. Japan, Hong Kong SAR, and England had significantly higher average achievement than the other participating countries. The United States, Latvia, Hungary, and the Russian Federation also performed better, on average, than most of the other countries.

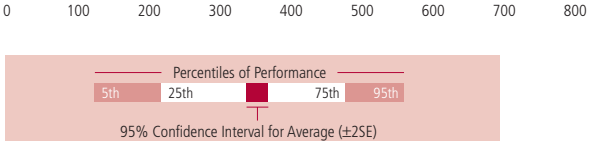
How Has Science Achievement Changed Since 1995 and 1999?

Exhibit 1.3 shows the countries that have comparable data from previous TIMSS assessments at the eighth and fourth grades. At the eighth grade, 35 countries and three of the benchmarking participants have data from one or both of the previous TIMSS assessments conducted in 1995 and 1999. Well over half of the countries and two of the benchmarking entities, the Canadian provinces of Ontario and Quebec, have participated in all three TIMSS assessments. Of these, 18 countries as well as Ontario and Quebec have trends in science achievement for their eighth-grade students across three points in time – 1995, 1999, and 2003. For several three-time participants, not all the results are presented because they were not strictly comparable. For example, changes in policy about age of school entry complicated trend data

Exhibit 1.3: Trends in Science Achievement

SCIENCE Grade 8

Countries	Average Scale Score	1999 to 2003 Difference	1995 to 2003 Difference	Science Achievement Distribution	Average Age
Singapore					
2003	578 (4.3)				14.3
1999	568 (8.0)	10 (9.1)			14.4
1995	580 (5.5)		-3 (7.0)		14.5
Chinese Taipei					
2003	571 (3.5)				14.2
1999	569 (4.4)	2 (5.5)			14.2
Korea, Rep. of					
2003	558 (1.6)				14.6
1999	549 (2.6)	10 (3.1) ▲			14.4
1995	546 (2.0)		13 (2.6) ▲		14.2
Hong Kong, SAR					
2003	556 (3.0)				14.4
1999	530 (3.7)	27 (4.8) ▲			14.2
1995	510 (5.8)		46 (6.6) ▲		14.2
Japan					
2003	552 (1.7)				14.4
1999	550 (2.2)	3 (2.8)			14.4
1995	554 (1.8)		-2 (2.5)		14.4
Hungary					
2003	543 (2.8)				14.5
1999	552 (3.7)	-10 (4.7) ▼			14.4
1995	537 (3.1)		6 (4.2)		14.3
Netherlands					
2003	536 (3.1)				14.3
1999	545 (6.9)	-9 (7.6)			14.2
1995	541 (6.0)		-6 (6.8)		14.4
United States					
2003	527 (3.1)				14.2
1999	515 (4.6)	12 (5.6) ▲			14.2
1995	513 (5.6)		15 (6.4) ▲		14.2
Australia					
2003	527 (3.8)				13.9
1995	514 (3.9)		13 (5.5) ▲		13.9
Sweden					
2003	524 (2.7)				14.9
1995	553 (4.4)		-28 (5.2) ▼		14.9
Slovenia					
2003	520 (1.8)				13.8
1995	514 (2.7)		7 (3.3) ▲		13.8
New Zealand					
2003	520 (5.0)				14.1
1999	510 (4.9)	10 (7.0)			14.0
1995	511 (4.9)		9 (7.0)		14.0
Lithuania					
2003	519 (2.1)				14.9
1999	488 (4.1)	31 (4.6) ▲			15.2
1995	464 (4.0)		56 (4.6) ▲		14.3
Slovak Republic					
2003	517 (3.2)				14.3
1999	535 (3.3)	-18 (4.6) ▼			14.3
1995	532 (3.3)		-15 (4.7) ▼		14.3



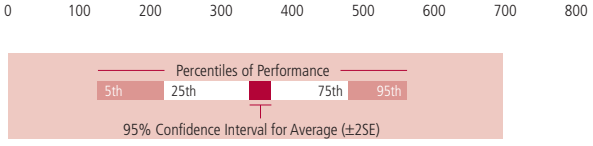
SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Trend notes: Because of differences in population coverage, 1999 data are not shown for Australia and Slovenia, and 1995 data are not shown for Israel, Italy, and South Africa. Korea tested later in 2003 than in 1999 and 1995, at the beginning of the next school year. Similarly, Lithuania tested later in 1999 than in 2003 and 1995. Data for Latvia in this exhibit include Latvian-speaking schools only.

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

Exhibit 1.3: Trends in Science Achievement *(Continued...)*

Countries	Average Scale Score	1999 to 2003 Difference	1995 to 2003 Difference	Science Achievement Distribution	Average Age
Belgium (Flemish)					
2003	516 (2.5)				14.1
1999	535 (3.1)	-19 (3.9) ▼			14.1
1995	533 (6.4)		-17 (6.8) ▼		14.1
Russian Federation					
2003	514 (3.7)				14.2
1999	529 (6.4)	-16 (7.2) ▼			14.1
1995	523 (4.5)		-9 (5.8)		14.0
Latvia (LSS)					
2003	513 (2.9)				15.1
1999	503 (4.8)	11 (5.5)			14.5
1995	476 (3.3)		37 (4.4) ▲		14.3
Scotland					
2003	512 (3.4)				13.7
1995	501 (5.6)		10 (6.6)		13.7
Malaysia					
2003	510 (3.7)				14.3
1999	492 (4.4)	18 (5.8) ▲			14.4
Norway					
2003	494 (2.2)				13.8
1995	514 (2.4)		-21 (3.3) ▼		13.9
Italy					
2003	491 (3.1)				13.9
1999	493 (3.9)	-2 (5.1)			14.0
Israel					
2003	488 (3.1)				14.0
1999	468 (4.9)	20 (5.7) ▲			14.1
Bulgaria					
2003	479 (5.2)				14.9
1999	518 (5.4)	-39 (7.5) ▼			14.8
1995	545 (5.2)		-66 (7.3) ▼		14.0
Jordan					
2003	475 (3.8)				13.9
1999	450 (3.8)	25 (5.5) ▲			14.0
Moldova, Rep. of					
2003	472 (3.4)				14.9
1999	459 (4.0)	13 (5.1) ▲			14.4
Romania					
2003	470 (4.9)				15.0
1999	472 (5.8)	-2 (7.4)			14.8
1995	471 (5.1)		-1 (7.1)		14.6
Iran, Islamic Rep. of					
2003	453 (2.3)				14.4
1999	448 (3.8)	5 (4.4)			14.6
1995	463 (3.6)		-9 (4.2) ▼		14.6
Macedonia, Rep. of					
2003	449 (3.6)				14.6
1999	458 (5.2)	-9 (6.3)			14.6
Cyprus					
2003	441 (2.0)				13.8
1999	460 (2.4)	-19 (3.4) ▼			13.8
1995	452 (2.1)		-11 (3.0) ▼		13.7



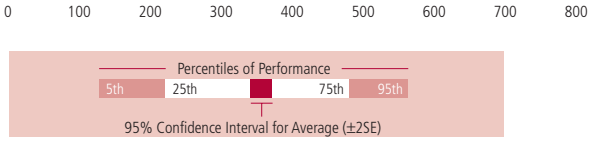
SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Trend notes: Because of differences in population coverage, 1999 data are not shown for Australia and Slovenia, and 1995 data are not shown for Israel, Italy, and South Africa. Korea tested later in 2003 than in 1999 and 1995, at the beginning of the next school year. Similarly, Lithuania tested later in 1999 than in 2003 and 1995. Data for Latvia in this exhibit include Latvian-speaking schools only.

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

Exhibit 1.3: **Trends in Science Achievement** *(...Continued)*

Countries	Average Scale Score	1999 to 2003 Difference	1995 to 2003 Difference	Science Achievement Distribution	Average Age
Indonesia					
2003	420 (4.1)				14.5
1999	435 (4.5)	-15 (6.1) ▼			14.6
Chile					
2003	413 (2.9)				14.2
1999	420 (3.7)	-8 (4.7)			14.4
Tunisia					
2003	404 (2.1)				14.8
1999	430 (3.4)	-26 (3.7) ▼			14.8
Philippines					
2003	377 (5.8)				14.8
1999	345 (7.5)	32 (9.7) ▲			14.1
South Africa					
2003	244 (6.7)				15.1
1999	243 (7.8)	1 (10.2)			15.5
‡ England					
2003	544 (4.1)				14.3
1999	538 (4.8)	5 (6.4)			14.2
1995	533 (3.6)		11 (5.5)		14.0
Benchmarking Participants					
Indiana State, US					
2003	531 (4.8)				14.5
1999	534 (7.0)	-4 (8.5)			14.4
Ontario Province, Can.					
2003	533 (2.7)				13.8
1999	518 (3.1)	15 (4.1) ▲			13.9
1995	496 (3.7)		37 (4.6) ▲		14.0
Quebec Province, Can.					
2003	531 (3.0)				14.2
1999	540 (4.8)	-9 (5.7)			14.3
1995	510 (6.9)		21 (7.5) ▲		14.5



SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

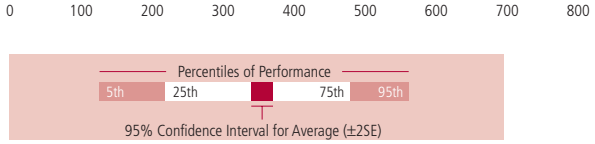
‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

Trend notes: Because of differences in population coverage, 1999 data are not shown for Australia and Slovenia, and 1995 data are not shown for Israel, Italy, and South Africa. Korea tested later in 2003 than in 1999 and 1995, at the beginning of the next school year. Similarly, Lithuania tested later in 1999 than in 2003 and 1995. Data for Latvia in this exhibit include Latvian-speaking schools only.

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

Exhibit 1.3: Trends in Science Achievement

Countries	Average Scale Score	1995 to 2003 Difference	Science Achievement Distribution	Average Age
Singapore				
2003	565 (5.5)			10.3
1995	523 (4.8)	42 (7.3) ▲		10.3
Japan				
2003	543 (1.5)			10.4
1995	553 (1.8)	-10 (2.3) ▼		10.4
Hong Kong, SAR				
2003	542 (3.1)			10.2
1995	508 (3.3)	35 (4.5) ▲		10.1
England				
2003	540 (3.6)			10.3
1995	528 (3.1)	13 (4.8) ▲		10.0
United States				
2003	536 (2.5)			10.2
1995	542 (3.3)	-6 (4.2)		10.2
Hungary				
2003	530 (3.0)			10.5
1995	508 (3.4)	22 (4.4) ▲		10.4
Latvia (LSS)				
2003	530 (2.8)			11.1
1995	486 (4.9)	43 (5.6) ▲		10.5
Netherlands				
2003	525 (2.0)			10.2
1995	530 (3.2)	-5 (3.5)		10.3
New Zealand				
2003	523 (2.3)			10.0
1995	505 (5.3)	18 (5.8) ▲		10.0
Australia				
2003	521 (4.2)			9.9
1995	521 (3.8)	-1 (5.6)		9.9
Scotland				
2003	502 (2.9)			9.7
1995	514 (4.5)	-12 (5.3) ▼		9.7
Slovenia				
2003	490 (2.5)			9.8
1995	464 (3.1)	26 (4.0) ▲		9.9
Cyprus				
2003	480 (2.4)			9.9
1995	450 (3.2)	30 (3.9) ▲		9.8
Norway				
2003	466 (2.6)			9.8
1995	504 (3.7)	-38 (4.6) ▼		9.9
Iran, Islamic Rep. of				
2003	414 (4.1)			10.4
1995	380 (4.6)	34 (6.1) ▲		10.5
Benchmarking Participants				
Ontario Province, Can.				
2003	540 (3.7)			9.8
1995	516 (3.7)	24 (5.3) ▲		9.9
Quebec Province, Can.				
2003	500 (2.5)			10.1
1995	529 (4.8)	-28 (5.4) ▼		10.3



▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

Percentiles of Performance
5th 25th 75th 95th
95% Confidence Interval for Average (±2SE)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Trend notes: Because of differences between 1995 and 2003 in population coverage, 1995 data are not shown for Italy. Data for Latvia in this exhibit include Latvian-speaking schools only. To be comparable with 1995, 2003 data for New Zealand in this exhibit include students in English medium instruction only (98% of the estimated population).

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

collection in Australia and Slovenia so their 1999 data are not shown. Also, the 1995 data are not shown for Israel, Italy, and South Africa since the characteristics of their samples were not completely known in that first assessment. Twelve countries and the U.S. state of Indiana can monitor changes in performance between 1999 and 2003, and five countries including Australia, Sweden, Slovenia, Scotland, and Norway, between 1995 and 2003. At the fourth grade, 15 of the TIMSS 2003 countries as well as Ontario and Quebec also participated in TIMSS 1995. Since TIMSS was not conducted at the fourth grade in 1999, these participants can track changes in student achievement over an eight-year period, between 1995 and 2003.

For the countries participating in assessments prior to TIMSS 2003, Exhibit 1.3 shows the results and the differences in average achievement between the years.[8] Countries are presented in descending order according to their average achievement in TIMSS 2003. At the eighth grade, a number of participants had significantly higher achievement in TIMSS 2003 than in previous assessments. Most notably, Korea, Hong Kong SAR, the United States, Lithuania, and Ontario have shown a pattern of improvement from assessment to assessment with significant change over the eight-year period. Malaysia, Israel, Jordan, Moldova, and the Philippines showed significant improvement from 1999 to 2003. Australia and Slovenia did not participate in 1999, but showed improvement from 1995 to 2003. Latvia (LSS) and Quebec showed improvement from 1995 to 2003 but not from 1999. Countries showing a decrease at the eighth grade in TIMSS 2003, from 1995, 1999, or both, included Hungary, Sweden, the Slovak Republic, Belgium (Flemish), the Russian Federation, Norway, Bulgaria, Iran, Cyprus, Indonesia, and Tunisia.

At the fourth grade, many countries had significant increases in average achievement between 1995 and 2003. Participants showing improved performance included Singapore, Hong Kong SAR, England, Hungary, Latvia (LSS), New Zealand, Slovenia, Cyprus, Iran, and

8 TIMSS used IRT methods to place the TIMSS 2003 results on the same scales that were developed for 1995 and also used for 1999 at the eighth grade. See Appendix A for more detailed information.

Ontario. Several participants showed significant declines, including Japan, Scotland, Norway, and Quebec.

A number of countries showed remarkable changes in science achievement over the eight-year period covered by the TIMSS assessments, some of which may be the result of societal or educational changes during this time. For example, the political changes in Eastern Europe more than a decade ago spawned far-reaching educational reform initiatives that have changed the face of education in many countries in the region. The achievement growth in Latvia and Lithuania as well as the strong performance of Estonia in its first TIMSS appearance may reflect the efforts at improvement in those countries. In contrast, countries in the region where reform efforts seem to have been less successful include Bulgaria, the Russian Federation, the Slovak Republic, each of which show decreases over the period.

What Are the Gender Differences in Science Achievement?

Exhibit 1.4 shows gender differences in eighth- and fourth-grade mathematics achievement in 2003. It presents average achievement separately for girls and boys for each of the TIMSS 2003 countries, as well as the difference between the means. Countries are shown in increasing order of this gender difference. The gender difference for each country is shown by a bar indicating the amount of the difference, whether the direction of the difference favored girls or boys, and whether the difference is statistically significant (indicated by a darkened bar).

On average, across all countries, boys outperformed girls at the eighth grade by six scale-score points (477 vs. 471), although the situation varied considerably from country to country. In eleven countries, including Egypt, Iran, Chinese Taipei, Botswana, South Africa, Lebanon, Singapore, Estonia, Cyprus, the Philippines, and New Zealand, the gender difference was not significant. Countries where the gender difference favored girls included Macedonia, Moldova, Armenia, the Palestinian National Authority, Saudi Arabia, Jordan, and Bahrain.

However, in the majority of participants (33), boys outperformed girls, often by a substantial margin. For example, countries where the gender difference was 20 points or more included Israel, Australia, Belgium (Flemish), Tunisia, Hungary, Chile, and Ghana. At the fourth grade, the average difference internationally was negligible. However, girls had significantly higher average achievement in Armenia, Moldova, the Philippines, and Iran. Boys had higher average achievement in the United States, Chinese Taipei, Cyprus, the Netherlands, and Scotland.

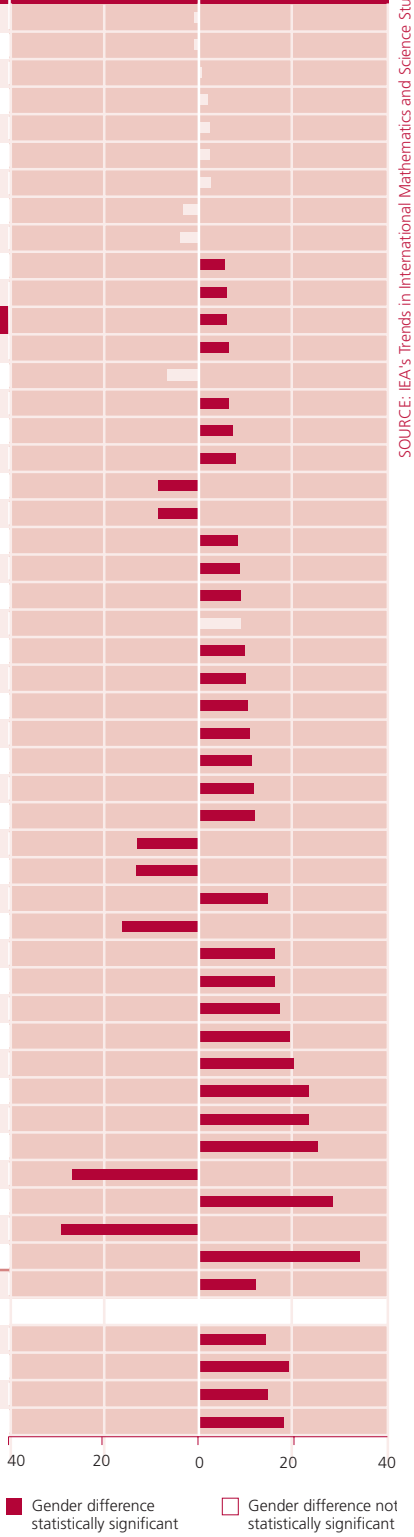
Achievement differences between TIMSS 2003 and 1995 and 1999 are presented separately for girls and for boys in Exhibit 1.5. At the eighth grade, girls showed a seven-point improvement, on average, since 1999, however, boys showed no improvement. Fifteen participants showed significant improvement for girls, and just eight for boys. Both boys and girls had significantly higher achievement in 2003 than in previous assessments in Hong Kong SAR, Israel, Jordan, Latvia (LSS), Lithuania, Malaysia, the Philippines, the United States, and Ontario. Girls but not boys showed improved performance compared to 1999 in Iran, Korea, Moldova, Singapore, and England. Only in Australia and Quebec did boys show improvement and girls not. Both boys and girls had significantly lower average achievement in TIMSS 2003 in Belgium (Flemish), Bulgaria, Cyprus, Norway, the Slovak Republic, Sweden, and Tunisia. In Indonesia, Macedonia, and the Russian Federation, the boys, but not the girls, had a significant decrease.

At the fourth grade, both boys and girls improved performance significantly on average since 1995 (17 points for girls and 9 points for boys). Both genders improved in Cyprus, Hong Kong SAR, Hungary, Iran, Latvia (LSS), New Zealand, Singapore, Slovenia, and Ontario. In England, only girls improved. Both boys and girls showed declines in Japan, Norway, and Quebec. Boys but not girls showed declines in the Netherlands and the United States.

Exhibit 1.4: Average Science Achievement by Gender

SCIENCE Grade 8

Countries	Girls		Boys		Difference (Absolute Value)	Gender Difference	
	Percent of Students	Average Scale Score	Percent of Students	Average Scale Score		Girls Scored Higher	Boys Scored Higher
Egypt	46 (2.7)	422 (4.8)	54 (2.7)	421 (5.5)	1 (6.8)		
Iran, Islamic Rep. of	40 (4.1)	454 (3.9)	60 (4.1)	453 (3.7)	1 (6.1)		
Chinese Taipei	48 (1.0)	571 (3.8)	52 (1.0)	572 (3.8)	1 (3.1)		
Botswana	51 (0.7)	364 (3.2)	49 (0.7)	366 (3.4)	2 (3.3)		
South Africa	51 (0.9)	242 (7.2)	49 (0.9)	244 (7.7)	2 (6.1)		
Lebanon	57 (1.8)	392 (4.8)	43 (1.8)	395 (6.0)	3 (6.4)		
Singapore	49 (0.8)	576 (4.0)	51 (0.8)	579 (5.0)	3 (3.1)		
Estonia	50 (1.0)	554 (2.8)	50 (1.0)	551 (2.9)	3 (2.8)		
Cyprus	49 (0.6)	443 (2.3)	51 (0.6)	440 (2.8)	4 (3.0)		
[1] Lithuania	50 (0.9)	516 (2.7)	50 (0.9)	522 (2.4)	6 (2.5)		
[1] Serbia	49 (0.8)	465 (2.9)	51 (0.8)	471 (2.6)	6 (2.5)		
International Avg.	50 (0.2)	471 (0.7)	50 (0.2)	477 (0.7)	6 (0.6)		
Slovenia	50 (0.9)	517 (2.4)	50 (0.9)	524 (2.3)	7 (3.0)		
Philippines	58 (0.9)	380 (5.9)	42 (0.9)	374 (6.4)	7 (4.1)		
Latvia	49 (0.8)	509 (2.6)	51 (0.8)	516 (3.0)	7 (2.4)		
Sweden	51 (0.9)	521 (3.2)	49 (0.9)	528 (2.7)	8 (2.5)		
Norway	50 (0.8)	490 (2.2)	50 (0.8)	498 (3.0)	8 (2.9)		
[2] Macedonia, Rep. of	49 (0.9)	454 (3.7)	51 (0.9)	445 (4.2)	8 (3.3)		
Moldova, Rep. of	51 (0.8)	477 (3.5)	49 (0.8)	468 (3.7)	8 (2.6)		
Romania	52 (0.9)	465 (5.5)	48 (0.9)	474 (4.9)	9 (3.5)		
† Hong Kong, SAR	50 (2.4)	552 (3.4)	50 (2.4)	561 (3.8)	9 (3.9)		
Japan	49 (1.2)	548 (3.0)	51 (1.2)	557 (2.7)	9 (4.5)		
New Zealand	52 (1.7)	515 (4.8)	48 (1.7)	525 (6.7)	9 (5.7)		
Malaysia	50 (1.8)	505 (4.3)	50 (1.8)	515 (4.0)	10 (4.0)		
Italy	50 (0.9)	486 (2.7)	50 (0.9)	496 (3.8)	10 (2.5)		
Russian Federation	49 (1.2)	508 (3.7)	51 (1.2)	519 (4.2)	11 (3.1)		
[1] ‡ Morocco	50 (1.8)	392 (3.2)	50 (1.8)	403 (3.8)	11 (4.6)		
[1] Indonesia	50 (0.7)	415 (3.9)	50 (0.7)	426 (4.6)	11 (2.7)		
† Scotland	50 (1.3)	506 (4.0)	50 (1.3)	517 (3.5)	12 (3.6)		
◆◆ Korea, Rep. of	48 (2.8)	552 (2.1)	52 (2.8)	564 (1.9)	12 (2.5)		
Armenia	53 (0.7)	468 (4.0)	47 (0.7)	455 (3.4)	13 (2.8)		
Palestinian Nat'l Auth.	55 (2.4)	441 (3.7)	45 (2.4)	428 (5.2)	13 (6.2)		
† Netherlands	49 (1.2)	528 (3.3)	51 (1.2)	543 (3.8)	15 (3.5)		
Saudi Arabia	43 (2.3)	407 (6.2)	57 (2.3)	391 (5.4)	16 (8.2)		
Bulgaria	48 (1.3)	470 (6.3)	52 (1.3)	487 (5.2)	16 (5.2)		
‡ United States	52 (0.7)	519 (3.2)	48 (0.7)	536 (3.4)	16 (2.1)		
Slovak Republic	48 (1.3)	508 (3.8)	52 (1.3)	525 (3.4)	18 (3.1)		
[2] Israel	52 (1.6)	479 (3.2)	48 (1.6)	498 (4.1)	20 (4.2)		
Australia	51 (2.2)	517 (4.6)	49 (2.2)	537 (4.6)	20 (5.6)		
Belgium (Flemish)	54 (2.1)	505 (3.0)	46 (2.1)	528 (3.4)	24 (4.2)		
Tunisia	53 (0.7)	392 (2.3)	47 (0.7)	416 (2.6)	24 (2.6)		
Hungary	50 (1.0)	530 (3.4)	50 (1.0)	556 (3.0)	26 (3.0)		
Jordan	49 (1.7)	489 (4.5)	51 (1.7)	462 (5.6)	27 (6.9)		
Chile	48 (1.6)	398 (3.2)	52 (1.6)	427 (3.6)	29 (4.0)		
Bahrain	50 (0.4)	453 (2.7)	50 (0.4)	423 (2.3)	29 (3.5)		
Ghana	45 (0.9)	236 (6.4)	55 (0.9)	271 (6.5)	35 (4.7)		
‡ England	50 (2.4)	538 (4.7)	50 (2.4)	550 (5.1)	12 (5.3)		
Benchmarking Participants							
Basque Country, Spain	49 (1.7)	481 (3.0)	51 (1.7)	496 (3.3)	15 (3.6)		
Indiana State, US	49 (1.2)	521 (4.7)	51 (1.2)	540 (5.3)	19 (3.1)		
Ontario Province, Can.	51 (0.9)	526 (3.1)	49 (0.9)	540 (2.8)	15 (2.6)		
Quebec Province, Can.	50 (1.6)	522 (3.7)	50 (1.6)	540 (3.2)	18 (3.1)		



SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

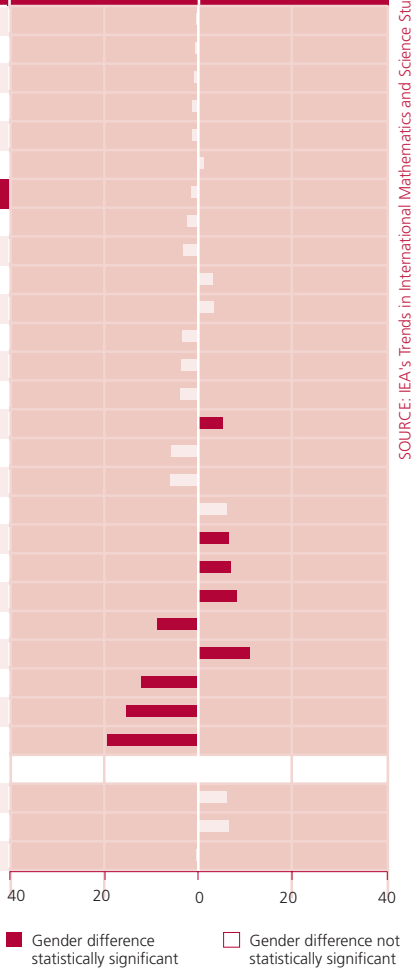
2 National Defined Population covers less than 90% of National Desired Population (see Exhibit A.6).

◆◆ Korea tested the same cohort of students as other countries, but later in 2003, at the beginning of the next school year.

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

Exhibit 1.4: Average Science Achievement by Gender

Countries	Girls		Boys		Difference (Absolute Value)	Gender Difference	
	Percent of Students	Average Scale Score	Percent of Students	Average Scale Score		Girls Scored Higher	Boys Scored Higher
[1] Lithuania	49 (0.9)	513 (3.0)	51 (0.9)	513 (2.9)	0 (2.5)		
Singapore	49 (1.4)	565 (5.4)	51 (1.4)	565 (6.4)	1 (4.2)		
Slovenia	48 (1.1)	491 (3.0)	52 (1.1)	490 (3.2)	1 (3.7)		
Norway	50 (0.8)	467 (3.2)	50 (0.8)	466 (2.9)	1 (3.1)		
Russian Federation	50 (0.7)	527 (5.9)	50 (0.7)	526 (4.9)	1 (3.3)		
Belgium (Flemish)	50 (1.0)	518 (1.9)	50 (1.0)	519 (2.3)	1 (2.3)		
International Avg.	49 (0.2)	489 (1.1)	51 (0.2)	488 (0.9)	1 (0.8)		
Morocco	49 (1.1)	306 (7.9)	51 (1.1)	303 (6.8)	2 (6.0)		
† Hong Kong, SAR	47 (1.1)	544 (3.3)	53 (1.1)	541 (3.2)	3 (2.3)		
Italy	48 (0.8)	514 (4.2)	52 (0.8)	517 (3.8)	3 (2.8)		
Japan	49 (0.6)	542 (1.8)	51 (0.6)	545 (2.0)	3 (2.4)		
† Australia	50 (1.0)	522 (3.8)	50 (1.0)	519 (5.5)	4 (4.3)		
Tunisia	48 (0.9)	316 (6.1)	52 (0.9)	312 (6.0)	4 (4.3)		
† England	50 (0.9)	542 (3.3)	50 (0.9)	538 (4.6)	4 (3.3)		
† United States	50 (0.5)	533 (2.5)	50 (0.5)	538 (2.8)	5 (1.7)		
Latvia	49 (0.9)	534 (2.6)	51 (0.9)	529 (3.2)	6 (3.2)		
New Zealand	50 (1.1)	523 (3.3)	50 (1.1)	517 (2.5)	6 (3.1)		
Hungary	50 (0.9)	527 (3.7)	50 (0.9)	533 (3.2)	6 (3.7)		
Chinese Taipei	48 (0.5)	548 (2.0)	52 (0.5)	555 (2.2)	7 (2.5)		
Cyprus	49 (0.7)	477 (2.5)	51 (0.7)	484 (2.9)	7 (2.6)		
† Netherlands	49 (1.1)	521 (2.2)	51 (1.1)	529 (2.2)	8 (2.1)		
Armenia	49 (0.8)	441 (4.5)	51 (0.8)	432 (4.7)	9 (3.4)		
† Scotland	51 (1.0)	496 (3.1)	49 (1.0)	508 (4.0)	11 (4.2)		
Moldova, Rep. of	50 (0.8)	503 (4.8)	50 (0.8)	490 (4.9)	12 (3.3)		
Philippines	51 (1.0)	339 (10.8)	49 (1.0)	324 (8.8)	15 (6.3)		
Iran, Islamic Rep. of	39 (4.2)	426 (7.0)	61 (4.2)	406 (4.7)	20 (8.4)		
Benchmarking Participants							
Indiana State, US	52 (1.1)	550 (3.9)	48 (1.1)	556 (4.5)	6 (4.0)		
Ontario Province, Can.	48 (1.1)	537 (4.0)	52 (1.1)	543 (4.6)	6 (4.3)		
Quebec Province, Can.	50 (0.9)	501 (2.7)	50 (0.9)	500 (3.1)	1 (2.9)		



SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

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

Exhibit 1.5: Trends in Average Science Achievement by Gender

Countries	Girls			Boys		
	2003 Average Scale Score	1999 to 2003 Difference	1995 to 2003 Difference	2003 Average Scale Score	1999 to 2003 Difference	1995 to 2003 Difference
Australia	517 (4.6)	– –	10 (6.0)	537 (4.6)	– –	18 (7.1) ▲
Belgium (Flemish)	505 (3.0)	-21 (5.4) ▼	-19 (9.2) ▼	528 (3.4)	-16 (7.9) ▼	-14 (9.7)
Bulgaria	470 (6.3)	-41 (8.6) ▼	-78 (8.8) ▼	487 (5.2)	-38 (8.3) ▼	-56 (7.6) ▼
Chile	398 (3.2)	-11 (5.6)	✧ ✧	427 (3.6)	-5 (6.2)	✧ ✧
Chinese Taipei	571 (3.8)	10 (5.5)	✧ ✧	572 (3.8)	-6 (6.6)	✧ ✧
Cyprus	443 (2.3)	-11 (4.2) ▼	-11 (3.6) ▼	440 (2.8)	-26 (4.2) ▼	-11 (3.8) ▼
Hong Kong, SAR	552 (3.4)	29 (5.7) ▲	60 (7.4) ▲	561 (3.8)	24 (6.2) ▲	36 (7.4) ▲
Hungary	530 (3.4)	-10 (5.5)	5 (4.8)	556 (3.0)	-10 (5.4)	7 (4.7)
Indonesia	415 (3.9)	-12 (7.7)	✧ ✧	426 (4.6)	-18 (6.7) ▼	✧ ✧
Iran, Islamic Rep. of	454 (3.9)	24 (6.9) ▲	6 (7.0)	453 (3.7)	-7 (5.7)	-22 (5.8) ▼
Israel	479 (3.2)	18 (6.8) ▲	– –	498 (4.1)	23 (7.0) ▲	– –
Italy	486 (2.7)	1 (4.9)	– –	496 (3.8)	-7 (7.2)	– –
Japan	548 (3.0)	5 (4.0)	3 (3.5)	557 (2.7)	0 (4.1)	-7 (3.6) ▼
Jordan	489 (4.5)	29 (6.8) ▲	✧ ✧	462 (5.6)	20 (8.3) ▲	✧ ✧
Korea, Rep. of	552 (2.1)	14 (4.4) ▲	22 (3.2) ▲	564 (1.9)	5 (4.0)	6 (3.4)
Latvia (LSS)	511 (3.2)	16 (5.9) ▲	48 (5.0) ▲	515 (3.3)	5 (6.0)	25 (5.4) ▲
Lithuania	516 (2.7)	38 (5.2) ▲	64 (5.2) ▲	522 (2.4)	23 (5.6) ▲	45 (5.1) ▲
Macedonia, Rep. of	454 (3.7)	-4 (7.1)	✧ ✧	445 (4.2)	-13 (6.6) ▼	✧ ✧
Malaysia	505 (4.3)	17 (7.1) ▲	✧ ✧	515 (4.0)	18 (7.1) ▲	✧ ✧
Moldova, Rep. of	477 (3.5)	22 (5.7) ▲	✧ ✧	468 (3.7)	3 (6.2)	✧ ✧
Netherlands	528 (3.3)	-8 (8.0)	0 (6.5)	543 (3.8)	-11 (8.2)	-11 (8.3)
New Zealand	515 (4.8)	9 (7.0)	18 (7.5) ▲	525 (6.7)	11 (9.7)	1
Norway	490 (2.2)	✧ ✧	-16 (3.4) ▼	498 (3.0)	✧ ✧	-25 (4.8) ▼
Philippines	380 (5.9)	29 (10.2) ▲	✧ ✧	374 (6.4)	35 (11.3) ▲	✧ ✧
Romania	465 (5.5)	-3 (8.0)	2 (7.7)	474 (4.9)	-1 (8.0)	-4 (7.5)
Russian Federation	508 (3.7)	-11 (8.0)	-7 (5.9)	519 (4.2)	-21 (7.3) ▼	-12 (6.4)
Scotland	506 (4.0)	✧ ✧	19 (6.6) ▲	517 (3.5)	✧ ✧	3 (7.5)
Singapore	576 (4.0)	19 (8.8) ▲	3 (7.8)	579 (5.0)	1 (10.9)	-8 (8.6)
Slovak Republic	508 (3.8)	-17 (5.0) ▼	-12 (5.7) ▼	525 (3.4)	-21 (5.6) ▼	-20 (4.7) ▼
Slovenia	517 (2.4)	– –	13 (3.8) ▲	524 (2.3)	– –	0 (4.0)
South Africa	242 (7.2)	8 (11.6)	– –	244 (7.7)	-9 (10.8)	– –
Sweden	521 (3.2)	✧ ✧	-26 (6.0) ▼	528 (2.7)	✧ ✧	-31 (5.5) ▼
Tunisia	392 (2.3)	-25 (3.9) ▼	✧ ✧	416 (2.6)	-26 (4.5) ▼	✧ ✧
United States	519 (3.2)	14 (5.8) ▲	14 (6.3) ▲	536 (3.4)	11 (6.3)	16 (6.9) ▲
‡ England	538 (4.7)	16 (7.9) ▲	15 (6.3) ▲	550 (5.1)	-4 (7.3)	7 (8.0)
International Avg.	486 (0.7)	7 (1.2) ▲	3 (1.3) ▲	495 (0.8)	0 (1.2)	-5 (1.4) ▼
Benchmarking Participants						
Indiana State, US	521 (4.7)	-3 (8.4)	✧ ✧	540 (5.3)	-5 (9.3)	✧ ✧
Ontario Province, Can.	526 (3.1)	17 (4.7) ▲	38 (4.7) ▲	540 (2.8)	13 (4.3) ▲	35 (5.5) ▲
Quebec Province, Can.	522 (3.7)	-14 (7.7)	16 (8.5)	540 (3.2)	-5 (5.6)	26 (8.1) ▲

▲ 2003 significantly higher

▼ 2003 significantly lower

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

Trend notes: Because of differences in population coverage, 1999 data are not shown for Australia and Slovenia, and1995 data are not shown for Israel, Italy, and South Africa. Korea tested later in 2003 than in 1999 and 1995, at the beginning of the next school year. Similarly, Lithuania tested later in 1999 than in 2003 and 1995. Data for Latvia in this exhibit include Latvian-speaking schools only.

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

A dash (–) indicates comparable data are not available.

A diamond (✧) indicates the country did not participate in the assessment.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 1.5: Trends in Average Science Achievement by Gender

Countries	Girls			Boys		
	2003 Average Scale Score	1995 to 2003 Difference		2003 Average Scale Score	1995 to 2003 Difference	
Australia	522 (3.8)	4 (5.2)		519 (5.5)	-5 (7.2)	
Cyprus	477 (2.5)	32 (3.9)	▲	484 (2.9)	29 (4.9)	▲
England	542 (3.3)	17 (4.8)	▲	538 (4.6)	8 (6.0)	
Hong Kong, SAR	544 (3.3)	43 (4.8)	▲	541 (3.2)	27 (5.1)	▲
Hungary	527 (3.7)	26 (5.2)	▲	533 (3.2)	17 (5.0)	▲
Iran, Islamic Rep. of	426 (7.0)	48 (8.8)	▲	406 (4.7)	23 (8.6)	▲
Japan	542 (1.8)	-5 (2.7)	▼	545 (2.0)	-14 (2.8)	▼
Latvia (LSS)	534 (3.0)	46 (6.4)	▲	526 (3.7)	40 (6.5)	▲
Netherlands	521 (2.2)	3 (3.9)		529 (2.2)	-14 (4.2)	▼
New Zealand	526 (3.2)	15 (5.7)	▲	521 (2.3)	22 (7.4)	▲
Norway	467 (3.2)	-30 (4.9)	▼	466 (2.9)	-43 (5.8)	▼
Scotland	496 (3.1)	-16 (5.6)	▼	508 (4.0)	-9 (6.7)	
Singapore	565 (5.4)	45 (8.0)	▲	565 (6.4)	39 (8.3)	▲
Slovenia	491 (3.0)	33 (4.6)	▲	490 (3.2)	21 (5.3)	▲
United States	533 (2.5)	-3 (4.6)		538 (2.8)	-10 (4.3)	▼
International Avg.	514 (1.1)	17 (1.4)	▲	514 (1.1)	9 (1.6)	▲
Benchmarking Participants						
Ontario Province, Can.	537 (4.0)	24 (5.8)	▲	543 (4.6)	25 (6.2)	▲
Quebec Province, Can.	501 (2.7)	-24 (5.7)	▼	500 (3.1)	-32 (7.1)	▼

▲ 2003 significantly higher than 1995

▼ 2003 significantly lower than 1995

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Trend notes: Because of differences between 1995 and 2003 in population coverage, 1995 data are not shown for Italy. Data for Latvia in this exhibit include Latvian-speaking schools only. To be comparable with 1995, 2003 data for New Zealand in this exhibit include students in English medium instruction only (98% of the estimated population).

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

Chapter 2

Performance at International Benchmarks

How Do Countries Compare with International Benchmarks of Science Achievement?

The TIMSS science achievement scale summarizes student performance on test items designed to measure a wide range of student knowledge and proficiency. In order to provide meaningful descriptions of what performance on the scale could mean in terms of the science that students know and can do, TIMSS identified four points on the scale for use as international benchmarks. Selected to represent the range of performance shown by students internationally, the advanced benchmark is 625, the high benchmark is 550, the intermediate benchmark is 475, and the low benchmark is 400. TIMSS worked with the Science and Mathematics Item Review Committee to conduct an ambitious scale-anchoring exercise to describe performance at these benchmarks.

Exhibit 2.1 summarizes what eighth- and fourth-grade students scoring at these benchmarks typically know and can do. At the eighth grade, performance ranged from demonstrating a grasp of some complex and abstract science concepts at the advanced benchmark to

recognizing some facts from the life and physical sciences at the low benchmark. At the fourth grade, students at the advanced benchmark can apply knowledge and understanding in beginning scientific inquiry whereas those at the low benchmark demonstrated just some elementary knowledge of the earth, life, and physical sciences. More detailed descriptions appear in the remaining sections of the chapter, together with example test items illustrating performance at each benchmark.

Exhibit 2.2 displays the percentage of students in each participating country that reached each international benchmark. Both the eighth- and fourth-grade results are presented in decreasing order by percentage reaching the advanced benchmark. In general, the high-performing countries had greater percentages of students reaching each benchmark, and the low-performing countries had lower percentages. Among the high performers at the eighth grade, for example, Singapore and Chinese Taipei had one-fourth or more of their students reaching the advanced benchmark, about two-thirds reaching the high benchmark, around 85 percent or more reaching the intermediate benchmark, and almost all (95 percent or more) reaching the low benchmark. In contrast, low-performing countries had almost no students reaching the advanced benchmark, no more than 8 percent reaching the high benchmark, about one-third reaching the intermediate benchmark, and about two-thirds reaching the low benchmark. At the fourth grade, 25 percent of the Singaporean students performed at or above the advanced benchmark, followed by about 15 percent of the students from England and Chinese Taipei. In all three of these top-performing countries, nearly all fourth-grade students, from 94 to 98 percent, reached the low benchmark. For the lowest-performing countries, Tunisia and Morocco, very few, if any, fourth-grade students reached the advanced benchmark, 1 or 2 percent reached the high benchmark, 9 to 10 percent the intermediate benchmark, and 24 to 27 percent the low benchmark.

Although Exhibit 2.2 is organized to draw particular attention to the percentage of high-achieving students in each country, it

conveys information about the distribution of middle and low performers also. For example, even though the Netherlands does not have the highest percentages at the advanced benchmark (6 percent at eighth grade and 3 percent at fourth grade), it appears to do an excellent job of educating all of its students, since 98 percent of the eighth-grade students and 99 percent of the fourth-grade students reached the low benchmarks at their respective grades. It should be noted that at the eighth grade, 13 countries as well as three of the benchmarking participants have less than 10 percent of their eighth-grade students reaching the advanced benchmark but have 90 percent or more reaching the low benchmark.

Exhibits 2.3 and 2.4, for the eighth and fourth grades, respectively, provide information on the changes in student performance between the previous assessments and TIMSS 2003. The exhibits show the percentage of students reaching each international benchmark (advanced-625, high-550, intermediate-475, and low-400) in each of the years. In general, the patterns in overall achievement are reflected in the benchmarks. For example, at the eighth grade the decrease in performance in the Slovak Republic, Bulgaria, Belgium (Flemish), and Cyprus is also apparent at all four benchmarks, implying a decrease at most levels of the proficiency distribution. In the Russian Federation, however, the decrease is reflected at the three top benchmarks but not at the low benchmark. Although Hong Kong SAR and Lithuania had an increase in performance over earlier assessments at all four benchmarks, and participants such as Korea, Latvia, Jordan, and Ontario had increases at all but the advanced benchmarks, for many countries increased performance was reflected at the intermediate and low international benchmarks. The United States, Australia, New Zealand, Scotland, Slovenia, Israel, Malaysia, Moldova, England, and Quebec all showed improved performance in the lower half of the proficiency distribution.

At the fourth grade, the general improvements between 1995 and 2003 also are reflected generally at the benchmarks. Singapore,

Hungary, Iran, and Ontario showed improvement at all four international benchmarks, while England, Latvia (LSS), Hong Kong SAR, Slovenia, and Cyprus improved at all but the advanced benchmark. Japan and Norway had a decrease in performance at all four benchmarks, while Quebec showed declines at all but the low international benchmark. The United States, Scotland, and the Netherlands had decreased performance at the advanced and high international benchmarks but not at the two lower ones, and Australia had a decrease at the advanced benchmark only.

To help interpret the achievement results, the remaining sections of the chapter first describe eighth-grade science achievement at each of the international benchmarks together with examples of the types of items typically answered correctly by students performing at the benchmark and then describes fourth-grade achievement at each of the international benchmarks together with examples of the types of items typically answered correctly by students performing at the benchmark.

At both the eighth and fourth grades, the analysis of performance at these benchmarks in science suggests that five primary factors appeared to differentiate performance among the four levels:

- The depth and breadth of content knowledge;
- The context of the problem (progressing from practical to more abstract);
- The level of scientific investigation skills;
- The complexity of diagrams, graphs, and tables;
- The completeness of written responses.

At both grade levels, student performance at the lower benchmarks is characterized by elementary knowledge of basic science facts, whereas at the advanced benchmarks students can, in addition, draw on more abstract conceptual knowledge and engage in scientific inquiry.

How Were the Benchmark Descriptions Developed?

To develop descriptions of achievement at the TIMSS 2003 international benchmarks, the TIMSS International Study Center used the scale anchoring method. Scale anchoring is a way of describing students' performance at different points on the TIMSS 2003 achievement scales at eighth and fourth grades in terms of the types of items students at those grades, respectively, answered correctly. It involves an empirical component in which items that discriminate between successive points on the scale are identified, and a judgmental component in which subject matter experts examine the content of the items and generalize to students' knowledge and understandings.

For the scale anchoring analysis, the results of students from all the TIMSS 2003 countries were pooled, so that the benchmark descriptions refer to all students achieving at that level. (That is, it does not matter which country the students are from, only how they performed on the test.) Criteria were applied to the TIMSS 2003 achievement scale results at the eighth grade to identify the sets of items that eighth-grade students reaching each international benchmark were likely to answer correctly and that those at the next lower benchmark were unlikely to answer correctly.[1] Similarly, criteria were applied to the TIMSS 2003 achievement scale results at the fourth grade to identify the sets of items that fourth-grade students reaching each international benchmark were likely to answer correctly and that those at the next lower benchmark were unlikely to answer correctly.

The sets of items produced by the analysis represented the accomplishments of students reaching each successively higher benchmark, and were used by a panel of subject-matter experts from the TIMSS countries to develop the benchmark descriptions.[2] The work of the panel involved developing a short description for each item of the mathematical understandings demonstrated by students answering it correctly, summarizing students' knowledge and understanding across the set of items for each benchmark to provide more general statements of achievement, and selecting example items illustrating the descriptions.

1 For example, for the advanced benchmark, an item was included if at least 65 percent of students scoring at the scale point corresponding to this benchmark answered the item correctly and less than 50 percent of students scoring at the high benchmark answered it correctly. Similarly, for the high benchmark, an item was included if at least 65 percent of students scoring at that point answered the item correctly and less than 50 percent of students at the intermediate benchmark answered it correctly.

2 The participants in the scale anchoring process are listed in Appendix G.

How Should the Descriptions Be Interpreted?

In general, the parts of the descriptions that relate to the scientific concepts or procedures are relatively straightforward. It needs to be acknowledged, however, that the cognitive behavior necessary to answer some items correctly may vary according to students' experience. An item may require only simple recall for a student familiar with the item's content and context, but necessitate problem-solving strategies from a student unfamiliar with the material. Nevertheless, the descriptions are based on what the panel believed to be the way the great majority of eighth- or fourth-grade students could be expected to perform when responding to the item.

It also needs to be emphasized that the descriptions of achievement characteristic of students at the international benchmarks are based solely on student performance on the TIMSS 2003 items. Since those items were developed in particular to sample the science domains prescribed for this study, neither the set of items nor the descriptions based on them purport to be comprehensive. There are undoubtedly other science curriculum elements on which students at the various benchmarks would have been successful if they had been included in the assessment.

Please note that at both grades students reaching a particular benchmark demonstrated the knowledge and understandings characterizing that benchmark as well as the competencies of students at the lower benchmarks. The description of achievement at each higher benchmark is cumulative, building on the description of achievement demonstrated by students at the next lower benchmark.

Finally, it must be emphasized that the descriptions of the international benchmarks are provided as one possible way of beginning to examine student performance. Some students scoring below a benchmark may indeed know or understand some of the concepts that characterize a higher level. Thus, it is important to consider performance on the individual items and clusters of items in developing a profile of student achievement in each country.

Several example items are included for each benchmark to complement the descriptions by giving a more concrete notion of the abilities students were able to demonstrate. Each example item is accompanied by the percentage of correct responses for each country as well as the international average. In general, at each grade, the five or six countries scoring highest on the overall test also scored highest on each of the items used to illustrate benchmarks. Likewise, the five or six countries with the lowest mean achievement also tended to have consistently low percentages of correct responses on the illustrative items. Not surprisingly, this was true for items assessing a range of cognitive skills – recall of information, using conceptual knowledge, and applying reasoning and analytic skills. The TIMSS 2003 results support the premise that successful problem solving and inquiry is grounded in mastery of more fundamental knowledge and skills.

Item Examples and Student Performance

Beginning with the eighth grade and then for the fourth grade, the remainder of this chapter describes each benchmark and presents two example items illustrating what students know and can do at that level. For each example item, the percent correct for each of the TIMSS 2003 countries is displayed, as well as the international average. The correct answer is circled for multiple-choice items. For open-ended items, the answers shown exemplify the types of student responses that were given full credit. The example items are ones that students reaching each benchmark were likely to answer correctly, and they represent the types of items used to develop the description of achievement at that benchmark.[3]

3 Some of the items used to develop the benchmark descriptions are being kept secure to measure achievement trends in future TIMSS assessments and are not available for publication.

Exhibit 2.1: **TIMSS 2003 International Benchmarks of Science Achievement**

SCIENCE Grade 8

Advanced International Benchmark – 625

Students demonstrate a grasp of some complex and abstract science concepts. They can apply knowledge of the solar system and of Earth features, processes, and conditions, and apply understanding of the complexity of living organisms and how they relate to their environment. They show understanding of electricity, thermal expansion, and sound, as well as the structure of matter and physical and chemical properties and changes. They show understanding of environmental and resource issues. Students understand some fundamentals of scientific investigation and can apply basic physical principles to solve some quantitative problems. They can provide written explanations to communicate scientific knowledge.

High International Benchmark – 550

Students demonstrate conceptual understanding of some science cycles, systems, and principles. They have some understanding of Earth's processes and the solar system, biological systems, populations, reproduction and heredity, and structure and function of organisms.They show some understanding of physical and chemical changes, and the structure of matter. They solve some basic physics problems related to light, heat, electricity, and magnetism, and they demonstrate basic knowledge of major environmental issues. They demonstrate some scientific inquiry skills. They can combine information to draw conclusions; interpret information in diagrams, graphs and tables to solve problems; and provide short explanations conveying scientific knowledge and cause/effect relationships.

Intermediate International Benchmark – 475

Students can recognize and communicate basic scientific knowledge across a range of topics. They recognize some characteristics of the solar system, water cycle, animals, and human health. They are acquainted with some aspects of energy, force and motion, light reflection, and sound. Students demonstrate elementary knowledge of human impact on and changes in the environment. They can apply and briefly communicate knowledge, extract tabular information, extrapolate from data presented in a simple linear graph, and interpret pictorial diagrams.

Low International Benchmark – 400

Students recognize some basic facts from the life and physical sciences. They have some knowledge of the human body and heredity, and demonstrate familiarity with some everyday physical phenomena. Students can interpret some pictorial diagrams and apply knowledge of simple physical concepts to practical situations.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 2.1: **TIMSS 2003 International Benchmarks of Science Achievement**

Advanced International Benchmark – 625

Students can apply knowledge and understanding in beginning scientific inquiry. Students demonstrate some understanding of Earth's features and processes and the solar system. They can communicate their understanding of structure, function, and life processes in organisms and classify organisms according to major physical and behavioral features. They demonstrate some understanding of physical phenomena and properties of common materials. Students demonstrate beginning scientific inquiry knowledge and skills.

High International Benchmark – 550

Students can apply knowledge and understanding to explain everyday phenomena. Students demonstrate some knowledge of Earth structure and processes and the solar system and some understanding of plant structure, life processes, and human biology. They demonstrate some knowledge of physical states, common physical phenomena, and chemical changes. They provide brief descriptions and explanations of some everyday phenomena and compare, contrast, and draw conclusions.

Intermediate International Benchmark – 475

Students can apply basic knowledge and understanding to practical situations in the sciences. Students demonstrate knowledge of some basic facts about Earth's features and processes and the solar system. They recognize some basic information about human biology and health and show some understanding of development and life cycles of organisms. They know some basic facts about familiar physical phenomena, states, and changes. They apply factual knowledge to practical situations, interpret pictorial diagrams, and combine information to draw conclusions.

Low International Benchmark – 400

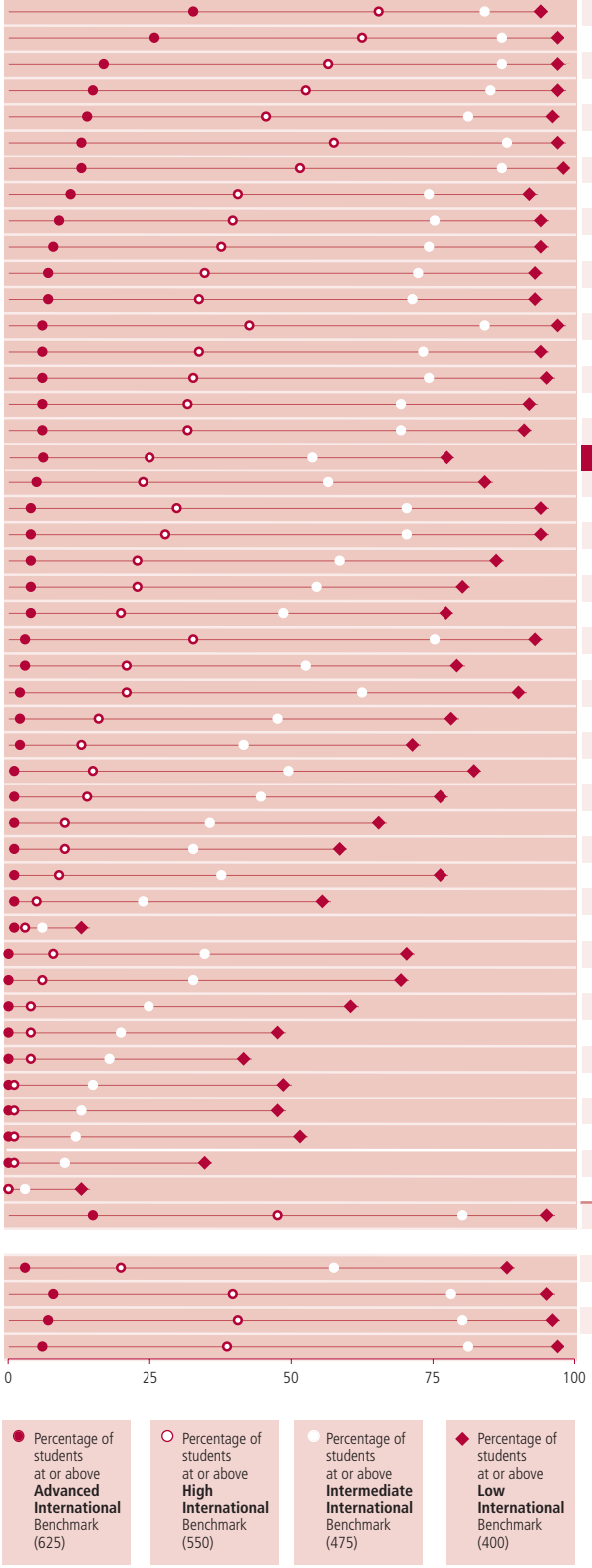
Students have some elementary knowledge of the earth, life, and physical sciences. Students recognize simple facts presented in everyday language and context about Earth's physical features, the seasons, the solar system, human biology, and the development and characteristics of animals and plants. They recognize facts about a range of familiar physical phenomena — rainbows, magnets, electricity, boiling, floating, and dissolving. They interpret labeled pictures and simple pictorial diagrams and provide short written responses to questions requiring factual information.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 2.2: Percentages of Students Reaching TIMSS 2003 International Benchmarks of Science Achievement

SCIENCE Grade 8

Countries	Percentages of Students Reaching International Benchmarks	Advanced International Benchmark (625)	High International Benchmark (550)	Intermediate International Benchmark (475)	Low International Benchmark (400)
Singapore		33 (1.6)	66 (2.3)	85 (1.7)	95 (0.8)
Chinese Taipei		26 (1.5)	63 (1.9)	88 (1.1)	98 (0.4)
◆◆ Korea, Rep. of		17 (0.9)	57 (1.1)	88 (0.7)	98 (0.4)
Japan		15 (0.7)	53 (1.1)	86 (0.8)	98 (0.3)
Hungary		14 (1.1)	46 (1.7)	82 (1.1)	97 (0.6)
† Hong Kong, SAR		13 (1.2)	58 (1.9)	89 (1.4)	98 (0.7)
Estonia		13 (1.0)	52 (1.6)	88 (1.2)	99 (0.3)
‡ United States		11 (0.8)	41 (1.7)	75 (1.4)	93 (0.8)
Australia		9 (1.1)	40 (2.0)	76 (1.9)	95 (0.8)
Sweden		8 (0.8)	38 (1.6)	75 (1.4)	95 (0.7)
New Zealand		7 (1.5)	35 (3.0)	73 (2.2)	94 (1.3)
Slovak Republic		7 (0.8)	34 (1.8)	72 (1.5)	94 (0.7)
† Netherlands		6 (0.8)	43 (2.4)	85 (1.7)	98 (0.7)
1 Lithuania		6 (0.6)	34 (1.2)	74 (1.3)	95 (0.6)
Slovenia		6 (0.5)	33 (1.3)	75 (1.3)	96 (0.6)
Russian Federation		6 (0.8)	32 (1.8)	70 (1.8)	93 (0.9)
† Scotland		6 (0.7)	32 (1.9)	70 (1.7)	92 (0.9)
International Avg.		6 (0.1)	25 (0.2)	54 (0.2)	78 (0.2)
2 Israel		5 (0.5)	24 (1.3)	57 (1.6)	85 (1.1)
Latvia		4 (0.4)	30 (1.5)	71 (1.6)	95 (0.6)
Malaysia		4 (0.8)	28 (2.2)	71 (2.0)	95 (0.7)
Italy		4 (0.6)	23 (1.5)	59 (1.5)	87 (1.1)
Bulgaria		4 (0.7)	23 (1.7)	55 (2.1)	81 (2.0)
Romania		4 (0.8)	20 (1.8)	49 (2.2)	78 (1.9)
Belgium (Flemish)		3 (0.3)	33 (1.6)	76 (1.4)	94 (0.9)
Jordan		3 (0.5)	21 (1.4)	53 (1.8)	80 (1.3)
Norway		2 (0.3)	21 (1.1)	63 (1.3)	91 (0.8)
1 Serbia		2 (0.3)	16 (1.0)	48 (1.3)	79 (1.0)
2 Macedonia, Rep. of		2 (0.3)	13 (1.2)	42 (1.8)	72 (1.5)
Moldova, Rep. of		1 (0.3)	15 (1.2)	50 (1.9)	83 (1.5)
Armenia		1 (0.3)	14 (1.3)	45 (1.9)	77 (1.4)
Palestinian Nat'l Auth.		1 (0.2)	10 (0.8)	36 (1.4)	66 (1.5)
Egypt		1 (0.2)	10 (0.7)	33 (1.4)	59 (1.6)
Iran, Islamic Rep. of		1 (0.2)	9 (0.6)	38 (1.3)	77 (1.3)
Chile		1 (0.1)	5 (0.6)	24 (1.3)	56 (1.5)
South Africa		1 (0.2)	3 (0.7)	6 (1.4)	13 (1.9)
Cyprus		0 (0.2)	8 (0.6)	35 (1.0)	71 (1.2)
Bahrain		0 (0.1)	6 (0.6)	33 (1.1)	70 (1.2)
1 Indonesia		0 (0.1)	4 (0.5)	25 (1.8)	61 (2.1)
Lebanon		0 (0.1)	4 (0.7)	20 (1.5)	48 (2.0)
Philippines		0 (0.1)	4 (0.6)	18 (1.7)	42 (2.5)
Saudi Arabia		0 (0.0)	1 (0.4)	15 (1.5)	49 (2.3)
1 ‡ Morocco		0 (0.0)	1 (0.3)	13 (1.1)	48 (1.9)
Tunisia		0 (0.0)	1 (0.2)	12 (1.0)	52 (1.5)
Botswana		0 (0.1)	1 (0.5)	10 (0.9)	35 (1.3)
Ghana		0 (0.0)	0 (0.1)	3 (0.4)	13 (1.3)
‡ England		15 (1.7)	48 (2.7)	81 (1.8)	96 (0.6)
Benchmarking Participants					
Basque Country, Spain		3 (0.6)	20 (1.5)	58 (1.9)	89 (0.9)
Indiana State, US		8 (1.5)	40 (2.8)	79 (2.1)	96 (0.8)
Ontario Province, Can.		7 (0.7)	41 (1.8)	81 (1.2)	97 (0.5)
Quebec Province, Can.		6 (1.0)	39 (2.0)	82 (1.5)	98 (0.4)



† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

2 National Defined Population covers less than 90% of National Desired Population (see Exhibit A.6).

◆◆ Korea tested the same cohort of students as other countries, but later in 2003, at the beginning of the next school year.

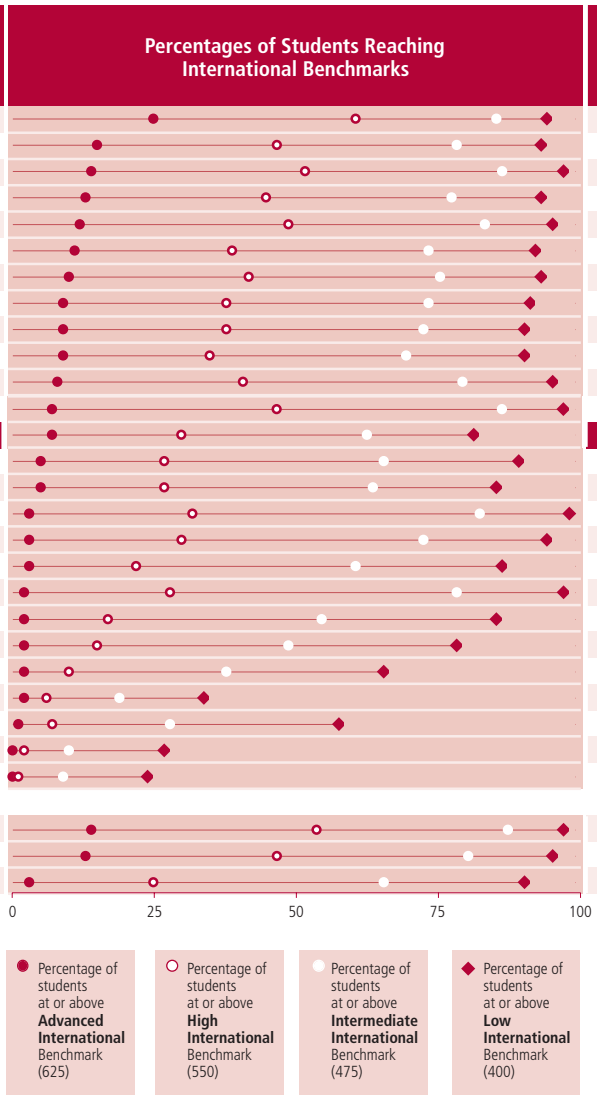
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 2.2: Percentages of Students Reaching TIMSS 2003 International Benchmarks of Science Achievement

SCIENCE Grade 4

Countries	Advanced International Benchmark (625)	High International Benchmark (550)	Intermediate International Benchmark (475)	Low International Benchmark (400)
Singapore	25 (2.4)	61 (2.6)	86 (1.6)	95 (0.9)
† England	15 (1.4)	47 (1.8)	79 (1.3)	94 (0.7)
Chinese Taipei	14 (1.0)	52 (1.1)	87 (0.7)	98 (0.3)
† United States	13 (0.8)	45 (1.4)	78 (1.0)	94 (0.5)
Japan	12 (0.6)	49 (1.1)	84 (0.7)	96 (0.4)
Russian Federation	11 (1.4)	39 (2.7)	74 (2.4)	93 (1.1)
Hungary	10 (0.9)	42 (1.6)	76 (1.4)	94 (0.7)
† Australia	9 (1.0)	38 (1.7)	74 (2.0)	92 (1.1)
New Zealand	9 (0.7)	38 (1.3)	73 (1.2)	91 (0.8)
Italy	9 (1.1)	35 (1.9)	70 (1.6)	91 (0.9)
Latvia	8 (0.6)	41 (1.6)	80 (1.3)	96 (0.6)
† Hong Kong, SAR	7 (0.8)	47 (2.2)	87 (1.2)	98 (0.3)
International Avg.	7 (0.2)	30 (0.3)	63 (0.3)	82 (0.2)
† Scotland	5 (0.5)	27 (1.5)	66 (1.5)	90 (0.9)
Moldova, Rep. of	5 (0.9)	27 (1.9)	64 (2.1)	86 (1.3)
† Netherlands	3 (0.5)	32 (1.5)	83 (1.2)	99 (0.4)
1 Lithuania	3 (0.5)	30 (1.3)	73 (1.6)	95 (0.7)
Slovenia	3 (0.4)	22 (1.3)	61 (1.4)	87 (0.9)
Belgium (Flemish)	2 (0.3)	28 (1.1)	79 (1.3)	98 (0.4)
Cyprus	2 (0.3)	17 (1.0)	55 (1.4)	86 (0.8)
Norway	2 (0.3)	15 (0.9)	49 (1.4)	79 (1.5)
Armenia	2 (0.4)	10 (1.0)	38 (1.7)	66 (1.8)
Philippines	2 (1.0)	6 (1.9)	19 (2.5)	34 (2.5)
Iran, Islamic Rep. of	1 (0.2)	7 (0.7)	28 (1.5)	58 (1.7)
Tunisia	0 (0.1)	2 (0.3)	10 (1.0)	27 (1.7)
Morocco	0 (0.0)	1 (0.3)	9 (0.8)	24 (1.6)
Benchmarking Participants				
Indiana State, US	14 (2.2)	54 (2.2)	88 (1.5)	98 (0.4)
Ontario Province, Can.	13 (1.6)	47 (1.9)	81 (1.4)	96 (0.6)
Quebec Province, Can.	3 (0.4)	25 (1.3)	66 (1.4)	91 (0.8)



SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

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

Exhibit 2.3: Trends in Percentages of Students Reaching TIMSS 2003 International Benchmarks of Science Achievement in 1995, 1999, and 2003

SCIENCE Grade 8

Countries	Advanced International Benchmark (625)			High International Benchmark (550)		
	2003 (Percent of Students)	1999 (Percent of Students)	1995 (Percent of Students)	2003 (Percent of Students)	1999 (Percent of Students)	1995 (Percent of Students)
Singapore	33 (1.6)	29 (3.2)	29 (3.2)	66 (2.3)	60 (3.5)	64 (2.8)
Chinese Taipei	26 (1.5)	27 (1.8)	✧ ✧	63 (1.9)	61 (2.1)	✧ ✧
Korea, Rep. of	17 (0.9)	19 (1.1)	17 (1.0)	57 (1.1)	50 (1.2) ▲	50 (1.2) ▲
Japan	15 (0.7)	16 (1.0)	18 (0.9) ▼	53 (1.1)	52 (1.3)	54 (1.1)
Hungary	14 (1.1)	19 (1.3) ▼	12 (1.1)	46 (1.7)	53 (1.8) ▼	44 (1.7)
Hong Kong, SAR	13 (1.2)	7 (0.9) ▲	7 (1.0) ▲	58 (1.9)	40 (2.1) ▲	33 (2.7) ▲
United States	11 (0.8)	12 (1.0)	11 (1.1)	41 (1.7)	37 (1.9)	38 (2.0)
Australia	9 (1.1)	– –	10 (1.1)	40 (2.0)	– –	36 (1.7)
Sweden	8 (0.8)	✧ ✧	19 (1.6) ▼	38 (1.6)	✧ ✧	52 (2.4) ▼
Slovak Republic	7 (0.8)	12 (1.1) ▼	12 (1.3) ▼	34 (1.8)	43 (1.7) ▼	42 (1.7) ▼
New Zealand	7 (1.5)	10 (1.3)	9 (1.2)	35 (3.0)	35 (2.2)	34 (2.1)
Netherlands	6 (0.8)	14 (2.1) ▼	12 (1.8) ▼	43 (2.4)	50 (3.6)	48 (2.8)
Russian Federation	6 (0.8)	15 (2.3) ▼	11 (1.1) ▼	32 (1.8)	41 (2.8) ▼	38 (2.3) ▼
Lithuania	6 (0.6)	5 (0.9)	2 (0.5) ▲	34 (1.2)	22 (1.8) ▲	14 (1.5) ▲
Scotland	6 (0.7)	✧ ✧	9 (1.4)	32 (1.9)	✧ ✧	30 (2.5)
Slovenia	6 (0.5)	– –	8 (0.8) ▼	33 (1.3)	– –	32 (1.5)
Israel	5 (0.5)	5 (0.5)	– –	24 (1.3)	23 (1.4)	– –
Latvia (LSS)	4 (0.6)	5 (1.1)	3 (0.6)	30 (1.8)	27 (2.5)	18 (1.1) ▲
Bulgaria	4 (0.7)	12 (2.0) ▼	22 (1.7) ▼	23 (1.7)	38 (2.6) ▼	46 (2.3) ▼
Italy	4 (0.6)	6 (0.9) ▼	– –	23 (1.5)	26 (1.8)	– –
Romania	4 (0.8)	5 (0.8)	5 (0.8)	20 (1.8)	21 (2.1)	22 (1.8)
Malaysia	4 (0.8)	5 (0.8)	✧ ✧	28 (2.2)	24 (2.0)	✧ ✧
Jordan	3 (0.5)	4 (0.5)	✧ ✧	21 (1.4)	17 (1.0) ▲	✧ ✧
Belgium (Flemish)	3 (0.3)	9 (1.3) ▼	9 (1.0) ▼	33 (1.6)	44 (1.5) ▼	45 (2.5) ▼
Norway	2 (0.3)	✧ ✧	6 (0.6) ▼	21 (1.1)	✧ ✧	32 (1.5) ▼
Macedonia, Rep. of	2 (0.3)	3 (0.4) ▼	✧ ✧	13 (1.2)	17 (1.9) ▼	✧ ✧
Moldova, Rep. of	1 (0.3)	4 (0.4) ▼	✧ ✧	15 (1.2)	17 (1.3)	✧ ✧
Iran, Islamic Rep. of	1 (0.2)	1 (0.3)	1 (0.4)	9 (0.6)	11 (1.3)	11 (1.3)
South Africa	1 (0.2)	0 (0.2)	– –	3 (0.7)	2 (0.7)	– –
Chile	1 (0.1)	1 (0.3)	✧ ✧	5 (0.6)	7 (1.1)	✧ ✧
Cyprus	0 (0.2)	2 (0.4) ▼	2 (0.4) ▼	8 (0.6)	14 (0.8) ▼	15 (1.0) ▼
Philippines	0 (0.1)	1 (0.2)	✧ ✧	4 (0.6)	4 (0.7)	✧ ✧
Indonesia	0 (0.1)	1 (0.3) ▼	✧ ✧	4 (0.5)	8 (1.0) ▼	✧ ✧
Tunisia	0 (0.0)	0 (0.1)	✧ ✧	1 (0.2)	3 (0.5) ▼	✧ ✧
‡ England	15 (1.7)	17 (1.7)	15 (1.7)	48 (2.7)	45 (2.4)	43 (1.8)
International Avg.	7 (0.2)	9 (0.2) ▼	11 (0.3) ▼	30 (0.3)	30 (0.3)	37 (0.4) ▼
Benchmarking Participants						
Indiana State, US	8 (1.5)	14 (2.1) ▼	✧ ✧	40 (2.8)	44 (3.5)	✧ ✧
Ontario Province, Can.	7 (0.7)	7 (0.9)	5 (0.6)	41 (1.8)	34 (1.6) ▲	26 (1.6) ▲
Quebec Province, Can.	6 (1.0)	10 (2.2)	7 (1.5)	39 (2.0)	43 (3.7)	30 (2.8) ▲

▲ 2003 significantly higher

▼ 2003 significantly lower

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

Trend notes: Because of differences in population coverage, 1999 data are not shown for Australia and Slovenia, and 1995 data are not shown for Israel, Italy, and South Africa. Korea tested later in 2003 than in 1999 and 1995, at the beginning of the next school year. Similarly, Lithuania tested later in 1999 than in 2003 and 1995. Data for Latvia in this exhibit include Latvian-speaking schools only.

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

A dash (–) indicates comparable data are not available.

A diamond (✧) indicates the country did not participate in the assessment.

Exhibit 2.3: Trends in Percentages of Students Reaching TIMSS 2003 International Benchmarks of Science Achievement in 1995, 1999, and 2003

SCIENCE Grade 8

Countries	Intermediate International Benchmark (475)			Low International Benchmark (400)		
	2003 (Percent of Students)	1999 (Percent of Students)	1995 (Percent of Students)	2003 (Percent of Students)	1999 (Percent of Students)	1995 (Percent of Students)
Singapore	85 (1.7)	84 (2.4)	91 (1.3) ▼	95 (0.8)	95 (1.2)	99 (0.2) ▼
Chinese Taipei	88 (1.1)	86 (1.3)	✧ ✧	98 (0.4)	96 (0.6) ▲	✧ ✧
Korea, Rep. of	88 (0.7)	81 (1.0) ▲	81 (0.9) ▲	98 (0.4)	96 (0.4) ▲	95 (0.5) ▲
Japan	86 (0.8)	84 (0.9)	85 (0.7)	98 (0.3)	97 (0.4)	97 (0.3)
Hungary	82 (1.1)	83 (1.3)	80 (1.5)	97 (0.6)	96 (0.8)	95 (0.7)
Hong Kong, SAR	89 (1.4)	80 (1.9) ▲	70 (2.7) ▲	98 (0.7)	96 (0.9)	90 (1.7) ▲
United States	75 (1.4)	67 (1.9) ▲	68 (2.2) ▲	93 (0.8)	87 (1.3) ▲	87 (1.6) ▲
Australia	76 (1.9)	– –	69 (1.6) ▲	95 (0.8)	– –	89 (1.0) ▲
Sweden	75 (1.4)	✧ ✧	83 (1.7) ▼	95 (0.7)	✧ ✧	97 (0.7) ▼
Slovak Republic	72 (1.5)	79 (1.4) ▼	77 (1.5) ▼	94 (0.7)	96 (0.6) ▼	95 (0.6)
New Zealand	73 (2.2)	66 (2.0) ▲	67 (2.2) ▲	94 (1.3)	88 (1.4) ▲	89 (1.2) ▲
Netherlands	85 (1.7)	83 (3.3)	82 (2.7)	98 (0.7)	96 (1.2)	96 (2.0)
Russian Federation	70 (1.8)	73 (2.3)	71 (2.2)	93 (0.9)	92 (1.0)	92 (1.1)
Lithuania	74 (1.3)	57 (2.0) ▲	45 (2.2) ▲	95 (0.6)	86 (1.7) ▲	79 (1.6) ▲
Scotland	70 (1.7)	✧ ✧	61 (2.2) ▲	92 (0.9)	✧ ✧	86 (1.4) ▲
Slovenia	75 (1.3)	– –	69 (1.6) ▲	96 (0.6)	– –	93 (0.7) ▲
Israel	57 (1.6)	50 (2.1) ▲	– –	85 (1.1)	75 (2.0) ▲	– –
Latvia (LSS)	72 (1.8)	65 (1.9) ▲	51 (1.8) ▲	95 (0.9)	91 (1.2) ▲	83 (1.4) ▲
Bulgaria	55 (2.1)	70 (2.0) ▼	75 (1.9) ▼	81 (2.0)	89 (1.4) ▼	93 (1.1) ▼
Italy	59 (1.5)	59 (2.0)	– –	87 (1.1)	86 (1.2)	– –
Romania	49 (2.2)	50 (2.6)	51 (2.2)	78 (1.9)	78 (2.0)	77 (1.7)
Malaysia	71 (2.0)	59 (2.2) ▲	✧ ✧	95 (0.7)	87 (1.4) ▲	✧ ✧
Jordan	53 (1.8)	42 (1.4) ▲	✧ ✧	80 (1.3)	69 (1.6) ▲	✧ ✧
Belgium (Flemish)	76 (1.4)	81 (1.5) ▼	80 (3.0)	94 (0.9)	97 (1.0) ▼	94 (2.0)
Norway	63 (1.3)	✧ ✧	72 (1.3) ▼	91 (0.8)	✧ ✧	94 (0.9) ▼
Macedonia, Rep. of	42 (1.8)	46 (2.0)	✧ ✧	72 (1.5)	73 (2.2)	✧ ✧
Moldova, Rep. of	50 (1.9)	44 (1.8) ▲	✧ ✧	83 (1.5)	74 (1.6) ▲	✧ ✧
Iran, Islamic Rep. of	38 (1.3)	38 (1.8)	43 (2.2) ▼	77 (1.3)	72 (1.8) ▲	81 (1.8) ▼
South Africa	6 (1.4)	7 (1.5)	– –	13 (1.9)	14 (2.1)	– –
Chile	24 (1.3)	27 (1.7)	✧ ✧	56 (1.5)	60 (1.5) ▼	✧ ✧
Cyprus	35 (1.0)	45 (1.5) ▼	43 (1.3) ▼	71 (1.2)	77 (1.1) ▼	72 (1.1)
Philippines	18 (1.7)	15 (1.9)	✧ ✧	42 (2.5)	34 (2.7) ▲	✧ ✧
Indonesia	25 (1.8)	33 (1.7) ▼	✧ ✧	61 (2.1)	68 (2.5) ▼	✧ ✧
Tunisia	12 (1.0)	25 (1.6) ▼	✧ ✧	52 (1.5)	68 (2.1) ▼	✧ ✧
‡ England	81 (1.8)	76 (1.9)	75 (1.4) ▲	96 (0.6)	94 (0.7) ▲	93 (0.7) ▲
International Avg.	61 (0.3)	58 (0.3) ▲	69 (0.4) ▼	84 (0.3)	81 (0.3) ▲	90 (0.2) ▼
Benchmarking Participants						
Indiana State, US	79 (2.1)	76 (2.6)	✧ ✧	96 (0.8)	93 (1.3) ▲	✧ ✧
Ontario Province, Can.	81 (1.2)	72 (1.6) ▲	61 (1.9) ▲	97 (0.5)	95 (0.5) ▲	88 (1.1) ▲
Quebec Province, Can.	82 (1.5)	83 (2.4)	69 (3.5) ▲	98 (0.4)	98 (0.5)	92 (2.6) ▲

▲ 2003 significantly higher

▼ 2003 significantly lower

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

Trend notes: Because of differences in population coverage, 1999 data are not shown for Australia and Slovenia, and 1995 data are not shown for Israel, Italy, and South Africa. Korea tested later in 2003 than in 1999 and 1995, at the beginning of the next school year. Similarly, Lithuania tested later in 1999 than in 2003 and 1995. Data for Latvia in this exhibit include Latvian-speaking schools only.

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

A dash (–) indicates comparable data are not available.

A diamond (✧) indicates the country did not participate in the assessment.

Exhibit 2.4: Trends in Percentages of Students Reaching TIMSS 2003 International Benchmarks of Science Achievement in 1995 and 2003

SCIENCE Grade 4

Countries	Advanced International Benchmark (625)		High International Benchmark (550)		Intermediate International Benchmark (475)		Low International Benchmark (400)	
	2003 (Percent of Students)	1995 (Percent of Students)	2003 (Percent of Students)	1995 (Percent of Students)	2003 (Percent of Students)	1995 (Percent of Students)	2003 (Percent of Students)	1995 (Percent of Students)
Singapore	25 (2.4)	14 (1.6) ▲	61 (2.6)	42 (2.2) ▲	86 (1.6)	71 (1.7) ▲	95 (0.9)	89 (0.9) ▲
England	15 (1.4)	15 (1.1)	47 (1.8)	42 (1.7) ▲	79 (1.3)	72 (1.3) ▲	94 (0.7)	90 (0.8) ▲
United States	13 (0.8)	19 (1.2) ▼	45 (1.4)	50 (1.6) ▼	78 (1.0)	78 (1.1)	94 (0.5)	92 (0.7)
Japan	12 (0.6)	15 (0.8) ▼	49 (1.1)	54 (1.3) ▼	84 (0.7)	87 (0.7) ▼	96 (0.4)	97 (0.4) ▼
Hungary	10 (0.9)	7 (0.7) ▲	42 (1.6)	32 (1.7) ▲	76 (1.4)	67 (1.8) ▲	94 (0.7)	90 (1.0) ▲
New Zealand	9 (0.7)	11 (1.2)	39 (1.3)	35 (1.8)	74 (1.2)	66 (1.8) ▲	92 (0.7)	85 (1.7) ▲
Australia	9 (1.0)	13 (1.1) ▼	38 (1.7)	40 (1.3)	74 (2.0)	72 (1.7)	92 (1.1)	89 (1.1)
Latvia (LSS)	7 (0.8)	5 (1.4)	39 (1.9)	21 (2.1) ▲	80 (1.5)	55 (2.1) ▲	96 (0.6)	85 (1.4) ▲
Hong Kong, SAR	7 (0.8)	5 (0.6)	47 (2.2)	30 (1.6) ▲	87 (1.2)	69 (1.7) ▲	98 (0.3)	91 (1.1) ▲
Scotland	5 (0.5)	12 (1.1) ▼	27 (1.5)	37 (1.8) ▼	66 (1.5)	68 (1.9)	90 (0.9)	88 (1.3)
Slovenia	3 (0.4)	2 (0.4)	22 (1.3)	14 (1.1) ▲	61 (1.4)	45 (1.5) ▲	87 (0.9)	79 (1.4) ▲
Netherlands	3 (0.5)	6 (0.7) ▼	32 (1.5)	38 (2.1) ▼	83 (1.2)	82 (1.6)	99 (0.4)	98 (0.7)
Norway	2 (0.3)	8 (0.9) ▼	15 (0.9)	32 (1.6) ▼	49 (1.4)	65 (1.7) ▼	79 (1.5)	88 (1.1) ▼
Cyprus	2 (0.3)	1 (0.4)	17 (1.0)	11 (1.0) ▲	55 (1.4)	39 (1.8) ▲	86 (0.8)	74 (1.3) ▲
Iran, Islamic Rep. of	1 (0.2)	0 (0.1) ▲	7 (0.7)	3 (0.7) ▲	28 (1.5)	15 (1.5) ▲	58 (1.7)	42 (2.1) ▲
International Avg.	8 (0.3)	9 (0.2) ▼	35 (0.5)	32 (0.4) ▲	71 (0.4)	63 (0.4) ▲	90 (0.3)	85 (0.3) ▲
Benchmarking Participants								
Ontario Province, Can.	13 (1.6)	10 (0.7) ▲	47 (1.9)	37 (1.7) ▲	81 (1.4)	71 (1.7) ▲	96 (0.6)	90 (1.0) ▲
Quebec Province, Can.	3 (0.4)	9 (1.3) ▼	25 (1.3)	40 (3.7) ▼	66 (1.4)	77 (2.5) ▼	91 (0.8)	94 (1.3)

▲ 2003 significantly higher

▼ 2003 significantly lower

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Trend notes: Because of differences between 1995 and 2003 in population coverage, 1995 data are not shown for Italy. Data for Latvia in this exhibit include Latvian-speaking schools only. To be comparable with 1995, 2003 data for New Zealand in this exhibit include students in English medium instruction only (98% of the estimated population).

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

Grade 8: Achievement at the Advanced International Benchmark

Exhibit 2.5 describes performance at the advanced international benchmark. Eighth-grade students reaching this benchmark demonstrated a grasp of some complex and abstract science concepts and could apply knowledge of earth, life, physical, and environmental science. They understand some fundamentals of scientific investigation and could apply basic physical principles to solve quantitative problems. They also could provide written explanations to communicate scientific knowledge. They typically demonstrated success on the knowledge and skills represented by this benchmark, as well as those demonstrated at the high, intermediate, and low benchmarks.

Example Item 1 in Exhibit 2.6 illustrates the type of physics question an eighth-grade student performing at the advanced benchmark generally answered correctly. Students were shown a diagram depicting a ray of sunlight entering a glass prism and a screen on the other side, and were asked to describe what would be seen on the screen, drawing on the diagram if necessary. To receive full credit, students had to explicitly indicate that different colors are seen on the screen, either through a written explanation or by drawing on the diagram. Partial credit was awarded to students who mentioned refraction or bending of the light beam but made no reference to color. This question was difficult for most students, with on average just 23 percent receiving full credit for their responses. However, more than half the students in Korea, Singapore, Malaysia, and Ontario gained full credit.

Students reaching the advanced benchmark typically could interpret information in diagrams, maps, graphs, and tables to solve problems or draw conclusions. Illustrating this, Example Item 2 from earth science shown in Exhibit 2.7 provides students with information in tabular form about the planets Venus and Mercury – surface temperature, atmospheric composition, distance from the Sun, and time to revolve around the Sun. To answer this item correctly, students had to recognize that the best explanation for the higher surface temperature

on Venus was that the high proportion of carbon dioxide in its atmosphere causes a greenhouse effect. This item was answered correctly by 36 percent of students on average, with more than half of the students in Korea, Hong Kong SAR, Chinese Taipei, and Singapore choosing the correct answer.

Exhibit 2.5: **Description of TIMSS 2003 Advanced International Benchmark (625) of Science Achievement**

SCIENCE Grade 8

Advanced International Benchmark – 625

Summary

Students demonstrate a grasp of some complex and abstract science concepts. They can apply knowledge of the solar system and of Earth features, processes, and conditions, and apply understanding of the complexity of living organisms and how they relate to their environment. They show understanding of electricity, thermal expansion, and sound, as well as the structure of matter and physical and chemical properties and changes. They show understanding of environmental and resource issues. Students understand some fundamentals of scientific investigation and can apply basic physical principles to solve some quantitative problems. They can provide written explanations to communicate scientific knowledge.

Students can apply knowledge of the solar system and of Earth features, processes, and conditions. They relate the changing seasons to the tilt in Earth's axis as it orbits the Sun and the phases of the Moon to its motion around Earth. They recognize the gravitational pull of the moon as the major cause of tides. They recognize that surface temperature of a planet is amplified by atmospheric composition and can relate latitude to average yearly temperature. Students identify a physical process that causes weathering of rocks and, from a list of rock types, identify limestone as the type involved in the formation of underground caves. Students recognize the low percentage of water on Earth that is fresh.

Students show understanding of the complexity of living organisms and how they relate to their environment. They recognize the hierarchy of organization in living organisms, and can state one structure that is found in plant but not animal cells. They state two factors in addition to chlorophyll that are needed for photosynthesis, can explain that photosynthesis takes place when light is shone on a plant, and recognize that the gas given off is oxygen. They can justify their choice of plants or animals as the likely first inhabitants of an island, and state one effect of introducing a new predator. They recognize that producers use energy from the sun to make food chemical elements and that recycle back into the environment when animals and plants die. Students also know some animal adaptations needed for survival including physical and behavioral characteristics. In addition, they can list some conditions that are found at the bottom of oceans that make it difficult for most organisms to live there, and recognize that fossils found in sedimentary rock are formed from organisms that lived in the sea. In the area of human health, students recognize that leafy vegetables are a good source of minerals and that vaccines provide the body with long-term immunity.

Students show understanding of physics principles and phenomena, including electricity, thermal expansion, and sound. They interpret a circuit diagram and recognizes that the current flows through two bulbs is the same and recognize that an iron nail becomes magnetized when current flows through a wire coiled around the nail. They recognize that mass is conserved during thermal expansion and that railway tracks have gaps to allow for thermal expansion. They recognize that the motion and arrangement of particles of a liquid are slower and closer together than those of gas particles. Students also recognize that force of gravity acts on a person regardless of position and movement. They can describe what is seen when sunlight passes through a glass prism. They recognize that plucking a guitar string harder affects the volume rather than the pitch of sound produced, and they can predict the effect of removing air on the propagation of sound.

Students demonstrate an understanding of the structure of matter as well as of physical and chemical properties and changes. They recognize that the nucleus of most atoms is composed of protons and neutrons, that an ion is formed when a neutral atom gains an electron, and that the diagram that best represents the structure of water molecules. They identify which of oxygen, hydrogen, and water are elements and distinguish between mixtures and a pure substance (sugar). Students recognize that sugar molecules continue to exist when sugar is dissolved in water. They recognize that water should be added to a saline solution to make it half as concentrated, and determine the amount of water necessary. Based on an incomplete table comparing pure water and salt water, students can explain that the addition of salt to water produces a solution of greater density. They can distinguish between chemical and physical changes, identify oxygen as the gas that causes rust formation, and recognize that both burning coal and exploding fireworks release energy. Students explain why litmus paper does not change color in a mixture of the right proportions of an acid and a base. Students can identify a property of metals and describe how this property may be used to determine whether a substance is a metal or nonmetal. They recognize that electrical conductivity has been used to classify materials into two groups. Students can calculate the density of a metal in a block given the block's mass and length of its sides. They can compare the previously computed density of a metal block to the densities of different metals presented in a table, infer what metal the block is made of, and explain their answers.

Students show understanding of environmental and resource issues. They can state one renewable energy source and describe one way it can be used, and recognize coal as a non-renewable resource. Students recognize that increased algal growth in a lake is likely due to fertilizer runoff, can explain how acid rain is formed from the burning of fossil fuels, and can describe how science and technology may be used to address oil spills in the oceans. Based on demographic and other information, students can predict population change and explain how this will affect land use and pollution. They can state one reason why the human population increased rapidly over the last 200 years.

Students demonstrate understanding of some fundamentals of scientific investigation. In an experimental situation, they recognize which variables to control, what questions can be addressed by an investigation, why scientists make repeated measurements and how an estimate may be improved by averaging repeated measurements. Given a set of equipment, they can design a procedure to measure the volume of an irregularly-shaped object. They apply basic physical principles to solve some quantitative problems and develop explanations involving abstract concepts. They can compare information from several sources, combine information to draw conclusions, and interpret information in diagrams, maps, graphs, and tables to solve problems. They can provide written explanations to communicate scientific knowledge.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 2.6: TIMSS 2003 Advanced International Benchmark (625) of Science Achievement – Example Item 1

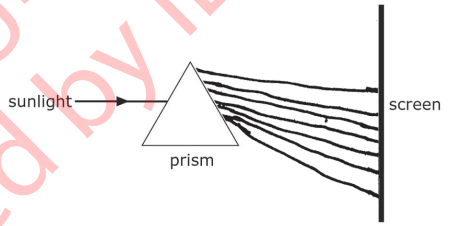
An ItemThat Students Reaching the Advanced International Benchmark Are Likely to Answer Correctly*

SCIENCE Grade 8

Content Area: Physics

Description: Describes that a spectrum can be seen when sunlight passes through by a glass prism.

The diagram shows a ray of sunlight entering a glass prism.



Describe what will be seen on the screen.
(You may draw on the diagram to help explain your answer.)

On the screen, you will see the 7 colors of the rainbow.

The answer shown illustrates the type of student response that was given full credit.

Country	Percent Full Credit
◗◖ Korea, Rep. of	74 (2.1) ▲
Singapore	65 (2.5) ▲
Malaysia	53 (3.0) ▲
† Hong Kong, SAR	49 (2.5) ▲
‡ United States	49 (2.2) ▲
† Netherlands	45 (3.5) ▲
New Zealand	43 (3.3) ▲
Chinese Taipei	38 (2.5) ▲
Jordan	36 (2.8) ▲
Bahrain	34 (2.8) ▲
Armenia	33 (3.6) ▲
Palestinian Nat'l Auth.	33 (2.6) ▲
1 Lithuania	32 (3.0) ▲
Iran, Islamic Rep. of	31 (2.6) ▲
† Scotland	28 (2.9)
Sweden	25 (2.7)
Egypt	24 (2.0)
Hungary	24 (2.6)
Italy	24 (2.7)
International Avg.	**23 (0.3)**
Australia	22 (2.8)
Estonia	20 (2.5)
Romania	18 (2.3) ▼
2 Israel	17 (2.3) ▼
Latvia	17 (2.5) ▼
Belgium (Flemish)	15 (1.9) ▼
Norway	15 (2.0) ▼
Slovenia	15 (2.3) ▼
Saudi Arabia	14 (2.6) ▼
Chile	11 (1.5) ▼
Russian Federation	11 (2.0) ▼
Philippines	10 (1.2) ▼
Japan	10 (1.6) ▼
1 Indonesia	9 (1.4) ▼
Lebanon	7 (1.6) ▼
Bulgaria	7 (1.7) ▼
2 Macedonia, Rep. of	7 (1.6) ▼
Slovak Republic	6 (1.4) ▼
Botswana	5 (1.0) ▼
Cyprus	4 (1.3) ▼
South Africa	3 (0.9) ▼
Moldova, Rep. of	2 (0.8) ▼
1 Serbia	2 (0.8) ▼
Ghana	1 (0.4) ▼
1 ‡ Morocco	1 (0.7) ▼
Tunisia	0 (0.3) ▼
‡ England	47 (4.7) ▲
Benchmarking Participants	
Basque Country, Spain	16 (3.0) ▼
Indiana State, US	44 (3.4) ▲
Ontario Province, Can.	66 (3.9) ▲
Quebec Province, Can.	45 (3.0) ▲

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

* The item was answered fully correctly by a majority of students reaching this benchmark.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

2 National Defined Population covers less than 90% of National Desired Population (see Exhibit A.6).

◗◖ Korea tested the same cohort of students as other countries, but later in 2003, at the beginning of the next school year.

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

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Exhibit 2.7: TIMSS 2003 Advanced International Benchmark (625) of Science Achievement – Example Item 2

An Item That Students Reaching the Advanced International Benchmark Are Likely to Answer Correctly*

SCIENCE Grade 8

Content Area: Earth Science

Description: Given a table showing information about Venus and Mercury, recognizes that the higher average surface temperature on Venus is due to the greenhouse effect.

The table shows some information about the planets Venus and Mercury.

	Average Surface Temperature (°C)	Atmospheric Composition	Mean Distance from the Sun (millions of km)	Time to Revolve Around the Sun (Number of Days)
Venus	470	Mostly Carbon Dioxide	108	225
Mercury	300	Trace amounts of gases	58	88

Which of the following best explains why the surface temperature of Venus is higher than that of Mercury?

Ⓐ There is less absorption of sunlight on Mercury because of the lack of atmospheric gases.

● The high percentage of carbon dioxide in the atmosphere of Venus causes a greenhouse effect.

Ⓒ The longer time for Venus to revolve around the Sun allows it to absorb more heat from the Sun.

Ⓓ The Sun's rays are less direct on Mercury because it is closer to the Sun.

Country	Percent Full Credit	
◗◖ Korea, Rep. of	70 (1.9)	▲
† Hong Kong, SAR	69 (1.7)	▲
Chinese Taipei	69 (1.6)	▲
Singapore	60 (1.8)	▲
‡ United States	49 (1.5)	▲
Australia	48 (2.6)	▲
Japan	47 (1.9)	▲
Egypt	46 (1.8)	▲
Sweden	46 (2.6)	▲
New Zealand	45 (2.4)	▲
1 Lithuania	44 (2.1)	▲
Estonia	43 (2.6)	▲
2 Israel	41 (2.3)	▲
Hungary	41 (2.4)	▲
† Scotland	40 (2.5)	
Slovenia	39 (2.4)	
Latvia	38 (2.3)	
Italy	38 (2.2)	
† Netherlands	38 (2.4)	
Slovak Republic	38 (2.0)	
Belgium (Flemish)	38 (1.6)	
Russian Federation	37 (3.0)	
International Avg.	36 (0.3)	
1 Serbia	34 (2.1)	
Norway	34 (2.0)	
Iran, Islamic Rep. of	33 (1.9)	
Bulgaria	33 (2.2)	
Malaysia	31 (1.8)	▼
Chile	30 (1.6)	▼
Cyprus	30 (1.6)	▼
Palestinian Nat'l Auth.	28 (1.6)	▼
Bahrain	28 (1.8)	▼
Romania	28 (2.2)	▼
Philippines	28 (1.4)	▼
Jordan	28 (1.9)	▼
Botswana	24 (1.7)	▼
Moldova, Rep. of	24 (2.1)	▼
Lebanon	24 (1.6)	▼
South Africa	23 (1.3)	▼
Ghana	22 (1.7)	▼
Tunisia	19 (1.3)	▼
Saudi Arabia	18 (2.0)	▼
1 Indonesia	16 (1.4)	▼
1 ‡ Morocco	16 (1.8)	▼
2 Macedonia, Rep. of	15 (1.7)	▼
Armenia	15 (1.7)	▼
‡ England	44 (3.0)	▲
Benchmarking Participants		
Basque Country, Spain	34 (2.6)	
Indiana State, US	45 (2.9)	▲
Ontario Province, Can.	40 (2.3)	
Quebec Province, Can.	47 (2.4)	▲

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

* The item was answered correctly by a majority of students reaching this benchmark.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

2 National Defined Population covers less than 90% of National Desired Population (see Exhibit A.6).

◗◖ Korea tested the same cohort of students as other countries, but later in 2003, at the beginning of the next school year.

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

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Grade 8: Achievement at the High International Benchmark

Exhibit 2.8 describes performance at the high international benchmark. Eighth-grade students performing at this level demonstrated conceptual understanding of some science cycles, systems, and principles. For example, they were able to interpret a four-step decision diagram showing how to separate a mixture of sand, salt, iron filings, and small pieces of cork into its components, as depicted in Example Item 3 in Exhibit 2.9. To obtain full credit, students had to identify the component of the mixture extracted at each of the four steps. Partial credit was awarded to students identifying two or three components correctly. Internationally, 34 percent of the students, on average, achieved full credit. Countries where the majority of students were awarded full credit included Singapore, Chinese Taipei, Japan, Hong Kong SAR, Estonia, Korea, Hungary, the Slovak Republic, and province of Quebec.

Eighth-grade students reaching the high benchmark generally showed some understanding of ecosystems and food chains. In Example Item 4 in Exhibit 2.10, students were asked to predict what would happen to a community consisting of mice, snakes, and wheat plants if the snakes were all killed. To obtain full credit, students had to mention explicitly the effect on both the mouse population and the wheat plants. Partial credit was awarded to students who referred to one or other effect, but not both. The majority of students in Singapore, Malaysia, Chinese Taipei, Estonia, Australia, and Ontario achieved full credit, although internationally, just about one-third of the eighth-grade students did so.

Exhibit 2.8: **Description of TIMSS 2003 High International Benchmark (550) of Science Achievement**

SCIENCE Grade 8

High International Benchmark – 550

Summary

Students demonstrate conceptual understanding of some science cycles, systems, and principles. They have some understanding of Earth's processes and the solar system, biological systems, populations, reproduction and heredity, and structure and function of organisms. They show some understanding of physical and chemical changes, and the structure of matter. They solve some basic physics problems related to light, heat, electricity, and magnetism, and they demonstrate basic knowledge of major environmental issues. They demonstrate some scientific inquiry skills. They can combine information to draw conclusions; interpret information in diagrams, graphs and tables to solve problems; and provide short explanations conveying scientific knowledge and cause/effect relationships.

Students have some understanding of Earth's processes and the solar system. They can recognize a definition of sedimentary rock and know that fossil fuels are formed from the remains of living things. They recognize that Earthquakes and volcanoes occur along the boundaries of tectonic plates. Students recognize how a river changes as it flows from a mountain to a plain, can describe how atmospheric conditions on Earth change with increasing elevation, and can predict the likely location of a jungle relative to a mountain. Students recognize some features of the solar system, including the main differences between planets and moons, the definition of an Earth year and the relative distances of the Sun and Moon from Earth.

Students show some understanding of ecosystems, population, and structure and function. They interpret a diagram depicting the exchange of gases in a forest ecosystem, demonstrate an understanding of interrelations of plants and animals in ecosystems, and recognize that the loss of a food supply is likely the cause of a drop in population size. They also can explain that camouflage helps animals survive. They recognize that the main function of chlorophyll in plants is to absorb light energy. Students demonstrate some understanding of reproduction and heredity by recognizing that sperm and egg join during fertilization, and explaining that acquired characteristics such as the loss of a kidney cannot be passed onto the next generation. Students can state the importance of exercise for good health, and recognize which food source contains fat. They can identify some functions of blood, and know one function of the uterus. They can describe how body temperature in humans is controlled. In addition, students can determine characteristics used to sort animals into classification groups.

Students can analyze situations and solve some basic problems related to light, heat, magnetism, and electricity. For example, they can relate shadow size to distance from a light source. They can recognize a ray diagram showing the path of light reflected from a mirror. They can also explain why lightning is seen before thunder is heard. Students also recognize that conduction is a process by which heat is transferred along a metal rod, that metal conducts heat faster than glass, wood, or plastic, that the thermal expansion of alcohol is greater than that of glass, and that gas molecules move faster when temperature increases. They can demonstrate knowledge of magnetism by drawing and explaining the orientation of a compass needle under the influence of a magnet and by labeling the poles of magnets cut into pieces. Students also can complete a table showing a proportional relation between voltage and current. They also demonstrate understanding of some physical properties of matter. For example, they can compare the densities of helium and air by recognizing that helium balloons rise in air. They also recognize that the surface of a liquid remains horizontal in a tilted container. They can explain that the temperature of boiling water does not increase as heat is added.

Students show some evidence of understanding chemical and physical changes and the structure of matter. They can identify vinegar as acidic solution and explain what causes a balloon to inflate when sodium bicarbonate in the balloon is mixed with vinegar. They can explain that candles burning in closed containers will extinguish due to lack of oxygen. They use a four step decision diagram that describes how to separate iron filings, cork, sand and salt from a mixture to identify which component is separated by magnetism, floating/sinking, filtering, and evaporation. Students interpret data in a table of physical properties to identify iron, water, and oxygen, and recognize that a graph that shows the effect of temperature on the solubility of sugar in water. They recognize that objects are made up of atoms.

Students demonstrate basic knowledge of major environmental issues. They can explain why the depletion of the ozone layer may be harmful to people, and recognize that increased carbon dioxide in the atmosphere may lead to global warming and that using public transportation can reduce air pollution. They can distinguish renewable from nonrenewable energy sources, describe the effects of a dam on wildlife, state two reasons why some people do not have enough water to drink, and recognize that overgrazing can lead to soil erosion. Students can also distinguish between soil change caused by natural causes and by human activity.

Students demonstrate some scientific inquiry skills. They distinguish an observation from other types of scientific statements; combine information to draw conclusions; interpret information in various types of diagrams, contour maps, graphs and tables to solve problems; and provide short explanations conveying scientific knowledge, and cause/effect relationships.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 2.9: TIMSS 2003 High International Benchmark (550) of Science Achievement – Example Item 3

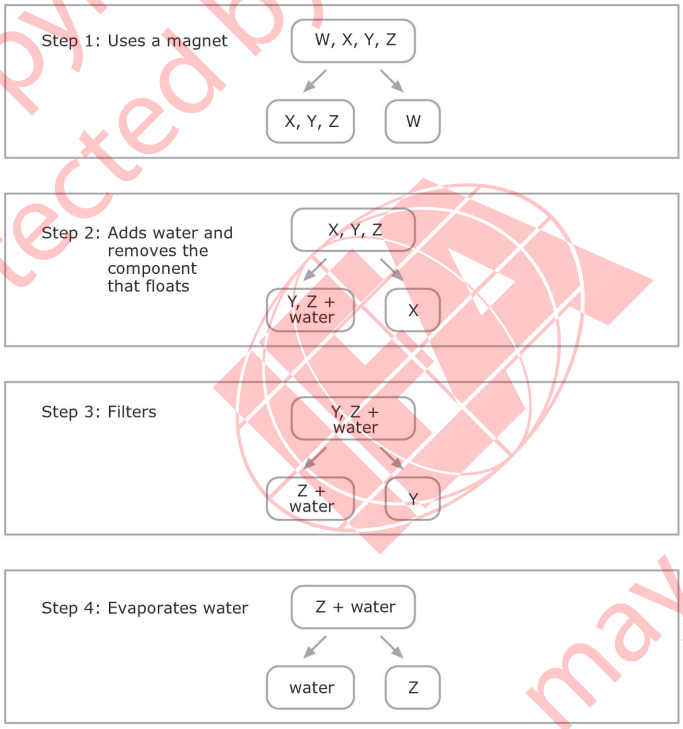
An Item That Students Reaching the High International Benchmark Are Likely to Answer Correctly*

SCIENCE Grade 8

Content Area: Chemistry

Description: Using a four-step decision diagram showing the steps used to separate iron filings, cork, sand, and salt from a mixture, identifies which component is separated by magnetism, floating/sinking, filtering, and evaporation.

Teresa is given a mixture of salt, sand, iron filings, and small pieces of cork. She separates the mixture using a 4-step procedure as shown in the diagram. The letters W, X, Y, and Z are used to stand for the four components but do not indicate which letter stands for which component.



Identify what each component is by writing *salt, sand, iron, or cork* in the correct spaces below.

Component W is: Iron

Component X is: cork

Component Y is: sand

Component Z is: salt

The answer shown illustrates the type of student response that was given full credit.

Country	Percent Full Credit
Singapore	68 (2.2) ▲
Chinese Taipei	67 (2.5) ▲
Japan	58 (2.5) ▲
† Hong Kong, SAR	58 (2.3) ▲
Estonia	56 (2.8) ▲
◆◆ Korea, Rep. of	54 (2.5) ▲
Hungary	51 (3.2) ▲
Slovak Republic	51 (3.0) ▲
Latvia	49 (3.4) ▲
† Scotland	48 (2.9) ▲
† Netherlands	47 (3.3) ▲
Sweden	47 (2.3) ▲
1 Lithuania	47 (2.8) ▲
New Zealand	46 (4.1) ▲
Malaysia	46 (3.0) ▲
Russian Federation	45 (2.8) ▲
Australia	44 (3.5) ▲
Belgium (Flemish)	44 (2.4) ▲
Armenia	42 (3.5) ▲
Slovenia	41 (4.1)
Italy	39 (3.0)
‡ United States	35 (2.0)
Jordan	35 (3.1)
Romania	35 (3.0)
International Avg.	**34 (0.4)**
Moldova, Rep. of	34 (3.7)
2 Israel	33 (2.6)
Norway	26 (2.8) ▼
Lebanon	26 (2.5) ▼
Chile	26 (2.2) ▼
Iran, Islamic Rep. of	25 (2.1) ▼
Bahrain	23 (2.6) ▼
Egypt	22 (2.2) ▼
Bulgaria	21 (3.1) ▼
Palestinian Nat'l Auth.	20 (1.9) ▼
1 Serbia	20 (2.6) ▼
Cyprus	19 (2.3) ▼
Tunisia	15 (1.8) ▼
Saudi Arabia	14 (2.5) ▼
2 Macedonia, Rep. of	14 (2.3) ▼
1 Indonesia	12 (1.6) ▼
Philippines	11 (1.5) ▼
South Africa	8 (1.3) ▼
Botswana	7 (1.6) ▼
1 ‡ Morocco	6 (1.9) ▼
Ghana	6 (1.2) ▼
‡ England	48 (3.8) ▲
Benchmarking Participants	
Basque Country, Spain	44 (3.8) ▲
Indiana State, US	42 (3.8) ▲
Ontario Province, Can.	37 (3.5)
Quebec Province, Can.	50 (3.5) ▲

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

* The item was answered fully correctly by a majority of students reaching this benchmark.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

2 National Defined Population covers less than 90% of National Desired Population (see Exhibit A.6).

◆◆ Korea tested the same cohort of students as other countries, but later in 2003, at the beginning of the next school year.

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

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Exhibit 2.10: TIMSS 2003 High International Benchmark (550) of Science Achievement – Example Item 4

An Item That Students Reaching the High International Benchmark Are Likely to Answer Correctly*

SCIENCE Grade 8

Content Area: Life Science

Description: Given that a community consists of mice, snakes, and wheat plants, explains what will happen to the mice and wheat plants if the snakes are killed.

The diagram above shows a community consisting of mice, snakes and wheat plants.

What would happen to this community if people killed the snakes?

Because there are no snakes, we would get more mice. This would cause less wheat plants.

The answer shown illustrates the type of student response that was given full credit.

Country	Percent Full Credit	
Singapore	78 (1.8)	▲
Malaysia	68 (2.1)	▲
Chinese Taipei	55 (2.0)	▲
Estonia	52 (2.3)	▲
Australia	50 (2.3)	▲
Sweden	48 (2.1)	▲
Hungary	48 (1.9)	▲
Belgium (Flemish)	46 (1.9)	▲
† Netherlands	45 (2.6)	▲
‡ United States	44 (1.7)	▲
† Scotland	42 (2.5)	▲
Slovak Republic	41 (2.4)	▲
1 Lithuania	41 (2.2)	▲
Iran, Islamic Rep. of	40 (2.1)	▲
Jordan	39 (2.4)	▲
Russian Federation	38 (1.6)	▲
◆◆ Korea, Rep. of	38 (1.9)	▲
† Hong Kong, SAR	37 (2.0)	
Romania	37 (2.7)	
New Zealand	35 (3.2)	
Egypt	34 (1.9)	
Armenia	34 (2.1)	
International Avg.	33 (0.3)	
Slovenia	33 (2.0)	
Latvia	32 (2.3)	
1 Serbia	32 (2.1)	
2 Macedonia, Rep. of	32 (2.5)	
Japan	31 (1.6)	
Norway	31 (2.4)	
1 Indonesia	30 (1.7)	
2 Israel	30 (2.0)	▼
Italy	27 (2.1)	▼
Moldova, Rep. of	26 (2.2)	▼
Tunisia	26 (1.8)	▼
Saudi Arabia	24 (2.1)	▼
Bulgaria	22 (2.2)	▼
Cyprus	18 (1.5)	▼
Chile	16 (1.8)	▼
Bahrain	16 (1.3)	▼
Palestinian Nat'l Auth.	16 (1.3)	▼
1 ‡ Morocco	16 (1.8)	▼
Philippines	16 (1.5)	▼
Lebanon	9 (1.6)	▼
Botswana	6 (1.1)	▼
South Africa	6 (1.1)	▼
Ghana	3 (0.6)	▼
‡ England	57 (2.4)	▲
Benchmarking Participants		
Basque Country, Spain	28 (2.4)	▼
Indiana State, US	40 (3.7)	
Ontario Province, Can.	55 (2.6)	▲
Quebec Province, Can.	41 (2.4)	▲

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

* The item was answered fully correctly by a majority of students reaching this benchmark.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

2 National Defined Population covers less than 90% of National Desired Population (see Exhibit A.6).

◆◆ Korea tested the same cohort of students as other countries, but later in 2003, at the beginning of the next school year.

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

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Grade 8: Achievement at the Intermediate International Benchmark

Eighth-grade students at the intermediate benchmark could recognize and communicate basic scientific knowledge across a range of topics (see Exhibit 2.11). Example Item 5 in Exhibit 2.12 shows an example from physics. When presented with a diagram showing a ball on the end of a string being whirled in a circle, students could apply their knowledge of circular motion to identify the diagram showing that the ball will fly in a straight line when the string is released. The international average percent correct for this item was 60 percent. In Korea, the Netherlands, and Estonia, 80 percent or more of the students answered correctly.

Example Item 6 from earth science, shown in Exhibit 2.13, addresses students' understanding of gravity. Students were presented with a diagram showing a person holding a ball while standing at three very different places on Earth. To answer correctly, students had to select the diagram showing that the dropped ball will always fall towards the center of the Earth. Internationally, on average, 70 percent of the eighth-grade students chose the correct option. About three-fourths or more of the students answered correctly in 21 countries and 3 benchmarking participants, with 90 percent or more in Japan, Estonia, and Korea.

Exhibit 2.11: **Description of TIMSS 2003 Intermediate International Benchmark (475) of Science Achievement**

Intermediate International Benchmark – 475

Summary

Students can recognize and communicate basic scientific knowledge across a range of topics. They recognize some characteristics of the solar system, water cycle, animals, and human health. They are acquainted with some aspects of energy, force and motion, light reflection, and sound. Students demonstrate elementary knowledge of human impact on and changes in the environment. They can apply and briefly communicate knowledge, extract tabular information, extrapolate from data presented in a simple linear graph, and interpret pictorial diagrams.

Students demonstrate some familiarity with the solar system. They recognize the Sun as a star, and can draw the position of the moon relative to the Sun and Earth during a solar eclipse. Students demonstrate some understanding of the water cycle by ordering the processes involved in Earth's water cycle and by recognizing the Sun as the source of energy for the water cycle. They can recognize that gravity draws objects toward the center of Earth. They recognize examples of fossil fuels.

Students have some knowledge of the characteristics of animals and human health. They recognize that mammals feed milk to their young and demonstrate some understanding of the immune system by recognizing that bacteria can be destroyed by white blood cells and by explaining why some people catch colds and others do not. Students also recognize that gills have the same function as lungs.

In physics, students are acquainted with some aspects of energy, force, and motion. They recognize that a compressed spring has stored energy and that an object will move in a straight line when released from a circular path. They can explain why a nail becomes warmer when pulled out of a wooden board. Students can demonstrate some knowledge of light by recognizing the necessity of reflected light for visibility of an object and by identifying the apparent position of a reflected image in a mirror. They can recognize that sound needs a medium through which to travel.

Students have some chemistry knowledge related to everyday life. For example, they recognize that fanning a fire makes it burn faster by supplying more oxygen.

Students demonstrate elementary knowledge of human impact on and changes in the environment. They can describe both a positive and a negative effect on farming of a dam located upriver. From a list of common waste materials, they recognize that paper will break down most quickly. They can state how volcanic eruptions impact the environment.

Students can extract information from a table to draw conclusions and interpret pictorial diagrams. They also can extrapolate from data presented in a simple linear graph. Students can apply knowledge to practical situations and communicate their knowledge through brief descriptive responses.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 2.12: TIMSS 2003 Intermediate International Benchmark (475) of Science Achievement – Example Item 5

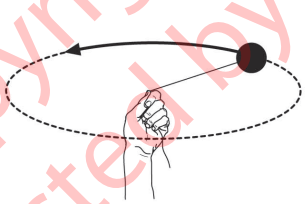
An Item That Students Reaching the Intermediate International Benchmark Are Likely to Answer Correctly*

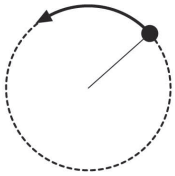
SCIENCE Grade 8

Content Area: Physics

Description: Applies knowledge of circular motion to identify the diagram that shows that an object will move in a straight line when released from a circular path.

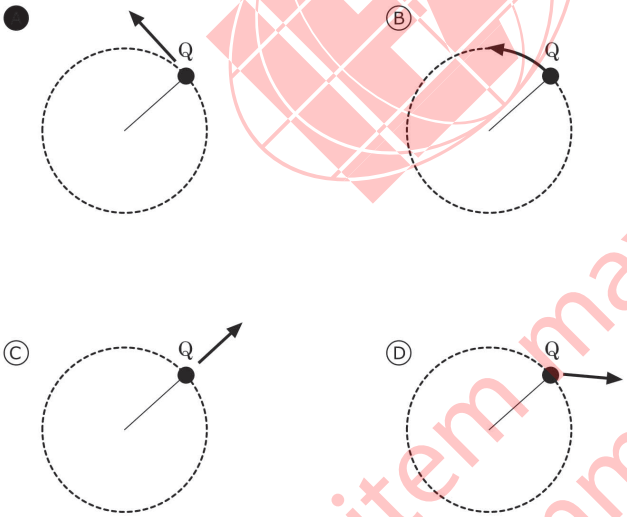
The diagram on the left shows a ball on the end of a string being whirled in a circle. The diagram on the right shows the whirling ball as viewed from above.





(View from above)

After several whirls, the string is released when the ball is at Q. Which of these diagrams shows the direction in which the ball will fly the instant the string is released?



Country	Percent Full Credit
◆◆ Korea, Rep. of	87 (1.2) ▲
† Netherlands	82 (1.8) ▲
Estonia	80 (1.6) ▲
Singapore	79 (1.3) ▲
Australia	77 (1.9) ▲
Japan	77 (1.5) ▲
Hungary	77 (1.8) ▲
† Scotland	77 (1.4) ▲
New Zealand	77 (2.4) ▲
Belgium (Flemish)	76 (1.5) ▲
‡ United States	76 (1.4) ▲
1 Lithuania	75 (1.6) ▲
Malaysia	75 (1.8) ▲
Sweden	74 (1.8) ▲
Russian Federation	74 (1.7) ▲
Slovak Republic	72 (2.2) ▲
Norway	72 (1.8) ▲
Latvia	71 (2.1) ▲
Slovenia	70 (2.0) ▲
† Hong Kong, SAR	69 (1.6) ▲
Chinese Taipei	68 (1.5) ▲
Italy	61 (2.1)
Bulgaria	60 (2.6)
1 Serbia	60 (2.2)
International Avg.	60 (0.3)
Cyprus	59 (1.8)
2 Israel	58 (2.0)
Romania	58 (2.8)
Chile	58 (1.6)
Armenia	58 (2.5)
2 Macedonia, Rep. of	54 (2.4) ▼
Moldova, Rep. of	52 (3.0) ▼
Iran, Islamic Rep. of	48 (1.9) ▼
Jordan	47 (2.2) ▼
1 Indonesia	47 (1.9) ▼
Bahrain	44 (2.0) ▼
Philippines	42 (1.9) ▼
Saudi Arabia	38 (2.5) ▼
Palestinian Nat'l Auth.	36 (1.9) ▼
1 ‡ Morocco	33 (2.2) ▼
Tunisia	31 (1.9) ▼
Egypt	30 (1.9) ▼
Lebanon	30 (2.1) ▼
Botswana	30 (1.7) ▼
South Africa	22 (1.8) ▼
Ghana	22 (1.6) ▼
‡ England	74 (2.0) ▲
Benchmarking Participants	
Basque Country, Spain	72 (2.3) ▲
Indiana State, US	77 (2.7) ▲
Ontario Province, Can.	78 (1.8) ▲
Quebec Province, Can.	79 (1.5) ▲

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

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* The item was answered correctly by a majority of students reaching this benchmark.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

2 National Defined Population covers less than 90% of National Desired Population (see Exhibit A.6).

◆◆ Korea tested the same cohort of students as other countries, but later in 2003, at the beginning of the next school year.

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

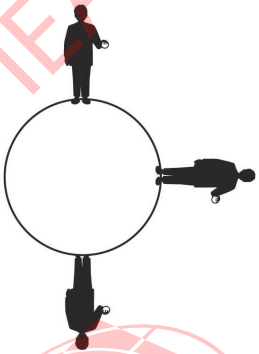
Exhibit 2.13: TIMSS 2003 Intermediate International Benchmark (475) of Science Achievement – Example Item 6

An Item That Students Reaching the Intermediate International Benchmark Are Likely to Answer Correctly*

SCIENCE Grade 8

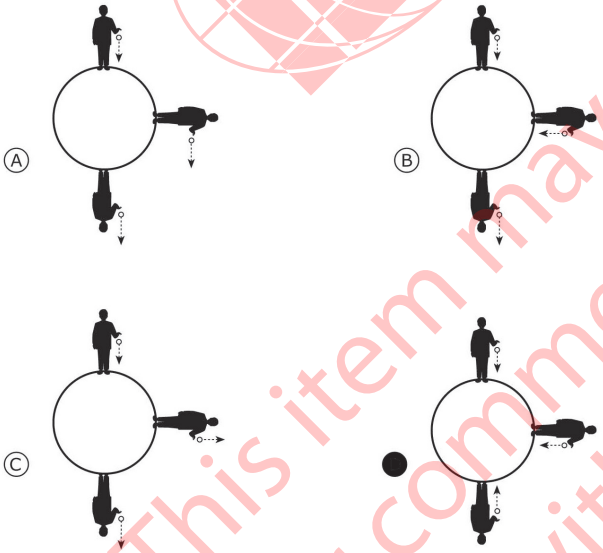
Content Area: Earth Science

Description: Uses knowledge of gravity to recognize that objects fall towards the center of Earth.



The diagram above shows a person holding a ball standing at three different places on Earth. If the person drops the ball, gravity will make it fall.

Which of the following diagrams best shows the direction the dropped ball will fall at the three different positions?



Country	Percent Full Credit	
Japan	92 (1.2)	▲
Estonia	91 (1.7)	▲
◆◆ Korea, Rep. of	90 (1.5)	▲
Hungary	88 (2.1)	▲
Sweden	87 (1.8)	▲
† Netherlands	87 (2.2)	▲
Malaysia	86 (1.5)	▲
Chinese Taipei	86 (1.7)	▲
Norway	84 (2.0)	▲
Slovenia	83 (2.4)	▲
Russian Federation	82 (1.8)	▲
1 Lithuania	81 (2.2)	▲
New Zealand	81 (2.9)	▲
† Hong Kong, SAR	81 (2.2)	▲
Latvia	80 (2.5)	▲
Singapore	80 (1.7)	▲
Slovak Republic	80 (2.2)	▲
Australia	79 (2.5)	▲
1 Serbia	78 (2.6)	▲
Belgium (Flemish)	77 (2.2)	▲
‡ United States	75 (1.8)	▲
† Scotland	73 (2.9)	
Armenia	72 (2.4)	
Lebanon	72 (2.5)	
Italy	71 (2.6)	
International Avg.	**70 (0.4)**	
Romania	70 (3.3)	
Iran, Islamic Rep. of	67 (2.7)	
Bahrain	67 (2.3)	
Jordan	66 (2.6)	
Moldova, Rep. of	66 (3.7)	
2 Israel	65 (3.2)	
Philippines	65 (2.4)	▼
1 Indonesia	62 (2.2)	▼
Bulgaria	61 (4.0)	▼
Botswana	61 (2.7)	▼
Saudi Arabia	61 (3.1)	▼
Palestinian Nat'l Auth.	58 (2.3)	▼
Chile	58 (2.4)	▼
Cyprus	58 (3.3)	▼
2 Macedonia, Rep. of	54 (3.4)	▼
Egypt	51 (2.3)	▼
Tunisia	47 (2.5)	▼
Ghana	43 (2.9)	▼
South Africa	40 (2.1)	▼
1 ‡ Morocco	6 (1.3)	▼
‡ England	78 (3.0)	▲
Benchmarking Participants		
Basque Country, Spain	67 (3.4)	
Indiana State, US	80 (3.3)	▲
Ontario Province, Can.	80 (2.5)	▲
Quebec Province, Can.	86 (1.8)	▲

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

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* The item was answered correctly by a majority of students reaching this benchmark.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

2 National Defined Population covers less than 90% of National Desired Population (see Exhibit A.6).

◆◆ Korea tested the same cohort of students as other countries, but later in 2003, at the beginning of the next school year.

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

Grade 8: Achievement at the Low International Benchmark

As shown in Exhibit 2.14, students performing at the low international benchmark recognized basic facts from the life and physical sciences. They had some knowledge of the human body and heredity, and demonstrated familiarity with some everyday physical phenomena. Example Item 7, presented in Exhibit 2.15, is from life science, and addresses students' knowledge of heredity. To answer correctly, students had to recognize that traits are transferred from parents to offspring through both the sperm and the egg. The international average was 74 percent correct, and three countries – Chinese Taipei, Hong Kong SAR, and Korea – had 90 percent or more of their students choosing the correct answer.

As an example from everyday physical phenomena, Example Item 8 shown in Exhibit 2.16 required students to identify the diagram depicting the correct arrangement of batteries in a flashlight. This was a relatively easy item, with at least half the eighth-grade students in every country and benchmarking entity choosing the correct option. On average across participants, 85 percent of students answered correctly.

Exhibit 2.14: **Description of TIMSS 2003 Low International Benchmark (400) of Science Achievement**

Low International Benchmark – 400

Summary

Students recognize some basic facts from the life and physical sciences. They have some knowledge of the human body and heredity, and demonstrate familiarity with some everyday physical phenomena. Students can interpret some pictorial diagrams and apply knowledge of simple physical concepts to practical situations.

Students demonstrate some basic knowledge of human biology. They identify the circulatory system from a list of its parts, and recognize that nerves carry sensory messages to the brain. They demonstrate some knowledge of inheritance by recognizing that traits are transferred through sperm and egg, and that traits are inherited from both parents.

Students recognize some facts about familiar physical phenomena. They can identify a situation where work is being done and the correct arrangement of batteries in a flashlight. They recognize evaporation as a process that takes place when clothes dry. Students are also able to identify a heterogeneous powder as a mixture.

Students can interpret some pictorial diagrams and apply knowledge of simple physical concepts to practical situations.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 2.15: TIMSS 2003 Low International Benchmark (400) of Science Achievement – Example Item 7

An Item That Students Reaching the Low International Benchmark Are Likely to Answer Correctly*

SCIENCE Grade 8

Content Area: Life Science

Description: Recognizes that traits are transferred to offspring through the sperm and egg.

Traits are transferred from generation to generation through the

Ⓐ sperm only

Ⓑ egg only

● sperm and the egg

Ⓓ testes

Country	Percent Full Credit
Chinese Taipei	97 (0.7) ▲
† Hong Kong, SAR	97 (0.6) ▲
◆◆ Korea, Rep. of	91 (0.9) ▲
Hungary	88 (1.6) ▲
Sweden	87 (1.5) ▲
† Netherlands	86 (1.6) ▲
Singapore	86 (1.0) ▲
‡ United States	86 (1.2) ▲
2 Israel	85 (1.4) ▲
† Scotland	83 (1.8) ▲
Estonia	83 (1.6) ▲
Belgium (Flemish)	83 (1.5) ▲
Chile	83 (1.1) ▲
Romania	80 (2.3) ▲
Slovak Republic	79 (2.0) ▲
Italy	79 (1.9) ▲
Malaysia	79 (1.4) ▲
Norway	78 (1.9) ▲
Latvia	77 (1.8) ▲
Bulgaria	76 (2.3)
Philippines	76 (1.6)
Japan	76 (1.8)
Slovenia	76 (2.2)
Bahrain	75 (1.7)
Russian Federation	74 (2.0)
International Avg.	74 (0.3)
Australia	73 (2.2)
1 Lithuania	72 (1.9)
Egypt	71 (1.8)
Armenia	71 (1.9)
New Zealand	70 (2.6)
Moldova, Rep. of	68 (2.2) ▼
2 Macedonia, Rep. of	68 (2.4) ▼
1 Serbia	67 (1.9) ▼
1 Indonesia	67 (1.9) ▼
1 ‡ Morocco	66 (2.6) ▼
Tunisia	64 (2.0) ▼
Cyprus	63 (2.0) ▼
Palestinian Nat'l Auth.	62 (2.0) ▼
Jordan	57 (2.1) ▼
Botswana	57 (1.8) ▼
Saudi Arabia	52 (2.8) ▼
South Africa	52 (1.5) ▼
Iran, Islamic Rep. of	50 (1.9) ▼
Ghana	50 (2.1) ▼
Lebanon	37 (2.6) ▼
‡ England	88 (1.5) ▲
Benchmarking Participants	
Basque Country, Spain	81 (2.6) ▲
Indiana State, US	87 (1.7) ▲
Ontario Province, Can.	79 (2.1) ▲
Quebec Province, Can.	89 (1.4) ▲

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

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* The item was answered correctly by a majority of students reaching this benchmark.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

2 National Defined Population covers less than 90% of National Desired Population (see Exhibit A.6).

◆◆ Korea tested the same cohort of students as other countries, but later in 2003, at the beginning of the next school year.

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

A dash (–) indicates comparable data are not available.

Exhibit 2.16: TIMSS 2003 Low International Benchmark (400) of Science Achievement – Example Item 8

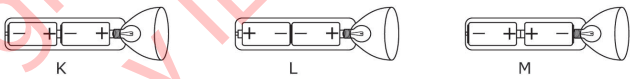
An Item That Students Reaching the Low International Benchmark Are Likely to Answer Correctly*

SCIENCE Grade 8

Content Area: Physics

Description: Identifies the diagram depicting the correct arrangement of batteries in a flashlight.

The diagrams show a flashlight and three ways to put batteries in it.



In order to make the flashlight work, which way must the batteries be placed?

● Only as in K

Ⓑ Only as in L

Ⓒ Only as in M

Ⓓ None of these ways would work.

Country	Percent Full Credit	
Singapore	97 (0.5)	▲
◆◆ Korea, Rep. of	93 (0.8)	▲
Japan	93 (0.9)	▲
† Hong Kong, SAR	93 (0.9)	▲
Russian Federation	93 (1.0)	▲
Slovak Republic	93 (1.1)	▲
Estonia	93 (1.1)	▲
Chinese Taipei	92 (0.8)	▲
Malaysia	91 (1.0)	▲
Romania	91 (1.2)	▲
Latvia	91 (1.5)	▲
Hungary	91 (1.2)	▲
Bulgaria	91 (1.6)	▲
Bahrain	90 (1.2)	▲
1 Lithuania	90 (1.1)	▲
Moldova, Rep. of	90 (1.6)	▲
Sweden	89 (1.0)	▲
‡ United States	89 (0.8)	▲
Armenia	88 (1.5)	▲
New Zealand	88 (2.0)	
Slovenia	87 (1.3)	▲
Lebanon	86 (1.4)	
† Netherlands	86 (1.7)	
Australia	85 (1.8)	
Belgium (Flemish)	85 (1.4)	
Cyprus	85 (1.5)	
International Avg.	85 (0.2)	
† Scotland	84 (1.6)	
1 Indonesia	84 (1.2)	
1 Serbia	84 (1.5)	
2 Macedonia, Rep. of	84 (1.7)	
Italy	83 (1.4)	
Iran, Islamic Rep. of	83 (1.3)	
Chile	82 (1.2)	
2 Israel	82 (1.6)	
Norway	81 (1.5)	▼
Botswana	81 (1.3)	▼
1 ‡ Morocco	81 (2.2)	
Jordan	78 (1.9)	▼
Saudi Arabia	78 (2.3)	▼
Palestinian Nat'l Auth.	78 (1.8)	▼
Philippines	77 (1.6)	▼
Egypt	67 (2.1)	▼
Tunisia	59 (1.9)	▼
Ghana	55 (1.8)	▼
South Africa	52 (1.7)	▼
‡ England	95 (1.0)	▲
Benchmarking Participants		
Basque Country, Spain	84 (2.1)	
Indiana State, US	90 (1.5)	▲
Ontario Province, Can.	86 (1.6)	
Quebec Province, Can.	87 (1.5)	

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

* The item was answered correctly by a majority of students reaching this benchmark.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

2 National Defined Population covers less than 90% of National Desired Population (see Exhibit A.6).

◆◆ Korea tested the same cohort of students as other countries, but later in 2003, at the beginning of the next school year.

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

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Grade 4: Achievement at the Advanced International Benchmark

At the fourth grade, students reaching the advanced benchmark demonstrated that they could apply their knowledge and understanding of science in beginning scientific inquiry. (see Exhibit 2.17). Example Item 1 in Exhibit 2.18 is part of an extended problem solving and inquiry task in the earth science content area, in which students were provided with a plan of a house and garden and were required to answer a series of questions about planting a new garden. In the question shown in this example, students were given a plan of the house and garden showing the points of the compass, and asked to explain which side of the house would receive most sun in the morning. To be awarded credit, students had to choose the East side, and explain their answer in terms of the sun rising in the East. Internationally, on average, just 26 percent of the fourth-grade students answered this item correctly. The best performance was in Chinese Taipei and Hong Kong SAR, where more than half of the students answered correctly.

In physical science, fourth-grade students reaching the advanced level were able to use their knowledge of physical properties to identify common materials. In Example Item 2 (Exhibit 2.19), students were required to interpret tabular information about the physical properties of three materials to identify which of them were wood, rock, and iron. To obtain full credit, students had to identify all three. Students correctly identifying one or two of the materials were awarded partial credit. On average, internationally, 38 percent of students achieved full credit. Performance was highest in Singapore and Japan, where 74 and 69 percent, respectively, obtained full credit.

Exhibit 2.17: **Description of TIMSS 2003 Advanced International Benchmark (625) of Science Achievement**

Advanced International Benchmark – 625

Summary

Students can apply knowledge and understanding in beginning scientific inquiry. Students demonstrate some understanding of Earth's features and processes and the solar system. They can communicate their understanding of structure, function, and life processes in organisms and classify organisms according to major physical and behavioral features. They demonstrate some understanding of physical phenomena and properties of common materials. Students demonstrate beginning scientific inquiry knowledge and skills.

Students demonstrate some understanding of Earth's features and processes and of the Moon in the solar system. They recognize that the Moon can be seen because it reflects the light from the Sun. They recognize that metals are found in rocks and can relate fossils to evidence of the past. From a plan of a house and garden, students can explain which side of the house receives most morning sun. They identify changes in soil from natural causes and recognize that decaying plants and animals enrich the soil and make plants grow. They can interpret a table of temperature and cloud cover data to predict a location where it snowed and interpret a map indicating that a river flows from mountains to the ocean.

Students can communicate their understanding of structure, function, and life processes in organisms by stating why humans need a skeleton, what the human body does to cool down during exercise, and how colds can be transmitted. They also can describe a physical change that takes place in children's bodies as they become adults. Students show some knowledge of reproduction by explaining why the last surviving member of an animal species cannot reproduce, that the color of a flower is determined by the flower color of the parent plant, and why some insects are important for flowering. They can recognize a group of animals that are all mammals, that the energy needed to heal a cut comes from food, and can select cheese from a list of common foods as the best source of calcium. They can combine information from a plan of a garden and a diagram showing plants and their light requirements to complete a table listing plants that would grow well in different areas of the garden. They can describe human activities that can lead to the extinction of animals.

Students demonstrate some understanding of physical properties of common materials and physical phenomena. They recognize that heat is required for melting and boiling but not for freezing. They also recognize that magnets with like poles repel and that magnetism, not gravity, makes objects repel each other. From a diagram, they recognize the direction of motion of two carts carrying magnets. They can identify two things wrong with a diagram showing a person's shadow and location of the sun. They can name one thing that shows that sunlight is made up of different colors. From investigations of the effects of different colored lights on the apparent color of a red shirt, students can describe the results and conclude that the color looks different under different colored light. They can also distinguish between renewable and non-renewable energy sources. In addition, they can recognize and explain that fine salt dissolves faster in water than coarse salt, and recognize the diagram that best shows how ice floats in water. They can interpret information from a table of physical properties to identify wood, rock and iron.

Students demonstrate beginning scientific inquiry knowledge and skills. They can describe the results of an investigation, draw conclusion from the results, and infer the purpose of an experiment from a table of data.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 2.18: TIMSS 2003 Advanced International Benchmark (625) of Science Achievement – Example Item 1

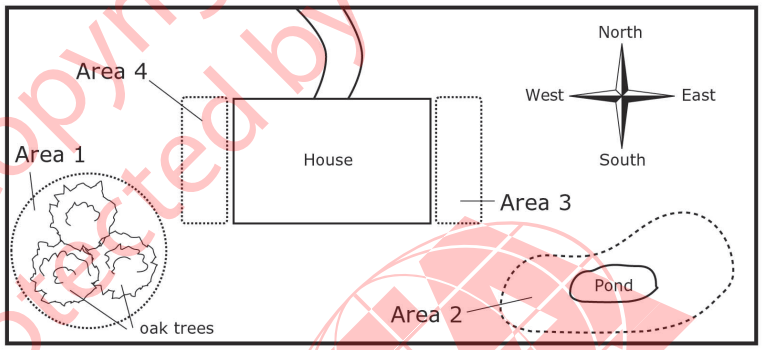
An Item That Students Reaching the Advanced International Benchmark Are Likely to Answer Correctly*

SCIENCE Grade 4

Content Area: Earth Science

Description: From a plan of a house and garden showing North, South, East, and West, identifies the side of the house that receives the most sun in the morning and explains why.

A plan of Rebecca's house and garden is shown below. There are four areas in the garden where she would like to grow some plants (Areas 1, 2, 3, and 4).



Which side of Rebecca's house will receive the most sun in the morning?

(Check one box.)

- [x] East side (Area 3)
- [ ] West side (Area 4)

Explain your answer.

Because the sun comes up on the East side.

The answer shown illustrates the type of student response that was given full credit.

Country	Percent Full Credit
Chinese Taipei	55 (2.3) ▲
† Hong Kong, SAR	51 (3.2) ▲
Japan	45 (2.6) ▲
Singapore	42 (2.7) ▲
Hungary	41 (2.5) ▲
Latvia	34 (3.3) ▲
† Netherlands	33 (3.0) ▲
Slovenia	30 (3.6)
Italy	30 (2.5)
† United States	29 (1.8)
Cyprus	28 (2.2)
† Australia	28 (3.4)
New Zealand	27 (2.7)
International Avg.	26 (0.5)
1 Lithuania	23 (2.8)
Belgium (Flemish)	22 (2.6)
† England	21 (2.9)
Russian Federation	21 (2.3) ▼
Moldova, Rep. of	16 (2.8) ▼
Norway	14 (1.9) ▼
Iran, Islamic Rep. of	13 (1.9) ▼
† Scotland	11 (1.8) ▼
Morocco	10 (2.1) ▼
Philippines	7 (1.7) ▼
Tunisia	7 (1.5) ▼
Armenia	4 (0.9) ▼
Benchmarking Participants	
Indiana State, US	31 (4.2)
Ontario Province, Can.	28 (3.2)
Quebec Province, Can.	22 (2.7)

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

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* The item was answered fully correctly by a majority of students reaching this benchmark.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

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

Exhibit 2.19 TIMSS 2003 Advanced International Benchmark (625) of Science Achievement – Example Item 2

An Item That Students Reaching the Advanced International Benchmark Are Likely to Answer Correctly*

SCIENCE Grade 4

Content Area: Physical Science

Description: Interprets information from a table of physical properties of three materials to identify wood, rock, and iron).

The properties of three materials are compared in the table below. One of the materials is wood, one is rock and one is iron.

Property	Material 1	Material 2	Material 3
Sinks in water?	Yes	No	Yes
Burns easily?	No	Yes	No
Attracted by a magnet?	Yes	No	No

Identify the three materials by filling in the spaces below.

Wood is material number: 2

Rock is material number: 3

Iron is material number: 1

The answer shown illustrates the type of student response that was given full credit.

Country	Percent Full Credit
Singapore	74 (2.3) ▲
Japan	69 (1.6) ▲
† Netherlands	59 (2.7) ▲
† Hong Kong, SAR	58 (2.7) ▲
† England	53 (2.5) ▲
Belgium (Flemish)	52 (2.4) ▲
Chinese Taipei	48 (1.7) ▲
1 Lithuania	45 (2.5) ▲
Cyprus	44 (1.9) ▲
Russian Federation	42 (2.8)
Latvia	42 (2.6)
Italy	41 (2.2)
† Australia	39 (2.8)
† United States	39 (1.7)
International Avg.	38 (0.4)
† Scotland	38 (2.6)
New Zealand	37 (1.9)
Hungary	35 (2.1)
Slovenia	35 (2.4)
Norway	25 (2.0) ▼
Tunisia	15 (1.7) ▼
Armenia	14 (1.6) ▼
Philippines	12 (1.7) ▼
Moldova, Rep. of	9 (1.3) ▼
Iran, Islamic Rep. of	9 (1.4) ▼
Morocco	7 (1.4) ▼
Benchmarking Participants	
Indiana State, US	47 (3.1) ▲
Ontario Province, Can.	43 (2.9)
Quebec Province, Can.	41 (2.5)

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

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* The item was answered fully correctly by a majority of students reaching this benchmark.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

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

Grade 4: Achievement at the High International Benchmark

As detailed in Exhibit 2.20, fourth-grade students reaching the high benchmark were able to apply their knowledge and understanding to explain everyday phenomena. For example, Exhibit 2.21 containing Example Item 3 from earth science shows that when given a diagram showing a variety of landscape features, including mountains, a forest, a desert, a meadow, a river, and the ocean, these fourth-grade students were able to recognize the best location for growing crops. The international average was 57 percent, with students from Japan having the highest achievement (75%) followed by Latvia, the United States, and Hong Kong SAR (70% each).

In the physical sciences, students demonstrated some understanding of physical states. Example Item 4 presented in Exhibit 2.22 shows that students can describe one difference between solids and liquids. Students were given credit if they referred to differences in the arrangement or speed of particles or molecules, to solids having a fixed shape and liquids taking the shape of their container, or to solids being hard and liquids being wet, flowing, runny, or similar. Forty-four percent of the fourth-grade students, on average, internationally, performed this task correctly. England and Singapore had the highest performance, with 74 and 73 percent of students answering correctly.

Exhibit 2.20: **Description of TIMSS 2003 High International Benchmark (550) of Science Achievement**

High International Benchmark – 550

Summary

Students can apply knowledge and understanding to explain everyday phenomena. Students demonstrate some knowledge of Earth structure and processes and the solar system and some understanding of plant structure, life processes, and human biology. They demonstrate some knowledge of physical states, common physical phenomena, and chemical changes. They provide brief descriptions and explanations of some everyday phenomena and compare, contrast, and draw conclusions.

Students demonstrate some knowledge of Earth structure and processes and the solar system. They identify the Earth, Moon, and Sun from a diagram and can interpret a pictorial diagram of the angle/length of shadows cast by sunlight at different times of day. They explain that when moist air becomes very cold, water in the air may condense or freeze, and early-morning moisture can be due to condensation. From a diagram showing a variety of landscape features, they recognize the best location for growing crops.

Students demonstrate some understanding of plant structure and life processes. They can explain why plants are living things and can state one thing apart from light and water that plants need to grow well. They can infer from a picture how a plant's seeds are spread. They also compare and contrast different animals, including distinguishing plant eaters and meat eaters by their teeth and fish and sea mammals by their physical features and behaviors. Students demonstrate some understanding of human biology. For example, they can state one thing that can cause the temperature of the human body to be higher than normal, and can recognize that sensory messages are interpreted in the brain and that exercise causes an increase in breathing and pulse rates.

In the physical sciences, students demonstrate some understanding of physical states, common physical phenomena, and chemical changes. They describe changes in matter, such as how a liquid can be turned into a solid or gas, and can state one difference between solids and liquids. From a diagram, they recognize the direction of heat transfer along a metal ruler and that ice melts most slowly in a closed container. They recognize that more sugar will dissolve in hot water and that metal conducts heat better than wood. They can infer the color of a light bulb from the apparent color of a red shirt. They recognize that gravity causes objects to fall to the ground, and from a diagram showing a person blowing into water using straw, can explain why bubbles rise to the top. From a diagram showing powders, students recognize those likely to be mixtures.

Students provide brief descriptive responses combining knowledge of science concepts with information from everyday experience of physical and life processes (e.g., early morning moisture can be due to condensation, liquid can be converted to a gas by heating, and seeds can be spread by wind). Students can compare, contrast, and draw conclusions (e.g., the structure of teeth from plant eaters and meat eaters, the physical features or behaviors distinguishing fish from sea mammals).

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

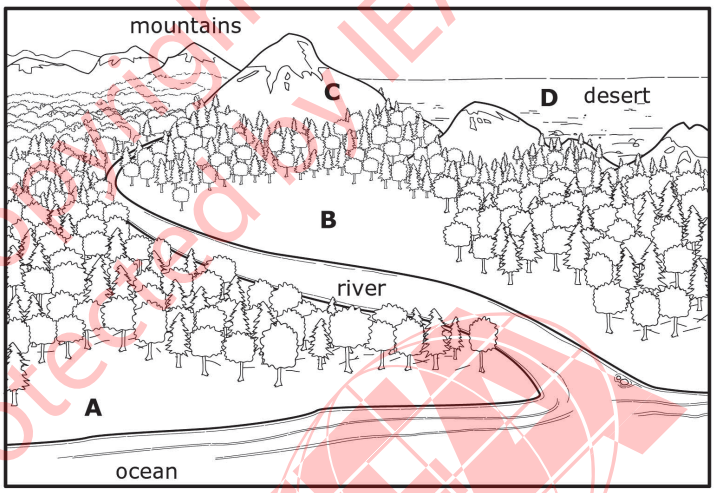
Exhibit 2.21: TIMSS 2003 High International Benchmark (550) of Science Achievement – Example Item 3

An Item That Students Reaching the High International Benchmark Are Likely to Answer Correctly*

SCIENCE Grade 4

Content Area: Earth Science

Description: From a diagram showing a variety of landscape features, recognizes the best location for growing crops.



Look at the picture above. Where is the best location to grow crops?

Ⓐ Location A

● Location B

Ⓒ Location C

Ⓓ Location D

Country	Percent Full Credit	
Japan	75 (1.6)	▲
Latvia	70 (1.9)	▲
† United States	70 (1.1)	▲
† Hong Kong, SAR	70 (2.0)	▲
1 Lithuania	69 (1.8)	▲
† Netherlands	69 (2.2)	▲
Hungary	69 (2.2)	▲
† England	69 (2.0)	▲
† Scotland	68 (2.0)	▲
Italy	68 (2.0)	▲
Chinese Taipei	67 (1.9)	▲
† Australia	66 (2.5)	▲
Norway	63 (2.3)	▲
New Zealand	63 (2.3)	▲
Russian Federation	63 (2.5)	▲
Singapore	62 (2.0)	▲
Cyprus	59 (2.2)	
International Avg.	57 (0.4)	
Slovenia	56 (2.5)	
Moldova, Rep. of	54 (3.0)	
Belgium (Flemish)	44 (2.2)	▼
Armenia	34 (2.3)	▼
Iran, Islamic Rep. of	32 (2.4)	▼
Morocco	27 (2.0)	▼
Philippines	24 (2.2)	▼
Tunisia	22 (1.6)	▼
Benchmarking Participants		
Indiana State, US	75 (2.3)	▲
Ontario Province, Can.	71 (2.4)	▲
Quebec Province, Can.	66 (2.4)	▲

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

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* The item was answered correctly by a majority of students reaching this benchmark.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

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

Exhibit 2.22: TIMSS 2003 High International Benchmark (550) of Science Achievement – Example Item 4

An Item That Students Reaching the High International Benchmark Are Likely to Answer Correctly*

SCIENCE Grade 4

Content Area: Physical Science

Description: Describes one difference between solids and liquids.

Describe one difference between solids and liquids.

In solids, molecules are packed together. In liquids they are more spread.

The answer shown illustrates the type of student response that was given full credit.

Country	Percent Full Credit	
† England	74 (2.2)	▲
Singapore	73 (2.0)	▲
† United States	67 (1.6)	▲
Chinese Taipei	66 (1.8)	▲
† Australia	64 (2.1)	▲
Hungary	64 (2.0)	▲
New Zealand	62 (2.2)	▲
Japan	59 (1.8)	▲
† Scotland	57 (2.1)	▲
† Hong Kong, SAR	56 (2.3)	▲
Italy	55 (2.1)	▲
Slovenia	51 (2.6)	▲
Russian Federation	49 (2.5)	▲
International Avg.	44 (0.4)	
Latvia	44 (2.5)	
Cyprus	41 (2.1)	
Moldova, Rep. of	37 (2.2)	▼
Belgium (Flemish)	32 (1.8)	▼
1 Lithuania	30 (1.6)	▼
Iran, Islamic Rep. of	29 (2.5)	▼
Philippines	22 (3.2)	▼
† Netherlands	21 (2.2)	▼
Armenia	21 (1.7)	▼
Norway	16 (2.0)	▼
Tunisia	11 (1.5)	▼
Morocco	8 (1.4)	▼
Benchmarking Participants		
Indiana State, US	71 (2.7)	▲
Ontario Province, Can.	70 (1.9)	▲
Quebec Province, Can.	51 (1.9)	▲

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

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* The item was answered fully correctly by a majority of students reaching this benchmark.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

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

Grade 4: Achievement at the Intermediate International Benchmark

Exhibit 2.23 presents the description of student achievement at the intermediate benchmark. At this benchmark, fourth-grade students could apply basic knowledge and understanding to practical situations in the sciences. In physical science, students showed some understanding of familiar physical phenomena, states, and changes. For example, as illustrated by Example Item 5 in Exhibit 2.24, when presented with a diagram depicting four identical burning candles each covered by a glass container of different size, students recognized that the candle in the largest container will be the last to go out. Sixty-six percent of the fourth-grade students, on average, internationally, answered the question correctly. Eighty percent or more answered correctly in Cyprus, Singapore, the Netherlands, and Hong Kong SAR.

In life science, the fourth-grade students demonstrated knowledge of some basic facts related to human biology and health. For example, as shown in Example Item 6 in Exhibit 2.25, when shown a diagram depicting six different organisms (a human, a frog, a dog, a whale, a butterfly, and a bird) students could classify them according to how they produce their young - those that give birth and those that lay eggs. Students correctly classifying all six organisms achieved full credit on this item, while those misclassifying no more than two earned partial credit. On average, internationally, 58 percent of fourth-grade students received full credit, with highest performance in Singapore (84%), the United States (76%), New Zealand (74%), the Netherlands (73%), and Australia (72%).

Exhibit 2.23: **Description of TIMSS 2003 Intermediate International Benchmark (475) of Science Achievement**

Intermediate International Benchmark – 475

Summary

Students can apply basic knowledge and understanding to practical situations in the sciences. Students demonstrate knowledge of some basic facts about Earth's features and processes and the solar system. They recognize some basic information about human biology and health and show some understanding of development and life cycles of organisms. They know some basic facts about familiar physical phenomena, states, and changes. They apply factual knowledge to practical situations, interpret pictorial diagrams, and combine information to draw conclusions.

Students know some basic facts about Earth's features and processes and the solar system. They can state one difference between the Sun and the Moon and one difference between two previously named seasons. They recognize the effect of rock hardness on abrasion and can recognize from its shape and size which rock has been carried furthest down a river. They also recognize that most of Earth's surface is covered by water, and that the water in the ocean is salty. They know that fossils are found in rocks, and that minerals come from rocks. Students recognize the effect of wind strength on a ribbon attached to a pole and can state two different uses humans have for wood.

In life science, students demonstrate knowledge of some basic facts related to human biology and health. For example, they recognize that a person's hair type can be predicted by parental hair type, and that excess food is stored as fat. They can state one thing that may happen to the body if not protected from the Sun. Students demonstrate some knowledge of the diversity, structure and habitats of animal life. For example, they recognize from pictorial diagrams the bird most likely to eat mammals, and the type of plants usually found in a tropical rain forest. They show some understanding of development and life cycles of organisms, including knowing that snakes shed their outer covering as they grow larger and classifying common organisms into those that give birth and those that lay eggs. From a list of common items, students can distinguish between living and non-living things. They can interpret from a food chain diagram that snakes eat voles and that tadpoles eat plants. They know that trees make their own food using sunlight, and can recognize from pictures of two types of seeds that they are scattered by the wind. They combine information from a plan of a garden and a diagram showing plants and their light requirements to explain why roses do not grow well under an oak tree.

Students show some understanding of familiar physical phenomena, states, and changes. They recognize that all objects have mass and that copper is a good heat conductor. They can state two uses of electricity in daily life. They recognize the state of a material from the shape it takes when transferred from a smaller to a larger container. Students can state one way that water in ice and liquid forms is used by humans. They recognize that salt water is a mixture, and can identify an object that is made of metal. They recognize that soap bubbles contain air. They can infer the color of a white shirt under a blue light. They recall that plant matter (apple core) will decay faster than other given substances. They can identify materials that burn, and from diagrams of candles in sealed containers, can identify the candle in the largest container as the last to go out.

Students apply factual knowledge to practical situations (e.g., recognize that excess food is stored as fat) and demonstrate some ability to interpret information in pictorial diagrams to reason to a conclusion (e.g., interpreting diagrams showing rocks of different shapes and sizes to identify the rock carried furthest down a river). They can also combine information from two sources to draw a conclusion (e.g., planning a garden).

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 2.24: TIMSS 2003 Intermediate International Benchmark (475) of Science Achievement – Example Item 5

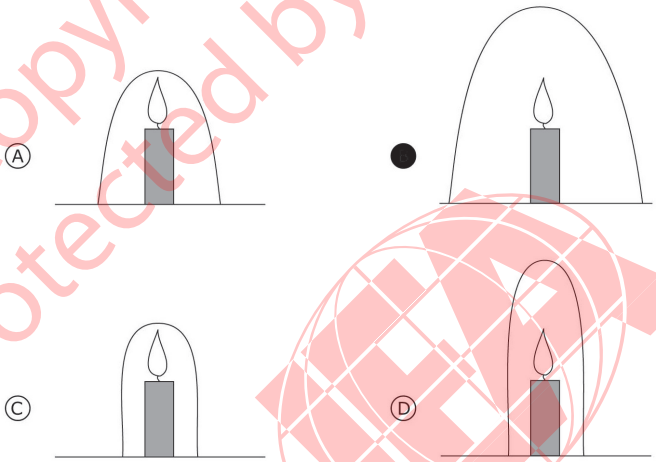
An Item That Students Reaching the Intermediate International Benchmark Are Likely to Answer Correctly*

SCIENCE Grade 4

Content Area: Physical Science

Description: Recognizes that a candle in the largest sealed container will be the last to go out.

The pictures below show four identical burning candles. Each is covered by a glass container of a different size. Which candle flame will be the last to go out?



Country	Percent Full Credit	
Cyprus	81 (2.0)	▲
Singapore	81 (2.4)	▲
† Netherlands	81 (2.8)	▲
† Hong Kong, SAR	80 (2.0)	▲
Hungary	79 (2.6)	▲
Latvia	78 (2.4)	▲
Belgium (Flemish)	78 (2.3)	▲
Chinese Taipei	75 (2.1)	▲
Italy	74 (2.7)	▲
Slovenia	73 (3.9)	
† United States	72 (1.8)	▲
1 Lithuania	71 (2.7)	
† England	69 (3.4)	
Norway	68 (2.7)	
International Avg.	66 (0.6)	
Russian Federation	66 (2.6)	
† Australia	66 (3.1)	
† Scotland	65 (2.6)	
New Zealand	63 (2.9)	
Moldova, Rep. of	61 (3.0)	
Armenia	55 (3.0)	▼
Iran, Islamic Rep. of	52 (3.8)	▼
Japan	51 (3.0)	▼
Philippines	47 (2.9)	▼
Morocco	34 (3.5)	▼
Tunisia	30 (2.8)	▼
Benchmarking Participants		
Indiana State, US	75 (3.1)	▲
Ontario Province, Can.	72 (3.3)	
Quebec Province, Can.	67 (2.7)	

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

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* The item was answered correctly by a majority of students reaching this benchmark.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

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

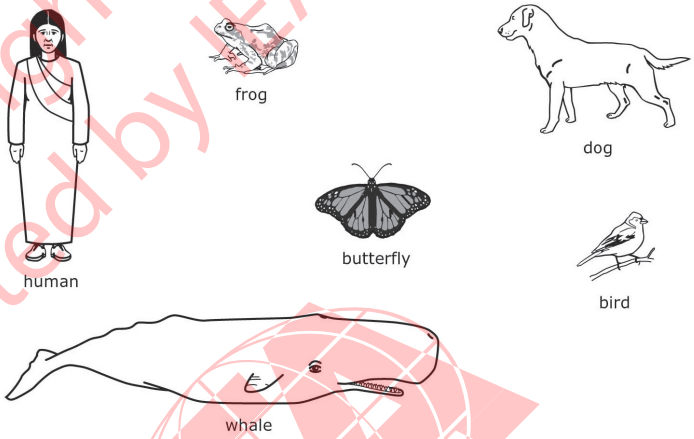
Exhibit 2.25: TIMSS 2003 Intermediate International Benchmark (475) of Science Achievement – Example Item 6

An Item That Students Reaching the Intermediate International Benchmark Are Likely to Answer Correctly*

SCIENCE Grade 4

Content Area: Life Science

Description: Given a diagram of six organisms, classifies them into those that give birth and those that lay eggs.



Some of the organisms shown above give birth to young that develop inside the mother. Some of the organisms have young that hatch from eggs that are laid outside the mother.

In the table below, write down the names of the organisms that belong to each group.

Organisms that give birth	Organisms that lay eggs
Human Dog Whale	Frog Butterfly Bird

The answer shown illustrates the type of student response that was given full credit.

Country	Percent Full Credit
Singapore	84 (1.3) ▲
† United States	76 (1.1) ▲
New Zealand	74 (1.9) ▲
† Netherlands	73 (2.5) ▲
† Australia	72 (2.6) ▲
† England	67 (2.0) ▲
Japan	67 (1.8) ▲
Italy	64 (2.5) ▲
Belgium (Flemish)	63 (2.2) ▲
Russian Federation	63 (2.7) ▲
Latvia	62 (2.1) ▲
Hungary	62 (2.0) ▲
1 Lithuania	60 (1.9)
† Scotland	59 (2.1)
Norway	58 (1.7)
† Hong Kong, SAR	58 (2.3)
International Avg.	58 (0.4)
Cyprus	54 (2.1)
Chinese Taipei	53 (1.9) ▼
Slovenia	52 (2.4) ▼
Moldova, Rep. of	51 (2.3) ▼
Armenia	46 (2.8) ▼
Philippines	41 (2.4) ▼
Iran, Islamic Rep. of	35 (2.5) ▼
Morocco	23 (2.3) ▼
Tunisia	19 (1.5) ▼
Benchmarking Participants	
Indiana State, US	80 (1.7) ▲
Ontario Province, Can.	70 (2.6) ▲
Quebec Province, Can.	67 (2.2) ▲

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

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* The item was answered fully correctly by a majority of students reaching this benchmark.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

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

Grade 4: Achievement at the Low International Benchmark

As can be seen from the description presented in Exhibit 2.26, fourth-grade students reaching the low international benchmark have some elementary knowledge of the earth, life, and physical sciences. As an example from life science (Example Item 7 in Exhibit 2.27), students could identify insects from a diagram by the presence of six legs. This item was answered correctly by most students (81 percent on average, internationally) and by more than 90 percent in Lithuania, Singapore, Japan, Italy, the Russian Federation, the United States, and Norway.

Students reaching the low benchmark showed familiarity with everyday physical phenomena. For example, as shown in Example Item 8 in Exhibit 2.28, students recognized that the weight of an object is independent of its orientation on a weighing scale. Almost three-fourths (72%), on average, internationally, recognized that an object would weigh the same regardless of how it was placed on the scale. More than 80 percent of the fourth-grade students in Lithuania, Moldova, the Russian Federation, Slovenia, Chinese Taipei, and Latvia answered this question correctly.

Exhibit 2.26: **Description of TIMSS 2003 Low International Benchmark (400) of Science Achievement**

Low International Benchmark – 400

Summary

Students have some elementary knowledge of the earth, life, and physical sciences. Students recognize simple facts presented in everyday language and context about Earth's physical features, the seasons, the solar system, human biology, and the development and characteristics of animals and plants. They recognize facts about a range of familiar physical phenomena – rainbows, magnets, electricity, boiling, floating, and dissolving. They interpret labeled pictures and simple pictorial diagrams and provide short written responses to questions requiring factual information.

Students know some elementary facts about Earth's physical features, seasons, and the solar system. They identify oxygen as the gas in the air needed for breathing, can explain why people should not drink water directly from the oceans, and recognize the hottest of Earth's layers. They know that the Sun is hotter than the Earth, the Moon, or Mars, that the Earth moves around the Sun, and can state the names of two seasons.

In life science, students demonstrate knowledge of some simple facts related to human biology. They recognize that air enters the lungs, that washing hands prevents illness by removing germs, which teeth are used for grinding, and that rice is edible and cotton is not. They also demonstrate some knowledge of animal development and structure. For example, they recognize that tadpoles hatch from frogs' eggs, that the larval form of a butterfly, that fat layers help keep animals warm, and that birds sit on their eggs to keep them warm. They recognize wings as being common to birds, bats, and butterflies, which foot structure belongs to a bird that lives on water, and can identify insects by the presence of six legs. Given lists of familiar animals, students can identify those that exhibit specified characteristics, such as eating only plants, eating only animals, and not laying eggs. From pictorial diagrams, students identify an animal that lives in the desert and the root as the plant part that takes in water. They can communicate an effect of environmental change (temperature) on aquatic life.

Students are familiar with some everyday physical phenomena, for example, sunlight and rain are required to produce rainbows, water changes into vapor during boiling, and sugar dissolves in water. From a diagram, they can identify the heaviest floating object, and recognize that the weight of an object does not depend on how it is placed on a scale. They recognize that magnets attract iron and that iron nails rust. In addition, students recognize that an iron nail can complete an electrical circuit to allow a bulb to light, and given diagrams showing a light bulb connected to a battery, recognize in which one the bulb will light.

Students interpret labeled pictures and simple diagrams (e.g., plant parts, stages of development of animals, simple electrical circuit) and provide short written responses to questions requiring factual information (e.g., an example of temperature change on aquatic life).

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 2.27: TIMSS 2003 Low International Benchmark (400) of Science Achievement – Example Item 7

An Item That Students Reaching the Low International Benchmark Are Likely to Answer Correctly*

SCIENCE Grade 4

Content Area: Life Science

Description: Given a diagram, recognizes insects by presence of six legs.

Which of these are insects?

● 1 and 3 only

Ⓑ 1 and 4 only

Ⓒ 2 and 4 only

Ⓓ 3 and 4 only

Country	Percent Full Credit	
[1] Lithuania	94 (1.1)	▲
Singapore	92 (1.0)	▲
Japan	91 (1.1)	▲
Italy	91 (1.1)	▲
Russian Federation	91 (1.2)	▲
† United States	91 (0.8)	▲
Norway	90 (1.3)	▲
Chinese Taipei	89 (1.2)	▲
Belgium (Flemish)	89 (1.4)	▲
† Netherlands	89 (1.6)	▲
† Australia	88 (1.6)	▲
Hungary	86 (1.5)	▲
† England	86 (1.6)	▲
Cyprus	85 (1.7)	▲
New Zealand	85 (1.5)	▲
Moldova, Rep. of	85 (1.5)	▲
Latvia	84 (1.6)	▲
† Scotland	83 (1.5)	
International Avg.	81 (0.3)	
† Hong Kong, SAR	81 (1.5)	
Slovenia	79 (1.7)	
Iran, Islamic Rep. of	76 (2.0)	▼
Philippines	64 (2.0)	▼
Armenia	59 (2.7)	▼
Tunisia	49 (2.1)	▼
Morocco	35 (2.4)	▼
Benchmarking Participants		
Indiana State, US	92 (1.6)	▲
Ontario Province, Can.	89 (1.4)	▲
Quebec Province, Can.	88 (1.3)	▲

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

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* The item was answered correctly by a majority of students reaching this benchmark.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

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

Exhibit 2.28: TIMSS 2003 Low International Benchmark (400) of Science Achievement – Example Item 8

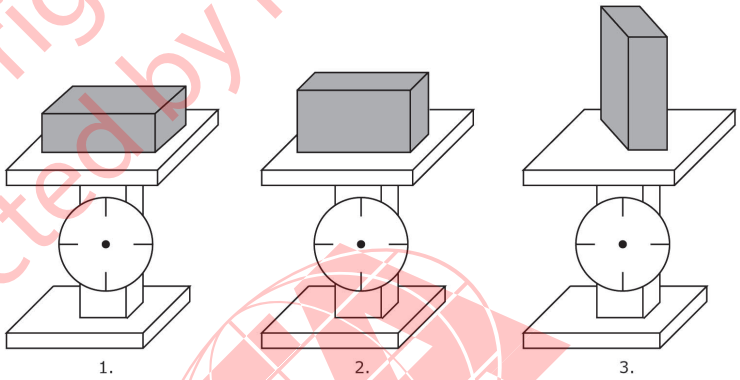
An Item That Students Reaching the Low International Benchmark Are Likely to Answer Correctly*

SCIENCE Grade 4

Content Area: Physical Science

Description: Recognizes that the weight of an object does not change depending on its orientation on a scale.

The same brick is put on a scale in three different ways.



What will the scale show?

Ⓐ 1 will show the greatest weight.

Ⓑ 2 will show the greatest weight.

Ⓒ 3 will show the greatest weight.

● All will show the same weight.

Country	Percent Full Credit	
[1] Lithuania	88 (1.4)	▲
Moldova, Rep. of	87 (1.7)	▲
Russian Federation	86 (1.5)	▲
Slovenia	85 (1.8)	▲
Chinese Taipei	85 (1.4)	▲
Latvia	84 (2.0)	▲
Singapore	79 (1.3)	▲
Hungary	79 (1.8)	▲
Italy	78 (2.0)	▲
† England	76 (1.7)	▲
Armenia	74 (2.6)	
† Netherlands	74 (2.3)	
† Australia	74 (2.3)	
Belgium (Flemish)	73 (1.7)	
† United States	73 (1.2)	
International Avg.	72 (0.4)	
Iran, Islamic Rep. of	72 (2.2)	
† Hong Kong, SAR	69 (2.1)	
† Scotland	68 (2.0)	▼
Japan	66 (2.0)	▼
New Zealand	66 (1.6)	▼
Cyprus	63 (2.3)	▼
Norway	54 (2.2)	▼
Morocco	54 (2.8)	▼
Philippines	52 (2.3)	▼
Tunisia	45 (2.3)	▼
Benchmarking Participants		
Indiana State, US	78 (2.5)	▲
Ontario Province, Can.	68 (2.3)	
Quebec Province, Can.	65 (2.1)	▼

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

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* The item was answered correctly by a majority of students reaching this benchmark.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

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

What Issues Emerge from the Benchmark Descriptions?

At both grades, the benchmark descriptions and example items strongly suggest a gradation in achievement, from the top-performing students' ability to grasp complex and abstract science concepts, apply knowledge to solve problems, and understand the fundamentals of scientific investigation to the lower-performing students' recognition of basic facts and familiarity with everyday physical phenomena. Basic scientific inquiry skills were not demonstrated until the upper benchmarks, indicating that science curricula in many countries may not be placing much emphasis on scientific investigation at fourth or eighth grades.

In looking across the item-level results, it also is important to note the variation in performance across the topics covered. For example, on just the few items (16) presented in this chapter, there was a substantial range in performance for many countries. While some countries consistently registered high or low performance, and others had results consistently near the international average, a number of countries performed significantly above the international average on at least one item, and significantly below the international average on at least one item. Such results may reflect intended differences in emphasis in national curricula. It is likely, however, that such results may be unintended, and the findings will provide important information about strengths and weaknesses in intended or implemented curricula. At the very least, an in-depth examination of the TIMSS 2003 results may reveal aspects of curricula that merit further investigation.

3

Chapter 3

Average Achievement in the Science Content Areas

Chapter 3 presents results by the major content areas in science to provide information about the possible effects of curricular variation on average achievement. Average performance is provided for five content areas at the eighth grade: life science, chemistry, physics, earth science, and environmental science, and for three at the fourth grade: life science, physical science, and earth science. Relative achievement is shown among the content areas for each country and results are presented by gender. Trends from 1999 are shown for the eighth grade (insufficient items are available from 1995 to report trends within content areas).

The TIMSS 2003 science assessments at the eighth and fourth grades were designed to allow as fair comparisons as possible among participating countries. Considerable effort was devoted to updating the science framework newly published in the *TIMSS Assessment Frameworks and Specifications 2003*.[1] IEA gratefully acknowledges the generous support of the US National Science Foundation in helping to fund this work, which took about two years, including a special international expert panel, iterative reviews by the NRCs, and a curriculum questionnaire completed by the countries. The effort focused on specifying

1 Mullis, I.V.S., Martin, M.O., Smith, T.A., Garden, R.A., Gregory, K.D., Gonzalez, E.J., Chrostowski, S..J, and O'Connor, K.M. (2003), *TIMSS Assessment Frameworks and Specifications 2003 (2nd Edition)*, Chestnut Hill, MA: Boston College. Please see Appendix A for more information about the framework and test development process.

the particular topics and subtopics to be assessed at each grade within each content area. Following on the framework development, also with additional funding from the US National Science Foundation, an enormous, collaborative test development effort involving the participating countries occurred at both grades to reflect the framework and its new emphasis on problem solving and inquiry. Nevertheless, curriculum data collected as part of TIMSS[2] indicate differences in the grade level at which particular topics are introduced and in the teaching emphases given some topics. In addition, within countries there can be variation among teachers in the relative emphasis given particular topics.

The TIMSS 2003 science tests were designed to enable reporting by five content areas in accordance with the TIMSS science framework. These areas, with their main topics, are:

Life science

1. Types, characteristics, and classification of living things
2. Structure, function, and life processes in organisms
3. Cells and their functions
4. Development and life cycles of organisms
5. Reproduction and heredity
6. Diversity, adaptation, and natural selection
7. Ecosystems
8. Human health.

At grade 4, cells and their functions is not included.

Chemistry

1. Classification and composition of matter
2. Particulate structure of matter
3. Properties and uses of water

2 Chapter 5 contains information about the official curriculum in each country as well as teachers' reports about the topics students have been taught. Appendix C provides an analysis of the match between the test and curriculum in different TIMSS 2003 countries and the effect of this match on the results.

4. Acids and bases
5. Chemical change.

At grade 4, chemistry is not reported separately, but combined with physics as physical science. At this grade level, the particulate structure of matter and acids and bases are not included.

Physics

1. Physical states and changes in matter
2. Energy types, sources, and conversions
3. Heat and temperature
4. Light
5. Sound and vibration
6. Electricity and magnetism
7. Forces and motion.

At grade 4, physics is not reported separately, but combined with chemistry as physical science. At this grade level, sound and vibration is not included.

Earth science

1. Earth's structure and physical features
2. Earth's processes, cycles, and history
3. Earth in the solar system and the universe.

Environmental science

1. Changes in population
2. Use and conservation of natural resources
3. Changes in environments.

Environmental science is not assessed at grade 4. However, there were a few items in the fourth-grade assessment that addressed the use and conservation of natural resources and changes in environments. These were reported as part of life science.

How Does Achievement Differ Across Science Content Areas?

Exhibit 3.1 presents average achievement in each of the five science content areas at the eighth grade and in the three content areas at the fourth grade. Countries are displayed in alphabetical order, and symbols indicate whether a country's performance is statistically significantly above or below the international average. To provide a basis of comparison for the performance of each country in each content area, the international average for each content area was scaled to be 474, the same as the overall international average.

At both grades, the countries scoring highest in the overall science assessment tended also to be the highest-scoring countries (though not always in the same rank order) in each of the major content areas. Correspondingly, countries scoring lowest on the overall test tended to have low average performance across all content areas.

At the eighth grade, the differences in average achievement between the highest- and lowest-performing countries were greatest for physics (340 scale-score points), next for life science (319), then earth science (311), chemistry (308), and environmental science (307). In contrast to the consistency in performance across content areas displayed by the higher- and lower-performing countries overall, performance varied substantially for some middle-performing countries. For example, Bulgaria performed significantly above the international average in physics and earth science, below average in environmental science, and about the international average in life science and chemistry.

At the fourth grade with fewer and less variable countries, the differences in achievement within the content areas were smaller between the highest- and lowest-performing countries. The largest

Exhibit 3.1: Average Achievement in Science Content Areas

SCIENCE Grade 8

Countries	Average Scale Scores for Science Content Areas									
	Life Science		Chemistry		Physics		Earth Science		Environmental Science	
Armenia	453 (3.3)	▼	466 (4.2)	▼	479 (3.2)		460 (3.7)	▼	417 (4.4)	▼
Australia	532 (3.8)	▲	506 (3.8)	▲	521 (3.7)	▲	531 (4.2)	▲	536 (3.4)	▲
Bahrain	445 (1.9)	▼	441 (2.6)	▼	443 (2.0)	▼	440 (2.4)	▼	439 (3.1)	▼
Belgium (Flemish)	526 (2.4)	▲	503 (2.0)	▲	514 (2.5)	▲	508 (2.5)	▲	523 (2.7)	▲
Botswana	370 (2.7)	▼	348 (3.1)	▼	371 (3.2)	▼	361 (3.1)	▼	381 (3.3)	▼
Bulgaria	474 (5.2)		482 (5.7)		485 (5.0)	▲	491 (4.9)	▲	464 (5.0)	▼
Chile	427 (2.7)	▼	405 (3.3)	▼	401 (3.1)	▼	435 (3.1)	▼	436 (2.9)	▼
Chinese Taipei	563 (3.1)	▲	584 (4.0)	▲	569 (3.3)	▲	548 (3.1)	▲	560 (3.1)	▲
Cyprus	437 (2.2)	▼	443 (2.6)	▼	450 (1.7)	▼	447 (2.1)	▼	441 (2.3)	▼
Egypt	425 (3.7)	▼	442 (3.8)	▼	414 (4.1)	▼	403 (4.4)	▼	430 (4.0)	▼
Estonia	547 (2.4)	▲	552 (2.1)	▲	544 (2.4)	▲	558 (2.9)	▲	540 (2.2)	▲
Ghana	256 (5.6)	▼	276 (6.6)	▼	239 (5.4)	▼	254 (5.6)	▼	267 (6.2)	▼
† Hong Kong, SAR	551 (2.9)	▲	542 (2.6)	▲	555 (2.8)	▲	549 (2.9)	▲	555 (2.6)	▲
Hungary	536 (2.7)	▲	560 (3.1)	▲	536 (2.7)	▲	537 (3.1)	▲	528 (2.9)	▲
1 Indonesia	424 (3.9)	▼	391 (3.8)	▼	430 (4.0)	▼	431 (3.8)	▼	454 (3.4)	▼
Iran, Islamic Rep. of	447 (2.6)	▼	445 (2.7)	▼	445 (3.0)	▼	468 (2.9)	▼	487 (2.1)	▲
2 Israel	491 (3.0)	▲	499 (3.4)	▲	484 (2.9)	▲	485 (3.0)	▲	486 (2.9)	▲
Italy	498 (3.2)	▲	487 (3.3)	▲	470 (3.2)		513 (3.2)	▲	497 (3.0)	▲
Japan	549 (2.0)	▲	552 (2.1)	▲	564 (1.9)	▲	530 (2.1)	▲	537 (2.0)	▲
Jordan	475 (4.0)		478 (4.4)		465 (3.8)	▼	472 (4.0)		492 (3.2)	▲
◆◆ Korea, Rep. of	558 (1.6)	▲	529 (2.5)	▲	579 (1.6)	▲	540 (1.9)	▲	544 (1.4)	▲
Latvia	511 (2.5)	▲	514 (3.2)	▲	512 (2.4)	▲	514 (2.8)	▲	508 (3.3)	▲
Lebanon	360 (5.0)	▼	433 (4.9)	▼	419 (4.0)	▼	395 (4.0)	▼	374 (5.1)	▼
1 Lithuania	517 (2.4)	▲	534 (2.3)	▲	519 (2.7)	▲	512 (2.7)	▲	507 (2.0)	▲
2 Macedonia, Rep. of	448 (3.8)	▼	467 (3.9)	▼	458 (3.1)	▼	440 (4.3)	▼	442 (3.7)	▼
Malaysia	504 (3.7)	▲	514 (3.8)	▲	519 (3.6)	▲	502 (3.8)	▲	513 (3.2)	▲
Moldova, Rep. of	466 (3.7)	▼	479 (3.9)		479 (3.7)		475 (4.0)		454 (3.8)	▼
1 ‡ Morocco	390 (2.6)	▼	402 (2.7)	▼	410 (2.7)	▼	397 (3.4)	▼	396 (3.3)	▼
† Netherlands	536 (3.3)	▲	514 (2.6)	▲	538 (3.4)	▲	534 (3.2)	▲	539 (2.8)	▲
New Zealand	523 (5.1)	▲	501 (5.6)	▲	515 (4.7)	▲	525 (4.8)	▲	525 (3.9)	▲
Norway	496 (2.5)	▲	485 (3.0)	▲	488 (2.6)	▲	517 (2.7)	▲	496 (2.2)	▲
Palestinian Nat'l Auth.	435 (3.6)	▼	444 (3.9)	▼	432 (3.6)	▼	439 (3.0)	▼	444 (3.7)	▼
Philippines	387 (5.8)	▼	342 (6.1)	▼	380 (4.7)	▼	377 (5.7)	▼	403 (5.4)	▼
Romania	471 (4.8)		474 (4.9)		473 (4.1)		469 (5.2)		472 (4.7)	
Russian Federation	514 (3.3)	▲	527 (4.0)	▲	511 (3.4)	▲	518 (3.3)	▲	491 (3.2)	▲
Saudi Arabia	412 (3.9)	▼	382 (4.8)	▼	394 (3.9)	▼	394 (4.0)	▼	410 (3.8)	▼
† Scotland	512 (3.3)	▲	499 (3.2)	▲	515 (3.0)	▲	515 (3.8)	▲	511 (3.5)	▲
1 Serbia	468 (2.6)	▼	474 (3.2)		471 (2.6)		471 (3.0)		457 (2.4)	▼
Singapore	569 (4.0)	▲	582 (4.2)	▲	579 (3.4)	▲	549 (3.9)	▲	568 (3.8)	▲
Slovak Republic	514 (2.9)	▲	519 (3.6)	▲	519 (2.9)	▲	523 (3.3)	▲	509 (2.8)	▲
Slovenia	521 (2.2)	▲	532 (2.6)	▲	509 (1.8)	▲	523 (2.2)	▲	515 (2.2)	▲
South Africa	250 (6.0)	▼	285 (5.9)	▼	244 (6.2)	▼	247 (6.3)	▼	261 (6.6)	▼
Sweden	528 (2.7)	▲	526 (2.6)	▲	525 (2.9)	▲	532 (3.3)	▲	499 (2.6)	▲
Tunisia	417 (2.0)	▼	413 (2.5)	▼	386 (2.5)	▼	408 (2.0)	▼	436 (2.2)	▼
‡ United States	537 (3.0)	▲	513 (3.2)	▲	515 (2.9)	▲	532 (2.9)	▲	533 (2.9)	▲
‡ England	543 (3.9)	▲	527 (4.2)	▲	545 (3.5)	▲	544 (4.1)	▲	540 (4.2)	▲
International Avg.	474 (0.5)		474 (0.5)		474 (0.5)		474 (0.5)		474 (0.5)	
Benchmarking Participants										
Basque Country, Spain	492 (2.6)	▲	472 (3.1)		483 (3.4)	▲	506 (2.9)	▲	494 (2.7)	▲
Indiana State, US	540 (4.5)	▲	516 (5.4)	▲	516 (4.4)	▲	536 (5.2)	▲	538 (4.0)	▲
Ontario Province, Can.	537 (2.9)	▲	507 (3.0)	▲	530 (3.1)	▲	533 (3.2)	▲	542 (2.4)	▲
Quebec Province, Can.	525 (3.2)	▲	517 (2.8)	▲	524 (2.6)	▲	550 (2.8)	▲	531 (2.9)	▲

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

2 National Defined Population covers less than 90% of National Desired Population (see Exhibit A.6).

◆◆ Korea tested the same cohort of students as other countries, but later in 2003, at the beginning of the next school year.

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

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 3.1 Average Achievement in Science Content Areas

Countries	Average Scale Scores for Science Content Areas		
	Life Science	Physical Science	Earth Science
Armenia	435 (4.4) ▼	429 (4.3) ▼	450 (3.6) ▼
† Australia	523 (3.8) ▲	518 (3.9) ▲	518 (4.1) ▲
Belgium (Flemish)	524 (1.7) ▲	507 (2.3) ▲	522 (1.7) ▲
Chinese Taipei	540 (1.6) ▲	554 (2.0) ▲	559 (2.6) ▲
Cyprus	482 (2.1) ▼	479 (2.3) ▼	487 (2.5)
† England	532 (3.1) ▲	546 (3.2) ▲	535 (3.5) ▲
† Hong Kong, SAR	535 (2.6) ▲	548 (2.7) ▲	536 (2.7) ▲
Hungary	536 (2.5) ▲	526 (2.7) ▲	526 (3.7) ▲
Iran, Islamic Rep. of	424 (4.6) ▼	419 (4.5) ▼	428 (3.0) ▼
Italy	521 (3.5) ▲	512 (3.5) ▲	519 (3.7) ▲
Japan	530 (1.3) ▲	557 (1.7) ▲	535 (1.9) ▲
Latvia	531 (2.3) ▲	532 (2.6) ▲	534 (2.9) ▲
1 Lithuania	516 (2.0) ▲	512 (2.5) ▲	503 (3.2) ▲
Moldova, Rep. of	504 (3.9) ▲	489 (3.9)	505 (4.9) ▲
Morocco	300 (6.1) ▼	308 (7.0) ▼	311 (6.1) ▼
† Netherlands	547 (1.8) ▲	505 (1.9) ▲	503 (2.3) ▲
New Zealand	520 (2.3) ▲	516 (2.3) ▲	522 (2.3) ▲
Norway	480 (2.2) ▼	456 (2.3) ▼	473 (2.8) ▼
Philippines	330 (9.0) ▼	343 (9.6) ▼	324 (9.2) ▼
Russian Federation	526 (4.7) ▲	527 (5.2) ▲	527 (6.0) ▲
† Scotland	506 (3.1) ▲	503 (2.6) ▲	498 (2.6) ▲
Singapore	558 (5.0) ▲	577 (5.9) ▲	538 (5.2) ▲
Slovenia	489 (2.9)	497 (2.3) ▲	490 (2.7)
Tunisia	290 (5.9) ▼	324 (5.3) ▼	336 (4.8) ▼
† United States	537 (2.2) ▲	531 (2.3) ▲	535 (2.5) ▲
International Avg.	489 (0.7)	489 (0.8)	489 (0.8)
Benchmarking Participants			
Indiana State, US	554 (2.9) ▲	546 (3.5) ▲	552 (3.6) ▲
Ontario Province, Can.	541 (3.6) ▲	537 (3.5) ▲	539 (3.8) ▲
Quebec Province, Can.	503 (2.2) ▲	497 (2.4) ▲	507 (2.7) ▲

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

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

difference – 269 scale-score points – was in physical science. For the other two content areas, the differences were 268 for life science, and 248 for earth science.

In Appendix B, Exhibits B.1 through B.5 for the eighth grade and Exhibits B.6 through B.8 for the fourth grade compare average achievement among individual countries for each of the content areas, respectively. The exhibits show whether or not the differences in average achievement between pairs of countries are statistically significant.

In Which Content Areas Are Countries Relatively Strong or Weak?

To highlight relative strengths and weaknesses within each country, Exhibit 3.2 profiles the relative average achievement in science content areas within each country at the eighth and fourth grades. For each country, Exhibit 3.2 displays the difference between average performance in each content area and average performance overall. The profiles reveal that at the eighth grade, many countries performed relatively better or worse in one or more content areas than they did overall. For example, it can be seen that Armenia performed relatively worse in environmental science than in the other four content areas. With just three content areas at the fourth grade, there also were fewer performance differences between the content areas. One example, however, is the Netherlands, which performed relatively better in life science than in physical science or earth science.

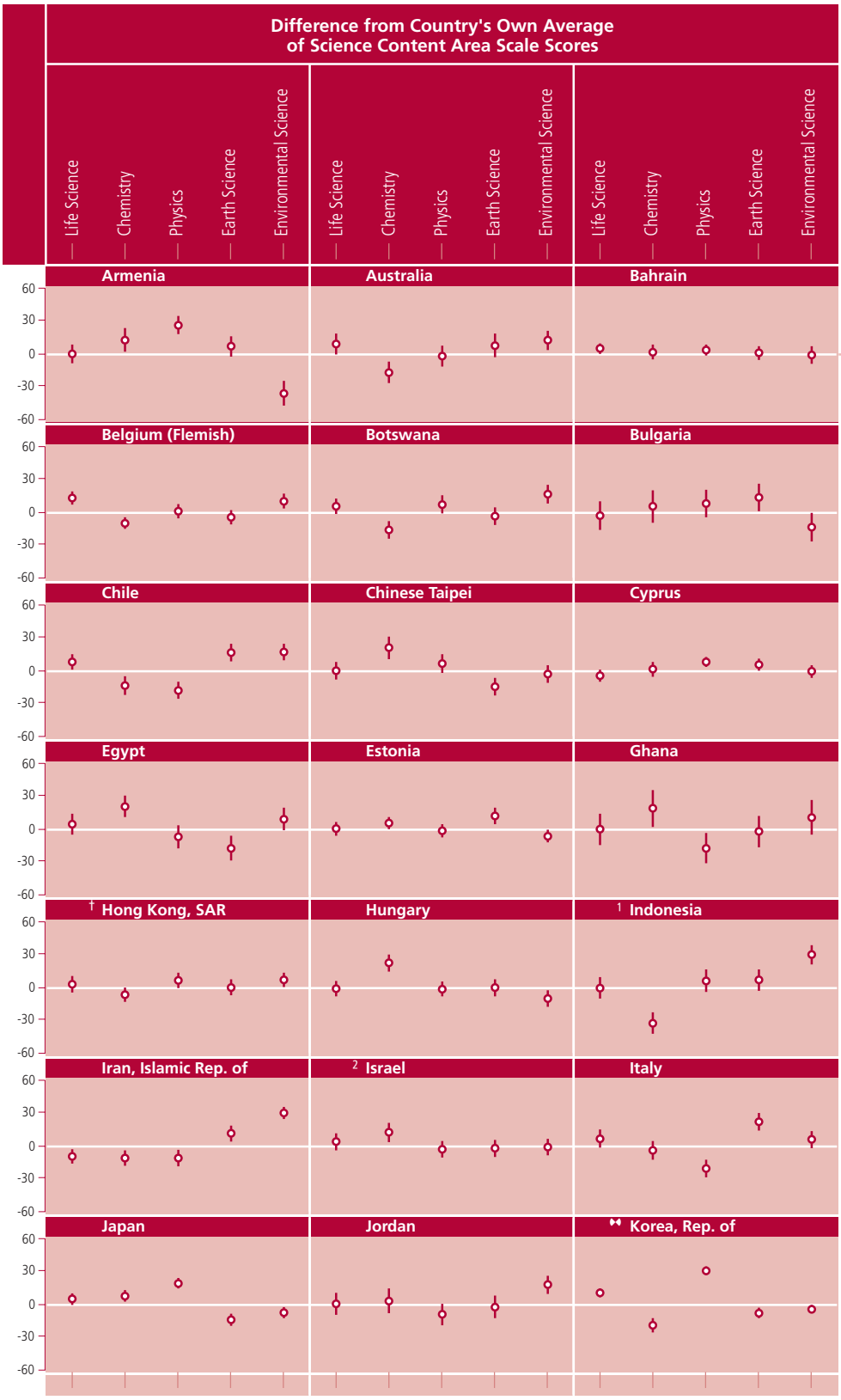
Differences in relative performance may be related to one or more factors, such as emphases in intended curricula or widely used textbooks, strengths or weaknesses in curriculum implementation, and the grade level at which topics are introduced. Differences in the match between the implemented curriculum and content measured by the test may also be a factor.

The profiles of relative performance reveal more variation across the content areas in some countries than in others. Average

achievement across content areas showed considerable variation in some countries. For example, at the eighth grade, variation of 60 or more scale-score points (one area at least 30 above and one 30 below) was found in Lebanon, the Philippines, and Indonesia. On the other hand, there were only a small number of scale points of difference between highest and lowest content area means in some countries at the eighth grade, with good examples being Latvia, Romania, Bahrain, and Cyprus. For the latter group of countries, the TIMSS 2003 data indicate a greater balance in science content covered through the grades. At the fourth grade, no countries had differences as large as 60 points, even though several had a particular strength or weakness. Generally, countries had comparable levels of performance across the three fourth-grade content areas.

Exhibit 3.2: Profiles of Within-Country Relative Performance in Science Content Areas
(Continued...)

SCIENCE Grade 8



SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

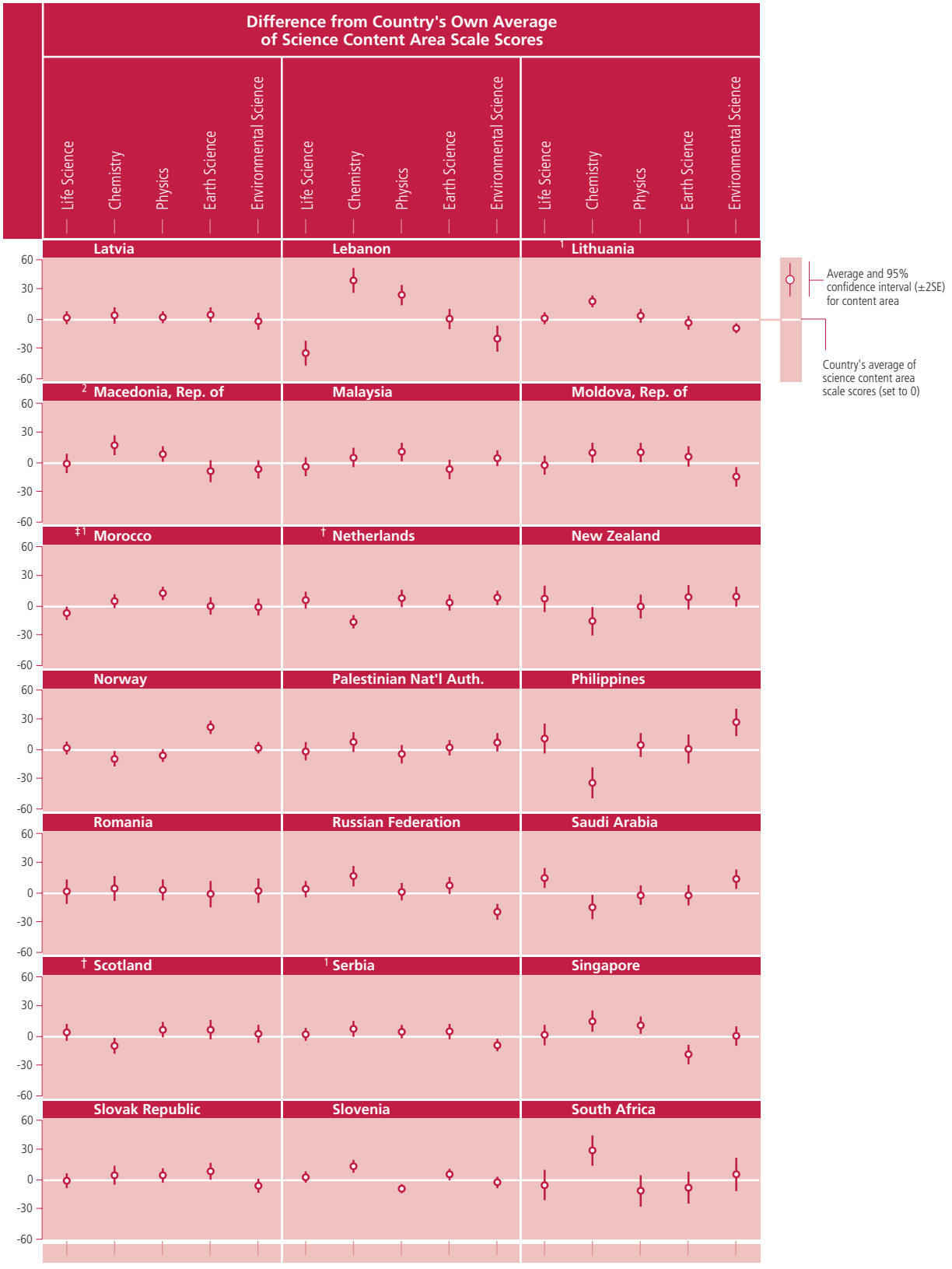
† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

2 National Defined Population covers less than 90% of National Desired Population (see Exhibit A.6).

◆◆ Korea tested the same cohort of students as other countries, but later in 2003, at the beginning of the next school year.

Exhibit 3.2: Profiles of Within-Country Relative Performance in Science Content Areas
(...Continued)



SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

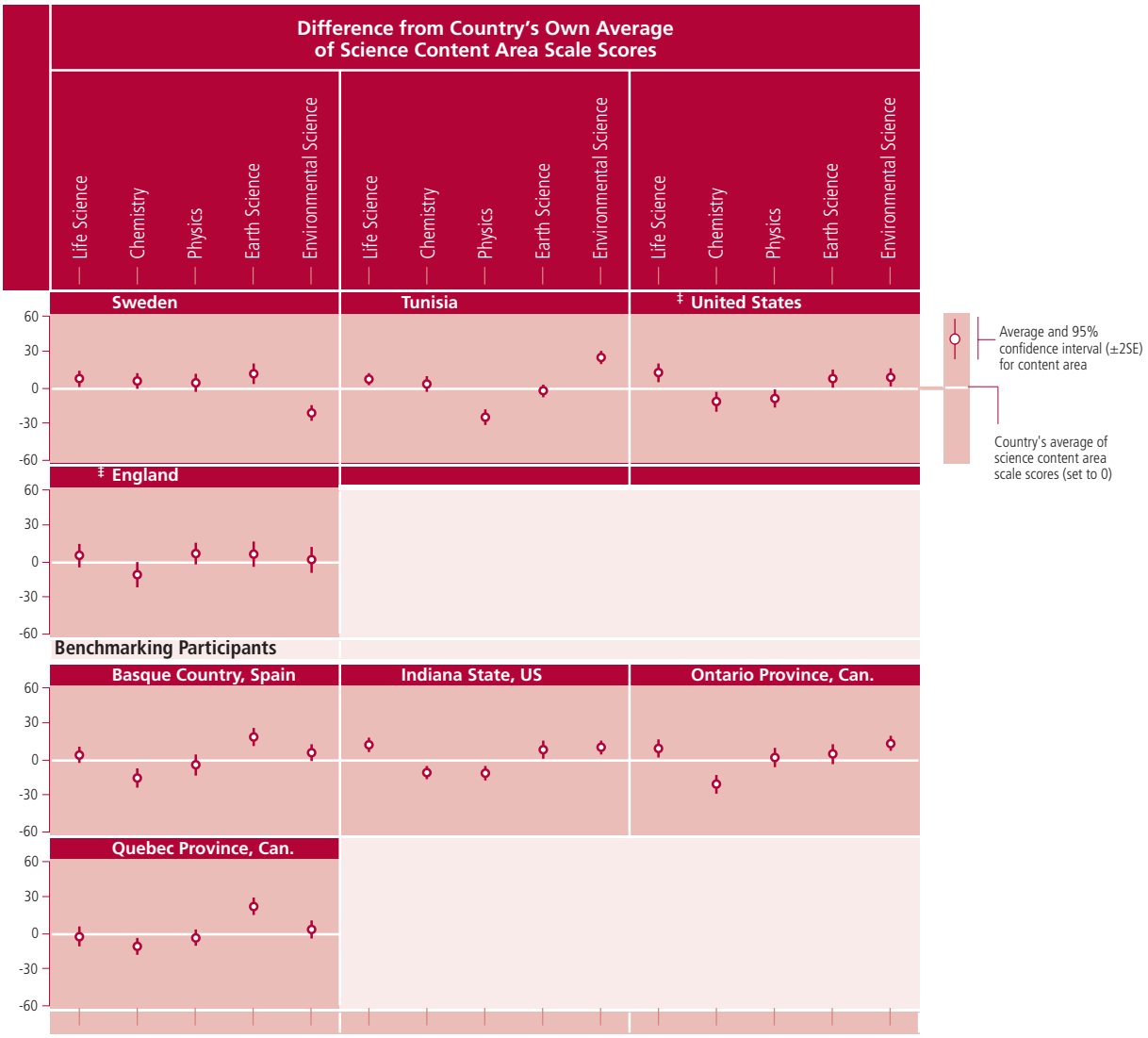
† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

2 National Defined Population covers less than 90% of National Desired Population (see Exhibit A.6).

Exhibit 3.2: Profiles of Within-Country Relative Performance in Science Content Areas

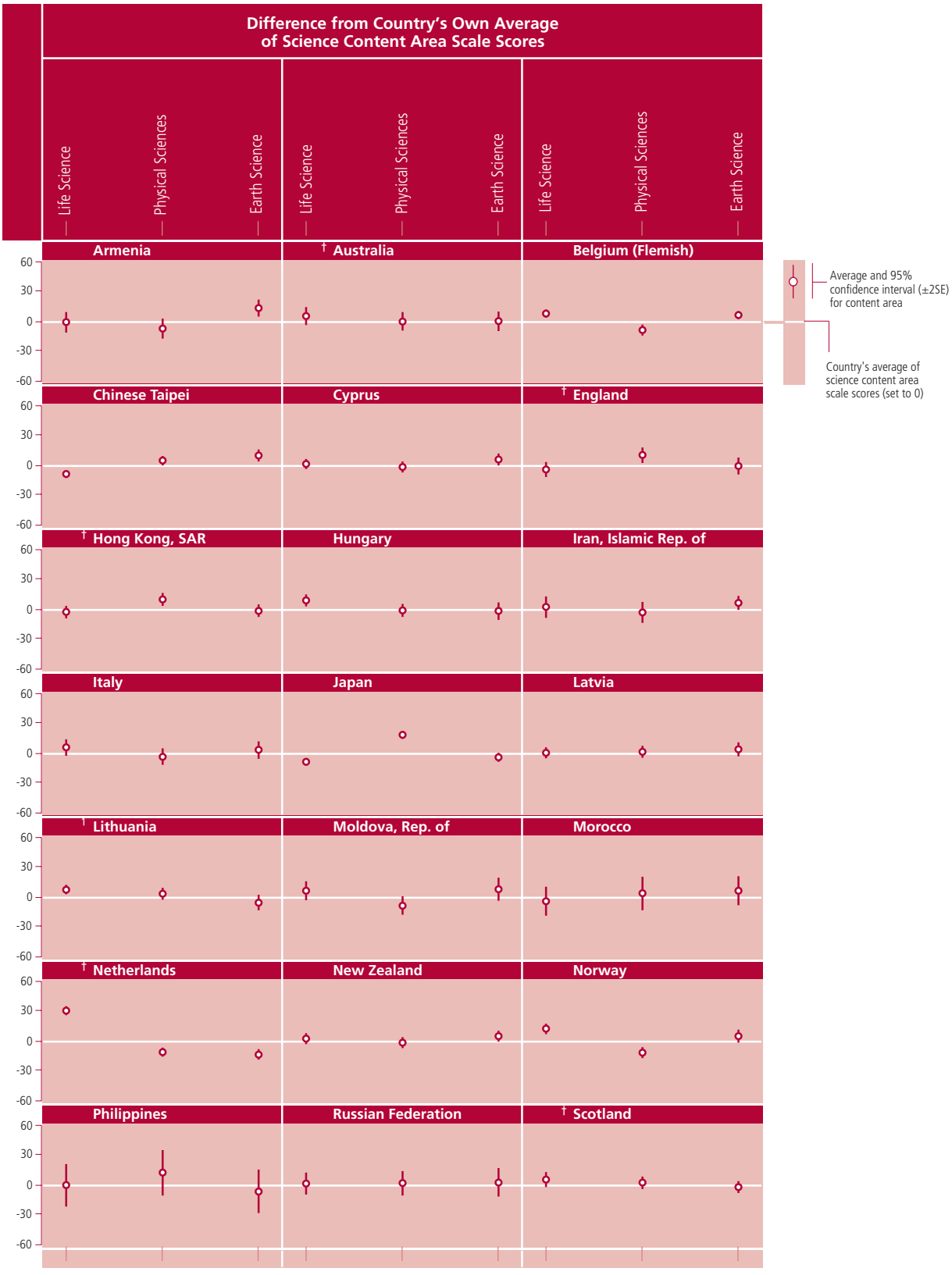


SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

Exhibit 3.2: Profiles of Within-Country Relative Performance in Science Content Areas



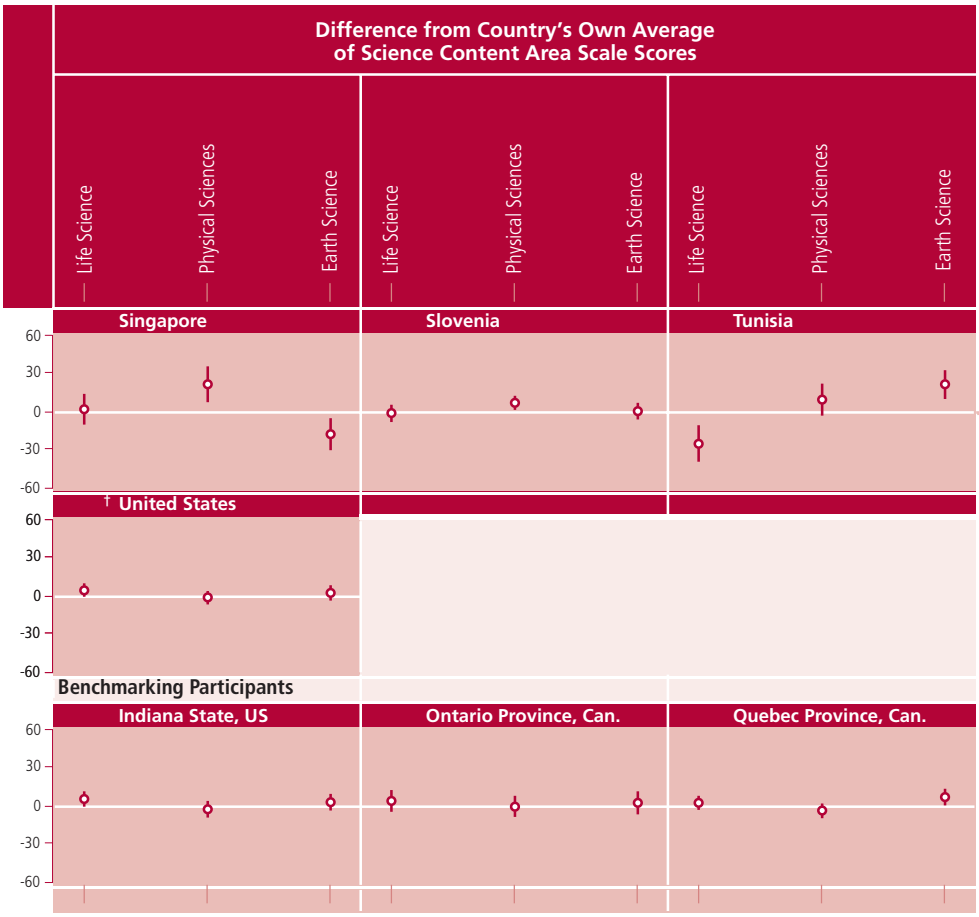
SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

Exhibit 3.2: Profiles of Within-Country Relative Performance in Science Content Areas

SCIENCE Grade 4



SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

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

Exhibit 3.3 displays average achievement in science content areas by gender for the eighth and fourth grades. Perhaps not surprising in view of the gender differences favoring boys in overall science eighth-grade achievement described in chapter 1, boys outperformed girls on average in four of the five content areas at this grade level. The most striking results were the large number of significant differences favoring boys in earth science and in physics.[3] In earth science, boys had higher average achievement than the girls in 34 countries and all four benchmarking participants whereas the girls had higher achievement in only 2 countries. On average internationally, the boys had an advantage of 16 points. In physics, boys had higher average achievement than the girls in 30 countries and 4 benchmarking participants compared to the girls having higher achievement in only 4 countries. The overall difference was 12 points higher for boys, on average. In environmental science, with a 4-point advantage on average, boys performed significantly higher in 20 countries and 2 benchmarking entities and girls in 7 countries. Although there was no difference in average performance in chemistry, boys performed better than girls in 12 countries and all 4 benchmarking participants whereas girls did better in just 8 countries. The most even gender balance was in life science, where girls outperformed boys by 3 points on average, and had higher average achievement in about the same number of countries – girls outperformed boys in 13 countries; boys outperformed girls in 12 countries. For each TIMSS assessment, examining item statistics to detect any gender bias is an important stage of item selection. It is therefore reasonable to assume that where significant differences do occur, they result from differences in performance rather than problem situations favoring one gender or the other.

At the fourth grade, gender differences in science content areas were much less pronounced, and there was a more even balance between boys' and girls' achievement levels. In both life science and

3 The results for TIMSS 2003 show many more significant differences than TIMSS 1999 because a Bonferroni correction was applied in 1999 across countries leading to extremely conservative estimates given the large number of countries.

physical science, girls had significantly higher achievement than boys (4 points in life science and 2 points in physical science). Girls performed better in life science than boys in 7 countries, whereas boys performed better in only one. In physical science, girls performed better than boys in six countries, and boys performed better in four countries. In earth science, however, the boy-girl difference was reversed, with boys having slightly higher average achievement overall (a 2-point difference). Boys performed better than girls in 9 countries, whereas girls performed better in 4 countries.

In some respects, the patterns in the performance of girls and boys found in TIMSS 2003 are consistent with previous IEA science assessments. Girls tended to perform about the same as boys in life science in both previous TIMSS assessments and the Second International Science Study (SISS),[4] while boys were markedly stronger in earth science and physics in previous studies.

4 Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., Gregory, K.D., Smith, T.A., Chrostowki, S.J., Garden, R.A., and O'Connor, K.M. (2000), *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade*, Chestnut Hill: MA: Boston College; Beaton, A.E., Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., Smith, T.A., and Kelly, D.L. (1996), *Science Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study (TIMSS)*, Chestnut Hill, MA: Boston College; Postlethwaite, T.N. and Wiley, D.E. (1992), *The IEA Study of Science II: Science Achievement in Twenty-Three Countries*, New York: Pergamon Press.

Exhibit 3.3: Average Achievement in Science Content Areas by Gender

Countries	Average Scale Scores for Science Content Areas											
	Life Science				Chemistry				Physics			
	Girls		Boys		Girls		Boys		Girls		Boys	
Armenia	462 (4.1)	▲	444 (3.1)		474 (5.0)	▲	456 (4.1)		481 (3.9)		478 (3.3)	
Australia	527 (4.6)		538 (4.5)		498 (5.1)		515 (4.9)	▲	510 (4.5)		532 (4.5)	▲
Bahrain	465 (2.8)	▲	424 (2.8)		458 (5.0)	▲	424 (2.3)		454 (2.8)	▲	432 (2.7)	
Belgium (Flemish)	521 (3.3)		532 (3.3)	▲	497 (3.0)		509 (3.5)	▲	501 (3.0)		528 (3.1)	▲
Botswana	374 (3.0)	▲	366 (3.3)		350 (3.5)		346 (3.8)		361 (3.6)		382 (3.6)	▲
Bulgaria	472 (6.1)		477 (5.2)		476 (7.2)		488 (5.7)	▲	474 (5.6)		495 (5.4)	▲
Chile	419 (3.0)		434 (3.5)	▲	394 (4.2)		415 (4.0)	▲	382 (3.4)		418 (3.6)	▲
Chinese Taipei	563 (3.6)		562 (3.4)		589 (4.3)	▲	579 (4.6)		568 (3.6)		571 (3.8)	
Cyprus	448 (2.9)	▲	427 (3.2)		446 (3.2)	▲	439 (2.9)		448 (2.2)		451 (2.3)	
Egypt	429 (4.6)		422 (5.2)		442 (4.6)		441 (6.0)		412 (4.7)		415 (6.1)	
Estonia	543 (2.8)		550 (2.9)	▲	552 (2.4)		551 (2.8)		551 (3.3)	▲	538 (2.3)	
Ghana	240 (7.1)		269 (6.1)	▲	267 (7.4)		283 (7.9)	▲	213 (7.0)		260 (6.9)	▲
† Hong Kong, SAR	550 (3.2)		552 (3.7)		541 (3.2)		543 (3.4)		549 (3.6)		561 (3.6)	▲
Hungary	531 (3.4)		542 (3.2)	▲	551 (3.4)		569 (3.7)	▲	522 (3.5)		551 (3.3)	▲
1 Indonesia	422 (4.0)		425 (4.3)		393 (4.3)		389 (4.4)		417 (4.2)		443 (4.6)	▲
Iran, Islamic Rep. of	454 (4.5)	▲	442 (3.5)		449 (5.4)		442 (4.5)		440 (4.6)		449 (4.2)	
2 Israel	486 (3.3)		497 (4.2)	▲	496 (4.3)		503 (4.1)		475 (3.3)		494 (3.9)	▲
Italy	496 (3.1)		499 (4.1)		486 (3.4)		487 (4.2)		459 (3.0)		481 (3.8)	▲
Japan	547 (3.1)		551 (3.0)		549 (3.8)		555 (2.4)		560 (3.3)		568 (2.9)	
Jordan	493 (4.8)	▲	458 (5.3)		496 (5.2)	▲	460 (6.2)		474 (4.8)	▲	457 (5.5)	
◆◆ Korea, Rep. of	555 (1.9)		562 (2.1)	▲	527 (3.0)		531 (2.8)		575 (2.7)		582 (1.8)	▲
Latvia	515 (3.0)	▲	508 (2.8)		513 (5.0)		514 (4.9)		503 (3.1)		520 (2.9)	▲
Lebanon	366 (5.6)	▲	352 (6.4)		436 (5.6)		430 (5.9)		413 (4.6)		426 (5.4)	▲
1 Lithuania	518 (2.9)		515 (2.9)		531 (2.8)		537 (3.3)		515 (2.7)		523 (3.2)	▲
2 Macedonia, Rep. of	460 (4.1)	▲	436 (4.5)		475 (4.2)	▲	459 (4.5)		457 (3.5)		458 (3.7)	
Malaysia	504 (4.3)		504 (4.2)		513 (4.9)		514 (4.9)		512 (4.3)		527 (3.9)	▲
Moldova, Rep. of	475 (4.2)	▲	456 (3.9)		482 (4.5)		475 (4.6)		479 (4.1)		478 (4.1)	
1 ‡ Morocco	388 (3.8)		392 (3.4)		399 (3.8)		405 (3.6)		400 (3.3)		422 (3.9)	▲
† Netherlands	534 (3.4)		539 (4.7)		510 (3.3)		519 (3.4)	▲	529 (3.8)		548 (3.8)	▲
New Zealand	525 (5.1)		521 (6.8)		496 (5.7)		506 (7.3)		512 (4.7)		519 (5.9)	
Norway	497 (2.6)		494 (3.1)		479 (3.4)		490 (3.5)	▲	483 (2.9)		492 (3.1)	▲
Palestinian Nat'l Auth.	443 (3.7)	▲	426 (6.0)		454 (3.9)	▲	433 (6.7)		436 (4.1)		427 (5.6)	
Philippines	395 (5.9)	▲	377 (6.5)		348 (6.2)		334 (8.2)		377 (4.9)		385 (5.3)	▲
Romania	473 (5.3)		470 (4.9)		477 (5.4)		471 (5.3)		465 (4.5)		481 (4.2)	▲
Russian Federation	515 (3.6)		513 (3.8)		526 (4.4)		529 (4.4)		502 (3.8)		520 (3.8)	▲
Saudi Arabia	419 (6.7)		406 (4.8)		398 (8.9)	▲	370 (6.1)		405 (7.2)	▲	385 (4.9)	
† Scotland	511 (4.1)		514 (3.7)		497 (4.2)		501 (3.4)		509 (4.0)		521 (3.4)	▲
1 Serbia	468 (3.2)		469 (3.3)		477 (4.2)		471 (4.2)		463 (3.5)		478 (2.6)	▲
Singapore	571 (3.7)		566 (4.8)		584 (4.0)		581 (5.1)		578 (3.4)		579 (4.0)	
Slovak Republic	512 (3.6)		515 (3.1)		514 (4.5)		524 (3.6)	▲	506 (3.3)		531 (3.2)	▲
Slovenia	522 (2.8)		519 (3.6)		531 (3.7)		533 (2.8)		502 (2.4)		515 (2.5)	▲
South Africa	249 (6.8)		249 (7.0)		282 (6.6)		287 (6.4)		237 (7.3)		251 (7.4)	
Sweden	531 (3.2)	▲	524 (2.9)		524 (3.1)		528 (2.8)		517 (3.5)		532 (2.9)	▲
Tunisia	412 (2.2)		423 (2.4)	▲	405 (2.5)		422 (3.3)	▲	371 (2.9)		402 (3.2)	▲
‡ United States	534 (3.2)		540 (3.3)	▲	506 (3.4)		519 (3.5)	▲	509 (3.5)		523 (3.0)	▲
‡ England	545 (4.3)		541 (5.2)		521 (5.3)		533 (5.1)	▲	537 (4.1)		552 (4.6)	▲
International Avg.	476 (0.6)	▲	473 (0.6)		474 (0.6)		474 (0.6)		468 (0.6)		480 (0.6)	▲
Benchmarking Participants												
Basque Country, Spain	490 (3.2)		494 (3.5)		466 (3.4)		478 (4.7)	▲	474 (4.1)		492 (3.5)	▲
Indiana State, US	534 (4.7)		545 (5.1)	▲	508 (5.1)		525 (6.7)	▲	505 (4.6)		526 (5.4)	▲
Ontario Province, Can.	533 (3.3)		542 (3.5)	▲	501 (3.3)		514 (3.6)	▲	524 (3.4)		536 (3.7)	▲
Quebec Province, Can.	520 (3.9)		530 (3.6)	▲	511 (3.4)		523 (3.0)	▲	514 (2.8)		534 (3.5)	▲

▲ Significantly higher than other gender

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

2 National Defined Population covers less than 90% of National Desired Population (see Exhibit A.6).

◆◆ Korea tested the same cohort of students as other countries, but later in 2003, at the beginning of the next school year.

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

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 3.3: Average Achievement in Science Content Areas by Gender

Countries	Average Scale Scores for Science Content Areas			
	Earth Science		Environmental Science	
	Girls	Boys	Girls	Boys
Armenia	464 (4.2) ▲	455 (3.8)	425 (5.1) ▲	408 (4.3)
Australia	516 (4.8)	547 (4.9) ▲	528 (4.4)	543 (4.0) ▲
Bahrain	445 (1.9)	436 (4.6)	452 (2.7) ▲	425 (5.6)
Belgium (Flemish)	494 (2.9)	525 (3.8) ▲	512 (3.4)	536 (3.5) ▲
Botswana	354 (4.7)	367 (4.1) ▲	385 (3.5) ▲	376 (4.1)
Bulgaria	477 (5.7)	503 (5.3) ▲	455 (6.4)	471 (4.9) ▲
Chile	413 (3.4)	455 (3.5) ▲	424 (3.0)	446 (3.8) ▲
Chinese Taipei	542 (3.2)	554 (3.9) ▲	561 (3.5)	558 (3.2)
Cyprus	442 (2.8)	452 (3.3) ▲	442 (2.8)	439 (3.0)
Egypt	397 (4.7)	409 (6.9)	435 (5.0)	426 (5.4)
Estonia	560 (4.4)	556 (3.2)	540 (2.7)	539 (2.7)
Ghana	230 (7.0)	274 (6.9) ▲	256 (6.7)	276 (7.1) ▲
† Hong Kong, SAR	539 (3.4)	558 (3.5) ▲	554 (3.0)	557 (3.6)
Hungary	520 (3.7)	555 (4.3) ▲	515 (3.4)	541 (3.4) ▲
1 Indonesia	424 (4.2)	438 (4.2) ▲	451 (4.1)	457 (4.0)
Iran, Islamic Rep. of	464 (4.2)	470 (4.1)	488 (3.1)	486 (3.1)
2 Israel	475 (3.2)	496 (3.9) ▲	476 (2.7)	497 (4.6) ▲
Italy	504 (3.1)	523 (4.2) ▲	494 (3.3)	500 (3.9)
Japan	524 (3.4)	536 (2.9) ▲	533 (2.8)	540 (2.9)
Jordan	479 (4.2) ▲	466 (5.5)	507 (4.1) ▲	479 (4.7)
◆◆ Korea, Rep. of	527 (2.0)	552 (2.4) ▲	538 (2.0)	548 (1.7) ▲
Latvia	504 (3.5)	524 (2.9) ▲	503 (3.4)	513 (4.0) ▲
Lebanon	389 (5.0)	402 (4.8) ▲	371 (6.2)	379 (7.0)
1 Lithuania	504 (3.4)	520 (3.1) ▲	504 (2.6)	509 (2.6)
2 Macedonia, Rep. of	438 (6.1)	443 (4.8)	443 (4.7)	442 (4.2)
Malaysia	494 (4.6)	510 (3.9) ▲	509 (3.6)	516 (3.8)
Moldova, Rep. of	474 (4.6)	475 (4.0)	461 (4.4) ▲	446 (4.5)
1 ‡ Morocco	389 (4.6)	406 (3.6) ▲	394 (4.5)	401 (4.0)
† Netherlands	523 (3.3)	545 (4.1) ▲	529 (3.8)	548 (3.5) ▲
New Zealand	514 (5.1)	537 (6.3) ▲	519 (3.7)	532 (5.5) ▲
Norway	506 (2.4)	527 (3.9) ▲	494 (2.6)	498 (2.9)
Palestinian Nat'l Auth.	441 (3.4)	436 (4.5)	454 (3.9) ▲	432 (6.0)
Philippines	376 (6.0)	377 (7.4)	410 (5.4) ▲	394 (6.0)
Romania	461 (5.6)	477 (5.7) ▲	469 (5.0)	475 (5.1)
Russian Federation	508 (3.6)	527 (3.7) ▲	486 (3.6)	496 (3.9) ▲
Saudi Arabia	400 (6.5)	389 (5.6)	417 (5.7)	405 (5.2)
† Scotland	503 (4.9)	527 (3.6) ▲	505 (4.1)	517 (3.6) ▲
1 Serbia	463 (3.5)	480 (3.2) ▲	453 (3.2)	461 (2.6) ▲
Singapore	542 (4.1)	556 (4.4) ▲	566 (3.7)	569 (4.5)
Slovak Republic	508 (4.9)	537 (3.7) ▲	498 (3.6)	518 (2.8) ▲
Slovenia	515 (3.3)	532 (3.4) ▲	512 (3.1)	519 (2.4) ▲
South Africa	245 (6.9)	248 (7.5)	260 (8.4)	260 (7.7)
Sweden	525 (3.5)	539 (4.3) ▲	494 (3.0)	505 (2.8) ▲
Tunisia	391 (2.3)	426 (2.3) ▲	427 (2.5)	445 (2.9) ▲
‡ United States	519 (3.2)	546 (3.1) ▲	527 (3.4)	539 (3.1) ▲
‡ England	535 (5.2)	553 (5.3) ▲	532 (4.5)	547 (5.1) ▲
International Avg.	466 (0.6)	482 (0.6) ▲	472 (0.6)	476 (0.6) ▲
Benchmarking Participants				
Basque Country, Spain	497 (3.0)	516 (3.4) ▲	490 (3.5)	497 (3.6)
Indiana State, US	523 (5.5)	549 (5.4) ▲	530 (4.5)	545 (4.7) ▲
Ontario Province, Can.	522 (3.3)	544 (3.7) ▲	538 (3.2)	545 (3.1)
Quebec Province, Can.	539 (3.6)	562 (3.1) ▲	523 (3.9)	540 (2.9) ▲

▲ Significantly higher than other gender

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

2 National Defined Population covers less than 90% of National Desired Population (see Exhibit A.6).

◆◆ Korea tested the same cohort of students as other countries, but later in 2003, at the beginning of the next school year.

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

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 3.3: Average Achievement in Science Content Areas by Gender

Countries	Average Scale Scores for Science Content Areas					
	Life Science		Physical Science		Earth Science	
	Girls	Boys	Girls	Boys	Girls	Boys
Armenia	443 (4.5) ▲	428 (5.0)	430 (4.5)	428 (4.9)	455 (3.9) ▲	445 (4.1)
† Australia	527 (3.5) ▲	520 (4.9)	518 (3.8)	518 (5.1)	519 (4.0)	518 (5.7)
Belgium (Flemish)	523 (1.9)	524 (2.3)	507 (2.6)	507 (2.5)	521 (2.2)	524 (2.4)
Chinese Taipei	539 (1.6)	542 (2.0)	551 (2.2)	557 (2.6) ▲	553 (2.9)	565 (2.8) ▲
Cyprus	479 (2.7)	485 (2.7)	475 (2.5)	483 (3.0) ▲	485 (2.6)	489 (3.0)
† England	532 (3.0)	531 (3.8)	549 (3.3)	544 (4.1)	535 (3.8)	536 (4.2)
† Hong Kong, SAR	536 (2.8)	533 (2.7)	551 (3.2) ▲	544 (2.8)	537 (3.4)	536 (3.0)
Hungary	537 (3.2)	536 (2.8)	522 (3.5)	530 (3.2)	520 (5.0)	531 (4.1) ▲
Iran, Islamic Rep. of	437 (6.6) ▲	415 (5.3)	432 (7.4) ▲	410 (5.2)	437 (5.2) ▲	423 (3.7)
Italy	521 (3.9)	521 (3.7)	510 (4.1)	513 (3.6)	514 (4.5)	523 (3.6) ▲
Japan	529 (2.0)	530 (2.0)	557 (2.2)	557 (2.4)	530 (2.5)	539 (2.3) ▲
Latvia	535 (2.4) ▲	527 (2.9)	536 (3.1) ▲	528 (3.1)	534 (3.4)	534 (3.3)
1 Lithuania	518 (2.4)	517 (2.5)	514 (2.8)	513 (3.2)	503 (4.2)	507 (3.8)
Moldova, Rep. of	511 (4.2) ▲	497 (4.5)	495 (4.1) ▲	483 (4.4)	511 (5.2) ▲	499 (5.6)
Morocco	303 (7.6)	297 (6.0)	311 (7.9)	305 (7.4)	313 (7.5)	308 (6.1)
† Netherlands	545 (2.2)	549 (2.2)	501 (2.2)	509 (2.2) ▲	496 (2.9)	509 (2.9) ▲
New Zealand	524 (2.9) ▲	516 (2.7)	519 (2.9) ▲	513 (2.6)	523 (3.1)	522 (2.3)
Norway	483 (2.6)	477 (2.8)	457 (3.0)	454 (2.6)	473 (3.4)	472 (3.5)
Philippines	339 (10.4) ▲	322 (8.1)	349 (10.6) ▲	337 (9.3)	331 (10.7) ▲	317 (8.6)
Russian Federation	528 (5.5)	525 (4.5)	527 (5.8)	526 (5.2)	528 (6.9)	527 (5.7)
† Scotland	500 (3.5)	511 (3.9) ▲	499 (3.0)	507 (3.7)	492 (2.9)	505 (3.6) ▲
Singapore	559 (4.9)	557 (5.7)	580 (5.8)	574 (6.6)	534 (5.0)	541 (6.1)
Slovenia	490 (3.6)	488 (3.8)	499 (2.8)	496 (3.2)	489 (3.0)	492 (4.1)
Tunisia	294 (6.5)	285 (6.3)	326 (5.9)	322 (5.5)	337 (5.5)	336 (5.8)
† United States	536 (2.1)	538 (2.6)	529 (2.1)	533 (2.7) ▲	531 (2.6)	539 (2.9) ▲
International Avg.	491 (0.8) ▲	487 (0.8)	490 (0.9) ▲	488 (0.8)	488 (0.9)	490 (0.8) ▲
Benchmarking Participants						
Indiana State, US	551 (2.6)	558 (4.3)	544 (3.3)	548 (4.5)	547 (3.5)	557 (4.6) ▲
Ontario Province, Can.	540 (3.7)	542 (4.7)	534 (3.6)	539 (4.6)	531 (4.0)	547 (5.1) ▲
Quebec Province, Can.	506 (2.3)	500 (3.1)	496 (2.5)	497 (3.0)	505 (2.7)	510 (3.8)

▲ Significantly higher than other gender

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

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

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

What Changes Have Occurred in Content-Area Achievement?

To examine changes in achievement in the science content areas, Exhibit 3.4 shows the average percent correct for eighth-grade students in 2003 and 1999 for items given in both the 2003 and 1999 TIMSS assessments. If achievement improved significantly between assessments, the 1999 result is annotated with an up arrow or down arrow. This content-area trend analysis uses average percent correct rather than average scale score because there were insufficient items to reliably link the results for both assessments to the TIMSS scale in all of the five different content areas. The first column in the table shows overall trends in the average percentage correct metric. For the most part, significant differences agree with those in the overall scale score (and the direction is always consistent).

During the four years between 1999 and 2003, participants were generally consistent in either showing improvements or declines. Lithuania had statistically significant improvements in all five content areas. Chile and Israel improved in four areas, and Ontario in three. Participants improving in two areas included Hong Kong SAR, Moldova, the Philippines, and the United States. On the other hand, Belgium (Flemish), Bulgaria, and Tunisia had statistically significant decreases in all five content areas. In Cyprus, average achievement showed statistically significant decreases in four content areas. Japan and the Slovak Republic showed significant decreases in three content areas and an increase in one.

Exhibit 3.4: Trends in Average Percent Correct in Science Content Areas*

Countries	Average Percent Correct for Science Content Areas											
	Total Science Trend Items (74 items)			Life Science Trend Items (17 items)			Chemistry Trend Items (14 items)		
	2003	1999		2003	1999		2003	1999	
Australia	57 (0.7)	– –		61 (0.8)	– –		53 (0.9)	– –	
Belgium (Flemish)	56 (0.5)	60 (0.5)	▼	61 (0.6)	64 (0.5)	▼	49 (0.5)	51 (1.0)	▼
Bulgaria	50 (1.1)	57 (1.1)	▼	50 (1.2)	58 (1.3)	▼	53 (1.2)	62 (1.1)	▼
Chile	40 (0.5)	38 (0.7)	▲	43 (0.6)	41 (0.8)	▲	41 (0.7)	38 (0.7)	▲
Chinese Taipei	66 (0.7)	67 (0.6)		62 (0.6)	64 (0.6)		71 (0.9)	72 (0.8)	
Cyprus	42 (0.4)	46 (0.3)	▼	41 (0.5)	49 (0.6)	▼	42 (0.5)	47 (0.7)	▼
Hong Kong, SAR	61 (0.7)	59 (0.7)		61 (0.6)	59 (0.8)	▲	57 (0.7)	56 (0.7)	
Hungary	62 (0.5)	63 (0.7)		61 (0.7)	61 (0.8)		66 (0.7)	67 (0.8)	
Indonesia	39 (0.6)	40 (0.6)		38 (0.6)	38 (0.7)		31 (0.4)	32 (0.6)	
Iran, Islamic Rep. of	44 (0.5)	44 (0.7)		39 (0.6)	40 (0.7)		46 (0.6)	48 (0.7)	▼
Israel	53 (0.6)	49 (0.8)	▲	56 (0.7)	50 (0.9)	▲	56 (0.8)	51 (0.9)	▲
Italy	53 (0.6)	53 (0.7)		55 (0.8)	54 (0.8)		52 (0.8)	53 (1.0)	
Japan	61 (0.5)	63 (0.4)	▼	61 (0.5)	63 (0.5)	▼	59 (0.6)	61 (0.6)	
Jordan	48 (0.7)	47 (0.6)		50 (0.9)	46 (0.7)	▲	51 (0.8)	52 (0.8)	
Korea, Rep. of	63 (0.4)	64 (0.4)		64 (0.5)	62 (0.5)		54 (0.5)	61 (0.5)	▼
Latvia (LSS)	54 (0.7)	53 (0.6)		53 (0.8)	50 (0.8)		54 (1.0)	53 (0.8)	
Lithuania	58 (0.6)	50 (0.8)	▲	57 (0.7)	48 (0.9)	▲	60 (0.7)	53 (0.9)	▲
Macedonia, Rep. of	45 (0.7)	46 (0.7)		45 (0.8)	47 (0.8)		52 (0.9)	52 (1.1)	
Malaysia	53 (0.8)	52 (0.8)		49 (1.0)	51 (1.0)		52 (0.9)	49 (0.7)	▲
Moldova, Rep. of	48 (0.7)	47 (0.8)		46 (1.0)	48 (0.9)		50 (0.8)	46 (1.0)	▲
Netherlands	61 (0.7)	61 (1.4)		66 (0.8)	63 (1.5)		53 (0.8)	53 (1.2)	
New Zealand	56 (1.0)	54 (1.0)		59 (1.0)	56 (1.1)		50 (1.2)	50 (1.1)	
Philippines	35 (0.8)	33 (0.9)		38 (1.0)	34 (1.0)	▲	31 (0.7)	34 (0.8)	▼
Romania	48 (1.0)	48 (0.9)		50 (1.1)	48 (1.1)		49 (1.1)	52 (1.2)	
Russian Federation	56 (0.6)	57 (1.3)		55 (0.5)	54 (1.5)		61 (1.0)	64 (1.5)	
Singapore	67 (0.9)	67 (1.4)		65 (0.9)	66 (1.5)		70 (1.1)	65 (1.6)	▲
Slovak Republic	56 (0.7)	58 (0.7)	▼	57 (0.8)	59 (0.8)		57 (0.9)	61 (0.8)	▼
Slovenia	57 (0.5)	– –		54 (0.8)	– –		61 (0.7)	– –	
South Africa	23 (0.7)	24 (0.7)		23 (0.7)	24 (0.9)		27 (0.6)	29 (0.6)	▼
Tunisia	35 (0.5)	41 (0.4)	▼	34 (0.6)	39 (0.5)	▼	40 (0.4)	45 (0.5)	▼
United States	58 (0.6)	57 (0.7)		63 (0.7)	61 (0.9)		55 (0.7)	55 (0.9)	
‡ England	61 (0.9)	61 (1.0)		63 (1.0)	64 (0.9)		57 (1.1)	56 (1.2)	
International Avg.	52 (0.1)	52 (0.1)	▲	52 (0.1)	52 (0.2)	▲	52 (0.1)	52 (0.2)	
Benchmarking Participants									
Indiana State, US	59 (1.0)	60 (1.4)		64 (1.0)	66 (1.4)		56 (1.3)	57 (1.5)	
Ontario Province, Can.	59 (0.6)	56 (0.6)	▲	65 (0.7)	61 (0.8)	▲	51 (0.8)	51 (0.9)	
Quebec Province, Can.	60 (0.7)	61 (1.9)		60 (0.8)	61 (1.9)		55 (0.8)	57 (1.1)	

▲ 2003 significantly higher than 1999

▼ 2003 significantly lower than 1999

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

* Applies only to items that appeared on both the 1999 and 2003 assessments. Fourth grade data are not available.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

Trend notes: Because of differences in population coverage, 1999 data are not shown for Australia and Slovenia. Korea tested later in 2003 than in 1999 at the beginning of the next school year. Similarly, Lithuania tested later in 1999 than in 2003. Data for Latvia in this exhibit include Latvian-speaking schools only.

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

A dash (–) indicates comparable data are not available.

Exhibit 3.4: Trends in Average Percent Correct in Science Content Areas*

Countries	Average Percent Correct for Science Content Areas											
	Physics Trend Items (22 items)			Earth Science Trend Items (12 items)			Environmental Science Trend Items (9 items)		
	2003	1999		2003	1999		2003	1999	
Australia	59 (0.9)	– –		57 (1.0)	– –		56 (1.0)	– –	
Belgium (Flemish)	61 (0.6)	64 (0.8)	▼	56 (0.7)	59 (1.0)	▼	49 (0.8)	54 (0.7)	▼
Bulgaria	48 (1.1)	52 (1.4)	▼	57 (1.3)	63 (1.2)	▼	43 (1.3)	50 (1.3)	▼
Chile	40 (0.5)	37 (0.7)	▲	41 (0.6)	38 (0.7)	▲	33 (0.6)	37 (0.8)	▼
Chinese Taipei	62 (0.8)	64 (0.7)		69 (0.8)	71 (0.7)		70 (0.9)	69 (0.8)	
Cyprus	46 (0.6)	47 (0.5)		43 (0.6)	46 (0.6)	▼	35 (0.6)	42 (0.7)	▼
Hong Kong, SAR	61 (0.7)	62 (0.8)		64 (0.8)	65 (0.9)		62 (1.0)	55 (1.0)	▲
Hungary	62 (0.7)	63 (0.8)		66 (0.7)	70 (0.9)	▼	52 (1.0)	53 (1.0)	
Indonesia	42 (0.7)	43 (0.7)		43 (0.8)	45 (0.9)		40 (0.8)	46 (0.9)	▼
Iran, Islamic Rep. of	41 (0.6)	42 (0.7)		54 (0.8)	53 (0.9)		42 (0.7)	40 (0.8)	
Israel	53 (0.8)	48 (0.9)	▲	54 (0.7)	50 (1.1)	▲	42 (0.9)	42 (1.0)	
Italy	49 (0.7)	50 (0.8)		61 (0.9)	58 (1.0)		47 (0.9)	49 (0.9)	
Japan	65 (0.5)	68 (0.4)	▼	62 (0.6)	66 (0.6)	▼	54 (0.9)	50 (0.7)	▲
Jordan	42 (0.8)	42 (0.6)		53 (0.8)	52 (0.7)		44 (1.0)	44 (0.8)	
Korea, Rep. of	68 (0.5)	67 (0.4)		67 (0.6)	67 (0.7)		58 (0.8)	58 (0.7)	
Latvia (LSS)	57 (0.9)	57 (0.8)		54 (1.0)	51 (1.0)	▲	49 (1.2)	48 (1.0)	
Lithuania	61 (0.6)	55 (0.9)	▲	59 (0.8)	49 (1.0)	▲	46 (0.8)	38 (1.0)	▲
Macedonia, Rep. of	45 (0.7)	45 (0.9)		47 (0.9)	45 (1.1)		34 (1.0)	35 (0.9)	
Malaysia	55 (0.8)	53 (0.8)		56 (1.0)	56 (1.0)		51 (1.1)	50 (1.0)	
Moldova, Rep. of	49 (0.9)	47 (0.9)	▲	53 (0.9)	52 (1.0)		38 (1.1)	38 (1.2)	
Netherlands	65 (0.7)	64 (1.5)		62 (0.9)	61 (1.5)		58 (1.3)	59 (2.0)	
New Zealand	60 (1.0)	57 (1.0)	▲	53 (1.1)	53 (1.0)		52 (1.4)	54 (1.1)	
Philippines	35 (0.8)	33 (0.8)		36 (1.0)	35 (1.0)		33 (1.3)	26 (1.1)	▲
Romania	47 (0.9)	47 (1.0)		51 (1.2)	52 (1.1)		44 (1.2)	42 (1.2)	
Russian Federation	56 (0.7)	58 (1.1)		61 (0.7)	60 (1.4)		45 (1.0)	46 (1.5)	
Singapore	68 (0.7)	69 (1.3)		65 (0.8)	63 (1.5)		68 (1.1)	73 (1.8)	▼
Slovak Republic	56 (0.7)	59 (0.9)	▼	60 (0.9)	57 (1.0)	▲	50 (1.0)	53 (0.9)	▼
Slovenia	56 (0.6)	– –		63 (0.7)	– –		51 (1.0)	– –	
South Africa	23 (0.8)	24 (0.7)		24 (0.7)	23 (0.6)		19 (1.0)	20 (0.9)	
Tunisia	33 (0.6)	39 (0.5)	▼	38 (0.7)	44 (0.7)	▼	30 (0.7)	38 (0.5)	▼
United States	57 (0.6)	54 (0.7)	▲	60 (0.7)	58 (0.8)	▲	55 (0.9)	54 (0.7)	
‡ England	63 (0.9)	61 (1.2)		64 (1.0)	63 (0.9)		54 (1.3)	56 (1.4)	
International Avg.	53 (0.1)	52 (0.2)		55 (0.2)	54 (0.2)	▲	47 (0.2)	47 (0.2)	
Benchmarking Participants									
Indiana State, US	56 (1.2)	55 (1.4)		60 (1.1)	63 (1.6)		57 (1.2)	60 (2.3)	
Ontario Province, Can.	61 (0.6)	58 (0.8)	▲	60 (0.8)	54 (0.7)	▲	58 (1.0)	57 (1.0)	
Quebec Province, Can.	63 (0.7)	63 (2.6)		65 (1.1)	65 (1.8)		54 (1.0)	60 (2.8)	▼

▲ 2003 significantly higher than 1999

▼ 2003 significantly lower than 1999

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

* Applies only to items that appeared on both the 1999 and 2003 assessments. Fourth grade data are not available.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

Trend notes: Because of differences in population coverage, 1999 data are not shown for Australia and Slovenia. Korea tested later in 2003 than in 1999 at the beginning of the next school year. Similarly, Lithuania tested later in 1999 than in 2003. Data for Latvia in this exhibit include Latvian-speaking schools only.

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

A dash (–) indicates comparable data are not available.

4

Chapter 4

Students' Backgrounds and Attitudes Towards Science

With its overarching goal of improving student learning in mathematics and science, TIMSS focuses primarily on curricular, instructional, and school resource factors in presenting information on the context in which learning takes place. However, as documented extensively by previous IEA studies of science achievement,[1] student achievement also is related to home background factors, and to students' activities and attitudes. Since information on such factors is indispensable for interpreting the achievement results, this chapter provides detailed information about students' home backgrounds and resources for learning, how they spend their time out of school, their self-confidence in learning science, and the value they place on science. Also provided is information on trends in attitudes to learning science across 1995, 1999, and 2003.

What Educational Resources Do Students Have in Their Homes?

IEA's ongoing assessments of student achievement in mathematics and science (TIMSS) and reading literacy (PIRLS) have shown that in almost every country, students from homes with extensive educational resources have higher achievement in science and other subjects than

1 For results from TIMSS 1999, see Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., Gregory, K.D., Smith, T.A., Chrostowski, S.J., Garden, R.A., and O'Connor, K.M. (2000), *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade*, Chestnut Hill, MA: Boston College. For TIMSS 1995 results, see Beaton, A.E., Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., Smith, T.A., and Kelly, D.L. (1996), *Science Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study*, Chestnut Hill, MA: Boston College;

those from less advantaged backgrounds. For the 2003 data presented in this report, TIMSS has focused on just a few central variables: level of parental education, students' educational aspirations, speaking the language of the test at home, having a range of study aids in the home and computer use at home, and at school.

Because for most children, parents are their first and probably most important educators, the level of education of the parents may be the most important educational resource in the home. Exhibit 4.1 summarizes eighth-grade students' reports of the highest level of education attained by their parents. Ordered alphabetically by country, this two-page display shows the percentages of students in each of five categories of parents' educational level, together with their average science achievement. Standard errors for percentages and averages also are shown. The education level of the parent with most education was used in assigning students to categories.

Although response rates to questions in the TIMSS questionnaires generally were high, students in some countries had difficulty in answering specific questions, particularly those about their parents' level of education. The exhibits in this chapter have special notations on this point. For a country where responses are available for at least 70 but less than 85 percent of the students, an "r" is included next to its data. Where responses are available for at least 50 but less than 70 percent of the students, an "s" is included. Where responses are available for less than 50 percent, an "x" replaces the data.

Exhibit 4.1 reveals great diversity in levels of parental education within and across the TIMSS countries. On average across countries, the percentages of eighth-grade students reporting that the highest level of education attained by either parent was as follows: finished university – 28%; finished post-secondary education but not university – 17%; finished upper secondary – 28%; finished lower secondary – 15%; and no more than primary (includes not attending school at all) – 12%. Countries with the highest percentages (40% or more) of students reporting university-educated parents included Armenia, Estonia,

Israel, Japan, Latvia, Norway, the Russian Federation, Sweden, and the United States. Among benchmarking participants, Indiana and Ontario were included. In contrast, countries reporting the highest percentages (40% or more) of parents with no more than primary education included Botswana, Iran, Morocco, Saudi Arabia, and Tunisia.

The different educational approaches, structures, and organizations across the TIMSS countries make comparisons of educational levels difficult, and this is exacerbated by high levels of 'do not know' and missing responses in some countries. Nonetheless, Exhibit 4.1 makes it clear that higher levels of parents' education are associated with higher eighth-grade student achievement in science in almost all countries. At 507 score points, the average science achievement of students with university-educated parents was more than 90 points greater than the average of students whose parents had no more than primary education.

As shown in Exhibit 4.2, students generally had high expectations for university education, particularly those who had a parent with a university education. More than half the eighth-grade students (54% on average across countries) reported that they expect to finish university, 30 percent do not expect to complete a university education, and a further 15 percent do not know. Students expecting to finish university had substantially greater average science achievement than those without university expectations. Among those expecting to finish university, the average achievement of those students with a parent who finished university (21% of students) was 30 points greater than those without a university-educated parent (33%).

Although speaking more than one language has advantages, TIMSS 1999 showed 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 at eighth grade than those who spoke it more often. Exhibit 4.3, which presents students' reports of how frequently they spoke the language of the TIMSS test

Exhibit 4.1: Highest Level of Education of Either Parent*

Countries		Finished University or Equivalent or Higher		Finished Post-secondary Vocational/Technical Education But Not University		Finished Upper Secondary Schooling	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia		51 (1.5)	475 (4.1)	22 (0.9)	461 (4.4)	24 (1.1)	451 (4.8)
Australia	r	29 (1.3)	564 (4.7)	27 (1.0)	540 (4.7)	25 (1.1)	517 (4.6)
Bahrain		33 (0.7)	462 (2.6)	7 (0.5)	446 (5.6)	23 (0.6)	449 (3.5)
Belgium (Flemish)	s	25 (1.4)	542 (3.2)	26 (1.0)	540 (3.0)	31 (1.1)	516 (3.5)
Botswana		10 (0.7)	419 (8.8)	14 (0.6)	388 (4.4)	16 (0.8)	360 (4.1)
Bulgaria		28 (1.3)	494 (10.1)	36 (1.4)	485 (5.2)	29 (1.4)	469 (6.3)
Chile		16 (1.0)	480 (4.3)	10 (0.5)	444 (4.6)	32 (1.1)	415 (3.2)
Chinese Taipei		17 (1.4)	619 (3.7)	11 (0.6)	593 (4.2)	46 (1.0)	568 (3.3)
Cyprus		28 (0.8)	470 (3.5)	14 (0.7)	459 (3.7)	36 (0.9)	439 (3.4)
Egypt		24 (1.1)	482 (4.8)	0 (0.0)	~ ~	11 (0.6)	452 (6.6)
Estonia		40 (1.4)	574 (3.1)	39 (1.1)	548 (2.7)	19 (0.7)	534 (3.4)
Ghana		10 (0.7)	310 (9.5)	17 (0.9)	285 (8.5)	22 (1.0)	276 (7.3)
Hong Kong, SAR		12 (1.0)	577 (5.9)	12 (0.5)	565 (4.3)	36 (0.9)	558 (3.0)
Hungary	r	37 (1.6)	580 (3.1)	0 (0.0)	~ ~	49 (1.6)	530 (2.8)
Indonesia		9 (0.9)	465 (6.7)	6 (0.5)	438 (6.4)	24 (1.1)	433 (5.1)
Iran, Islamic Rep. of		10 (0.8)	490 (5.7)	10 (0.7)	471 (3.8)	15 (0.8)	475 (3.9)
Israel	r	45 (1.3)	523 (3.9)	24 (0.9)	487 (4.2)	18 (0.9)	468 (5.0)
Italy		21 (1.3)	514 (5.7)	5 (0.4)	507 (6.1)	40 (0.9)	501 (3.1)
Japan	r	45 (1.4)	576 (2.5)	18 (0.7)	555 (3.2)	36 (1.1)	536 (2.5)
Jordan		35 (1.8)	506 (5.2)	15 (0.8)	488 (4.9)	30 (1.0)	475 (3.6)
Korea, Rep. of		35 (1.2)	580 (2.2)	15 (0.6)	560 (3.0)	41 (1.0)	551 (2.0)
Latvia	r	43 (1.8)	532 (3.7)	0 (0.0)	~ ~	34 (1.4)	517 (3.5)
Lebanon		19 (1.2)	434 (6.7)	21 (1.0)	417 (5.9)	19 (0.7)	405 (5.8)
Lithuania	r	36 (1.6)	548 (2.6)	31 (1.0)	523 (3.2)	30 (1.3)	497 (2.7)
Macedonia, Rep. of		22 (1.3)	498 (5.0)	19 (0.9)	476 (4.3)	43 (1.2)	449 (3.7)
Malaysia		11 (0.9)	548 (6.4)	20 (0.9)	526 (4.1)	27 (0.9)	518 (4.2)
Moldova, Rep. of		34 (1.4)	495 (3.9)	18 (1.0)	483 (4.8)	21 (1.1)	471 (4.8)
Morocco	r	16 (1.3)	413 (6.1)	0 (0.0)	~ ~	17 (0.8)	405 (5.9)
Netherlands	r	22 (1.6)	563 (4.6)	32 (1.3)	560 (3.7)	43 (1.9)	527 (3.2)
New Zealand	s	28 (1.9)	558 (7.0)	30 (1.5)	541 (5.9)	34 (1.9)	518 (5.3)
Norway	s	66 (1.4)	517 (2.3)	16 (1.0)	494 (4.0)	12 (0.9)	496 (6.5)
Palestinian Nat'l Auth.		27 (0.9)	469 (4.4)	12 (0.5)	443 (5.4)	36 (0.8)	441 (3.3)
Philippines		19 (1.2)	440 (7.8)	22 (0.8)	399 (6.8)	33 (0.9)	368 (5.9)
Romania		17 (1.8)	522 (5.8)	16 (1.0)	489 (5.1)	47 (1.5)	475 (5.0)
Russian Federation		44 (2.3)	536 (3.3)	26 (1.5)	515 (4.3)	24 (1.2)	494 (4.4)
Saudi Arabia		27 (1.9)	424 (6.0)	0 (0.0)	~ ~	12 (0.5)	404 (5.9)
Scotland		x x	x x	x x	x x	x x	x x
Serbia		20 (1.2)	514 (3.1)	68 (1.2)	467 (2.6)	2 (0.2)	~ ~
Singapore	r	16 (0.6)	638 (3.6)	4 (0.3)	605 (7.2)	21 (0.8)	602 (4.1)
Slovak Republic	r	34 (1.9)	556 (3.8)	0 (0.0)	~ ~	65 (1.9)	512 (3.2)
Slovenia	r	26 (1.3)	548 (2.9)	31 (0.8)	530 (2.3)	34 (1.1)	515 (3.1)
South Africa	r	11 (1.0)	341 (20.1)	13 (0.7)	280 (12.5)	30 (0.9)	250 (7.1)
Sweden	s	48 (1.8)	550 (3.7)	18 (1.1)	540 (4.5)	22 (1.3)	518 (4.3)
Tunisia		11 (0.9)	426 (5.1)	12 (0.8)	424 (3.7)	16 (0.6)	411 (4.3)
United States	r	56 (1.3)	554 (3.4)	9 (0.4)	522 (3.6)	26 (0.9)	511 (3.0)
‡ England		x x	x x	x x	x x	x x	x x
International Avg.		28 (0.2)	507 (0.9)	17 (0.1)	487 (0.8)	28 (0.2)	472 (0.8)
Benchmarking Participants							
Basque Country, Spain		34 (2.1)	510 (4.5)	14 (1.1)	493 (3.6)	21 (1.1)	488 (3.7)
Indiana State, US	r	46 (2.1)	551 (5.5)	10 (0.8)	531 (5.4)	33 (1.3)	530 (5.4)
Ontario Province, Can.	s	46 (2.3)	557 (3.4)	37 (1.6)	534 (3.1)	13 (1.1)	527 (4.5)
Quebec Province, Can.	r	33 (1.6)	549 (4.4)	34 (0.9)	540 (3.8)	21 (1.1)	516 (3.4)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

* Based on countries' categorizations to UNESCO's International Standard Classification of Education (Operational Manual for ISCED-1997).

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

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

An "r" indicates 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 the students.

Exhibit 4.1: Highest Level of Education of Either Parent*

Countries		Finished Lower Secondary Schooling		No More than Primary Schooling	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia		2 (0.4)	~ ~	1 (0.2)	~ ~
Australia	r	15 (0.9)	505 (5.4)	3 (0.4)	461 (11.6)
Bahrain		20 (0.7)	426 (4.1)	17 (0.7)	421 (3.4)
Belgium (Flemish)	s	11 (0.7)	505 (4.8)	6 (0.7)	446 (9.9)
Botswana		20 (0.8)	357 (4.9)	41 (1.2)	352 (3.2)
Bulgaria		6 (0.7)	462 (13.3)	2 (0.4)	~ ~
Chile		31 (1.0)	387 (3.2)	11 (0.9)	363 (5.3)
Chinese Taipei		21 (1.1)	547 (5.0)	6 (0.5)	540 (6.3)
Cyprus		15 (0.7)	409 (3.8)	7 (0.4)	398 (6.3)
Egypt		29 (0.9)	413 (4.8)	36 (1.4)	403 (4.5)
Estonia		2 (0.3)	~ ~	0 (0.1)	~ ~
Ghana		37 (1.2)	235 (6.6)	14 (1.0)	223 (5.8)
Hong Kong, SAR		25 (0.8)	555 (2.9)	15 (0.7)	549 (4.4)
Hungary	r	14 (1.3)	489 (6.5)	0 (0.1)	~ ~
Indonesia		22 (0.9)	402 (6.0)	39 (1.6)	412 (4.7)
Iran, Islamic Rep. of		22 (0.8)	446 (2.9)	43 (1.6)	440 (2.5)
Israel	r	8 (0.6)	458 (7.0)	5 (0.6)	456 (9.5)
Italy		30 (1.1)	469 (3.8)	5 (0.4)	434 (7.7)
Japan	r	2 (0.3)	~ ~	0 (0.0)	~ ~
Jordan		12 (0.9)	455 (5.7)	8 (0.6)	428 (7.2)
Korea, Rep. of		6 (0.4)	531 (5.0)	3 (0.4)	507 (6.4)
Latvia	r	23 (1.1)	508 (3.4)	0 (0.1)	~ ~
Lebanon		15 (0.8)	375 (5.9)	26 (1.7)	349 (5.8)
Lithuania	r	2 (0.3)	~ ~	1 (0.2)	~ ~
Macedonia, Rep. of		11 (0.8)	398 (5.8)	5 (0.6)	362 (14.0)
Malaysia		24 (1.0)	494 (3.9)	18 (1.0)	493 (4.3)
Moldova, Rep. of		17 (0.9)	460 (5.4)	10 (0.8)	435 (7.2)
Morocco	r	17 (1.1)	388 (5.3)	50 (1.7)	397 (3.3)
Netherlands	r	0 (0.0)	~ ~	3 (0.4)	488 (10.2)
New Zealand	s	5 (0.7)	498 (10.9)	2 (0.4)	~ ~
Norway	s	4 (0.5)	470 (9.1)	2 (0.3)	~ ~
Palestinian Nat'l Auth.		18 (0.8)	420 (4.6)	6 (0.5)	385 (7.6)
Philippines		13 (0.5)	337 (6.5)	14 (0.9)	332 (6.8)
Romania		13 (1.6)	464 (10.8)	7 (0.8)	398 (9.0)
Russian Federation		6 (0.5)	475 (7.3)	0 (0.1)	~ ~
Saudi Arabia		19 (1.7)	391 (4.8)	41 (1.7)	390 (3.8)
Scotland		x x	x x	x x	x x
Serbia		9 (0.9)	412 (5.3)	1 (0.2)	~ ~
Singapore	r	48 (0.8)	570 (4.6)	11 (0.5)	529 (6.7)
Slovak Republic	r	1 (0.3)	~ ~	0 (0.1)	~ ~
Slovenia	r	8 (0.7)	486 (5.4)	1 (0.2)	~ ~
South Africa	r	18 (0.7)	220 (5.3)	28 (1.1)	193 (5.4)
Sweden	s	9 (0.8)	504 (6.4)	3 (0.5)	463 (12.6)
Tunisia		17 (0.7)	403 (2.7)	44 (1.5)	393 (2.3)
United States	r	6 (0.4)	479 (5.8)	3 (0.3)	456 (6.0)
‡ England		x x	x x	x x	x x
International Avg.		15 (0.1)	442 (1.0)	12 (0.1)	416 (1.4)
Benchmarking Participants					
Basque Country, Spain		20 (1.5)	477 (4.3)	11 (0.8)	454 (5.7)
Indiana State, US	r	7 (0.9)	492 (9.9)	4 (0.5)	493 (14.8)
Ontario Province, Can.	s	3 (0.5)	526 (11.4)	2 (0.4)	~ ~
Quebec Province, Can.	r	10 (0.7)	518 (4.6)	1 (0.3)	~ ~

Background data provided by students.

* Based on countries' categorizations to UNESCO's International Standard Classification of Education (Operational Manual for ISCED-1997).

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

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

An "r" indicates 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 the students.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 4.2: Students' Educational Aspirations Relative to Parents' Educational Level*

SCIENCE Grade 8

Countries	Finish University and Either Parent Went to University or Equivalent		Finish University but Neither Parent Went to University or Equivalent		Not Finish University Regardless of Parents' Education		Do Not Know Regardless of Parents' Education	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia r	36 (1.5)	493 (4.1)	18 (0.9)	479 (4.9)	37 (1.5)	440 (4.6)	9 (0.5)	456 (6.1)
Australia s	22 (1.3)	574 (4.5)	22 (1.0)	556 (4.4)	45 (1.4)	511 (3.8)	11 (0.7)	522 (6.7)
Bahrain r	28 (0.7)	473 (2.7)	39 (0.8)	455 (2.5)	16 (0.7)	395 (3.3)	16 (0.6)	427 (4.7)
Belgium (Flemish) s	16 (1.2)	553 (3.4)	17 (0.9)	548 (3.2)	46 (1.6)	511 (3.3)	21 (0.8)	508 (4.5)
Botswana	8 (0.6)	436 (8.1)	36 (0.9)	401 (2.9)	45 (1.0)	337 (3.0)	12 (0.6)	329 (6.4)
Bulgaria	23 (1.3)	500 (11.3)	28 (1.1)	493 (6.0)	37 (1.7)	464 (6.2)	12 (0.9)	466 (8.1)
Chile	15 (1.0)	487 (4.3)	43 (1.1)	420 (3.5)	36 (1.0)	382 (2.7)	7 (0.4)	385 (7.0)
Chinese Taipei	15 (1.3)	624 (3.7)	56 (1.0)	587 (2.7)	16 (0.9)	506 (4.0)	14 (0.6)	540 (5.5)
Cyprus	23 (0.8)	481 (3.6)	40 (0.9)	458 (2.5)	18 (0.8)	397 (3.8)	19 (0.6)	414 (3.8)
Egypt r	23 (1.1)	496 (4.6)	44 (1.2)	443 (4.2)	18 (0.8)	382 (5.0)	14 (0.8)	424 (4.8)
Estonia	25 (1.2)	588 (3.4)	19 (0.7)	566 (3.6)	37 (1.1)	540 (2.8)	19 (0.6)	533 (3.8)
Ghana	6 (0.6)	350 (10.8)	21 (1.4)	318 (7.8)	67 (1.5)	239 (5.3)	7 (0.6)	198 (12.1)
Hong Kong, SAR	11 (0.9)	583 (4.7)	63 (1.1)	567 (2.5)	19 (1.0)	524 (5.5)	8 (0.4)	550 (5.8)
Hungary s	38 (1.8)	588 (3.0)	36 (1.2)	549 (3.1)	19 (1.4)	484 (4.6)	8 (0.7)	508 (8.4)
Indonesia	8 (0.9)	474 (6.8)	46 (1.3)	431 (4.4)	25 (1.2)	401 (6.4)	21 (1.0)	407 (4.7)
Iran, Islamic Rep. of	7 (0.6)	504 (7.0)	37 (0.9)	467 (2.9)	16 (0.8)	436 (3.8)	39 (1.1)	441 (2.7)
Israel r	35 (1.1)	532 (4.1)	29 (0.9)	494 (3.4)	23 (0.8)	454 (5.1)	14 (0.6)	478 (5.0)
Italy	15 (1.1)	527 (5.6)	35 (1.1)	511 (2.8)	38 (1.2)	469 (3.7)	12 (0.6)	462 (5.3)
Japan r	29 (1.3)	592 (2.9)	17 (0.7)	575 (2.7)	37 (1.2)	530 (2.3)	18 (0.7)	538 (3.6)
Jordan	27 (1.6)	519 (6.0)	35 (1.2)	489 (3.7)	13 (0.8)	429 (5.2)	24 (1.0)	464 (3.6)
Korea, Rep. of	31 (1.2)	584 (2.2)	48 (0.9)	560 (1.9)	11 (0.5)	506 (4.2)	9 (0.4)	540 (4.3)
Latvia s	35 (1.7)	539 (3.3)	34 (1.5)	526 (3.2)	16 (1.3)	515 (5.5)	15 (0.9)	490 (5.8)
Lebanon	16 (1.1)	447 (6.6)	52 (1.2)	405 (4.9)	16 (0.9)	351 (6.0)	16 (0.9)	353 (6.7)
Lithuania r	33 (1.6)	554 (2.9)	42 (1.3)	521 (2.5)	26 (1.2)	494 (3.3)	0 (0.0)	~ ~
Macedonia, Rep. of	20 (1.3)	508 (4.7)	40 (1.1)	480 (3.3)	30 (1.1)	406 (4.8)	10 (0.8)	408 (6.6)
Malaysia	10 (0.9)	552 (6.6)	54 (1.5)	519 (3.5)	26 (1.3)	487 (4.0)	10 (0.7)	508 (5.2)
Moldova, Rep. of r	23 (1.3)	507 (4.2)	23 (1.0)	488 (4.6)	37 (1.4)	460 (4.2)	17 (0.9)	454 (4.6)
Morocco r	13 (1.2)	417 (5.7)	38 (1.2)	406 (4.0)	20 (1.1)	392 (3.8)	29 (1.3)	393 (4.4)
Netherlands r	13 (1.3)	577 (4.7)	16 (1.5)	580 (4.1)	55 (2.5)	529 (3.0)	16 (1.1)	539 (5.2)
New Zealand s	17 (1.6)	577 (8.0)	22 (1.3)	549 (7.2)	36 (1.9)	519 (5.0)	25 (1.3)	517 (6.2)
Norway s	47 (1.3)	521 (2.6)	13 (0.9)	502 (5.2)	19 (1.0)	483 (4.6)	21 (0.8)	502 (3.3)
Palestinian Nat'l Auth.	20 (0.8)	484 (4.2)	34 (0.9)	458 (3.2)	19 (0.8)	394 (4.6)	26 (0.8)	427 (3.7)
Philippines	15 (1.2)	456 (6.9)	26 (1.2)	405 (6.3)	44 (1.7)	346 (6.0)	15 (0.9)	357 (7.4)
Romania	14 (1.6)	536 (5.5)	30 (1.2)	505 (4.6)	41 (1.7)	457 (5.4)	16 (1.2)	435 (7.5)
Russian Federation	35 (2.2)	547 (3.4)	30 (1.4)	518 (3.7)	21 (1.2)	489 (5.7)	13 (0.6)	481 (4.7)
Saudi Arabia r	24 (1.9)	432 (6.6)	45 (1.6)	404 (3.9)	13 (1.0)	381 (6.3)	19 (1.7)	393 (4.7)
Scotland	x x	x x	x x	x x	x x	x x	x x	x x
Serbia	15 (1.1)	528 (3.6)	27 (0.9)	506 (3.7)	48 (1.3)	440 (2.4)	10 (0.6)	432 (5.6)
Singapore r	13 (0.5)	643 (3.7)	43 (1.1)	604 (3.2)	28 (1.0)	530 (6.0)	15 (0.5)	574 (6.2)
Slovak Republic r	25 (1.8)	573 (3.9)	27 (1.1)	544 (3.6)	36 (1.5)	496 (2.8)	13 (0.8)	482 (5.9)
Slovenia r	18 (1.1)	565 (3.2)	26 (0.9)	548 (3.3)	42 (1.1)	499 (2.6)	14 (0.8)	517 (3.4)
South Africa r	8 (1.0)	386 (18.7)	26 (0.9)	273 (9.3)	54 (1.2)	221 (5.6)	12 (0.8)	202 (8.9)
Sweden s	32 (1.4)	561 (4.1)	14 (0.8)	539 (5.9)	33 (1.5)	515 (3.6)	21 (0.9)	522 (4.3)
Tunisia	8 (0.7)	436 (4.6)	46 (1.1)	409 (2.7)	26 (0.8)	394 (2.4)	21 (0.7)	402 (3.1)
United States r	48 (1.3)	558 (3.5)	27 (0.8)	518 (3.1)	16 (0.7)	487 (3.7)	9 (0.3)	520 (4.0)
‡ England	x x	x x	x x	x x	x x	x x	x x	x x
International Avg.	21 (0.2)	520 (0.9)	33 (0.2)	490 (0.7)	30 (0.2)	446 (0.9)	15 (0.1)	453 (0.8)
Benchmarking Participants								
Basque Country, Spain	23 (1.7)	520 (4.9)	27 (1.3)	503 (3.9)	18 (1.2)	470 (4.1)	32 (1.3)	470 (3.5)
Indiana State, US r	40 (2.4)	557 (5.7)	33 (1.5)	536 (5.2)	16 (1.5)	499 (4.8)	11 (1.0)	517 (6.4)
Ontario Province, Can. s	39 (2.2)	561 (3.6)	26 (1.4)	544 (3.6)	22 (1.7)	517 (4.6)	13 (0.9)	531 (3.6)
Quebec Province, Can. r	26 (1.6)	553 (4.9)	28 (1.1)	539 (4.2)	35 (1.9)	520 (3.2)	11 (0.7)	529 (4.8)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

* Based on countries' categorizations to UNESCO's International Standard Classification of Education (Operational Manual for ISCED-1997).

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

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

An "r" indicates 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 the students.

at home in relation to their average science achievement, shows that this remains true for the TIMSS 2003 countries, and holds also for science achievement at the fourth grade. At both eighth and fourth grades, students from homes where the language of the test is always or almost always spoken had higher average achievement than those who spoke it less frequently.

Whereas in most countries a large majority of students at each grade are from homes where the language of the test is spoken frequently, on average, internationally, about 20 percent of students were from homes where the language of the test was spoken only sometimes, or never. Countries where the majority of students speak the language of the test so infrequently included Botswana, Ghana, Indonesia, Lebanon, the Philippines, Singapore, and South Africa at the eighth grade, and Morocco, the Philippines, and Singapore at the fourth grade. Although in general average science achievement in such countries was relatively low, Singapore was a notable exception, with average achievement above the international average even among those rarely speaking the language of the test at home.

Many countries tested in more than one language in order to cover their whole student population. These included Bahrain (Arabic and English), Egypt (Arabic, English, and French), Estonia (Estonian and Russian), Hong Kong SAR (Chinese and English), Israel (Hebrew and Arabic), Latvia (Latvian and Russian), Lebanon (French and English) Macedonia (Macedonian and Albanian), Moldova (Moldavian and Russian), New Zealand (English and Maori at grade 4 only), Norway (Bokmål and Nynorsk), the Palestinian National Authority (Arabic and English), Romania (Romanian and Hungarian), the Slovak Republic (Slovak and Hungarian), and South Africa (English and Afrikaans). Among benchmarking participants, the Basque Country, Spain tested in Basque and Castilian, and the Canadian provinces of Ontario and Quebec in English and French. However, in countries like Botswana, Ghana, Indonesia, Morocco, the Philippines, Singapore, and South Africa, testing in all possible dialects and languages was prohibitive.

Exhibit 4.3: Students Speak Language of the Test at Home

Countries	Always		Almost Always		Sometimes		Never	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	80 (1.0)	460 (3.7)	16 (0.8)	474 (4.1)	4 (0.5)	446 (11.6)	0 (0.1)	~ ~
Australia	80 (2.3)	529 (3.5)	12 (1.1)	524 (8.8)	7 (1.3)	521 (13.2)	1 (0.4)	~ ~
Bahrain	66 (1.1)	437 (2.1)	15 (0.7)	460 (3.6)	15 (0.7)	429 (4.0)	4 (0.5)	430 (5.9)
Belgium (Flemish)	77 (1.3)	526 (2.2)	11 (0.6)	506 (6.1)	9 (0.8)	459 (9.2)	4 (0.6)	489 (8.7)
Botswana	5 (0.3)	374 (13.5)	6 (0.4)	412 (10.9)	80 (0.8)	366 (2.5)	9 (0.6)	316 (6.5)
Bulgaria	81 (2.0)	482 (5.4)	10 (0.8)	494 (8.7)	8 (1.4)	445 (11.3)	1 (0.3)	~ ~
Chile	87 (0.7)	416 (2.8)	9 (0.5)	408 (4.8)	4 (0.4)	357 (8.8)	0 (0.1)	~ ~
Chinese Taipei	44 (1.5)	589 (2.9)	36 (1.0)	573 (3.7)	19 (1.2)	532 (6.7)	1 (0.2)	~ ~
Cyprus	79 (0.8)	442 (2.2)	14 (0.6)	452 (3.6)	6 (0.4)	426 (6.7)	2 (0.2)	~ ~
Egypt	61 (1.3)	421 (3.9)	14 (0.8)	444 (6.0)	22 (1.0)	429 (5.3)	3 (0.3)	387 (14.5)
Estonia	90 (0.6)	554 (2.5)	8 (0.4)	546 (4.6)	2 (0.3)	~ ~	1 (0.2)	~ ~
Ghana	23 (1.1)	260 (7.0)	10 (0.7)	279 (10.9)	63 (1.3)	263 (5.8)	5 (0.9)	155 (11.5)
Hong Kong, SAR	77 (0.8)	565 (2.6)	15 (0.6)	535 (5.6)	7 (0.5)	520 (7.6)	1 (0.2)	~ ~
Hungary	95 (0.4)	543 (2.8)	4 (0.4)	548 (9.2)	0 (0.1)	~ ~	0 (0.1)	~ ~
Indonesia	22 (2.0)	421 (6.5)	11 (0.7)	427 (6.8)	57 (2.0)	419 (4.1)	10 (0.8)	417 (6.6)
Iran, Islamic Rep. of	55 (3.2)	463 (2.9)	9 (0.6)	469 (3.9)	21 (1.8)	434 (3.9)	15 (1.9)	438 (4.2)
Israel	79 (1.0)	488 (3.1)	15 (0.7)	505 (5.1)	5 (0.5)	482 (6.9)	1 (0.2)	~ ~
Italy	94 (0.5)	493 (3.0)	3 (0.3)	475 (8.0)	3 (0.3)	428 (8.5)	1 (0.2)	~ ~
Japan	94 (0.4)	554 (1.7)	4 (0.3)	533 (5.8)	1 (0.2)	~ ~	0 (0.1)	~ ~
Jordan	72 (1.2)	472 (3.6)	13 (0.7)	509 (6.4)	11 (0.7)	473 (6.0)	4 (0.5)	457 (16.7)
Korea, Rep. of	71 (0.8)	558 (1.8)	28 (0.8)	562 (2.4)	1 (0.2)	~ ~	0 (0.0)	~ ~
Latvia	77 (1.9)	514 (2.6)	14 (0.9)	519 (3.2)	6 (1.3)	484 (9.5)	2 (0.5)	~ ~
Lebanon	5 (0.5)	396 (11.1)	12 (0.7)	411 (7.0)	68 (1.1)	395 (4.5)	15 (0.8)	374 (7.1)
Lithuania	89 (1.0)	519 (2.3)	9 (0.5)	526 (4.6)	2 (0.4)	~ ~	1 (0.2)	~ ~
Macedonia, Rep. of	89 (1.4)	452 (3.7)	4 (0.4)	449 (9.5)	5 (0.9)	410 (12.8)	2 (0.6)	~ ~
Malaysia	51 (2.1)	502 (3.4)	14 (0.8)	521 (4.3)	28 (1.9)	518 (6.1)	7 (0.8)	523 (9.9)
Moldova, Rep. of	68 (1.6)	474 (3.9)	18 (0.9)	474 (4.5)	13 (1.2)	464 (5.9)	1 (0.2)	~ ~
Morocco	35 (1.8)	389 (4.1)	18 (0.9)	411 (4.0)	39 (1.4)	400 (3.1)	8 (0.8)	400 (7.8)
Netherlands	83 (1.3)	541 (3.1)	12 (1.0)	517 (6.7)	4 (0.5)	488 (11.8)	1 (0.2)	~ ~
New Zealand	80 (1.3)	525 (5.1)	12 (0.8)	508 (6.9)	6 (0.8)	495 (11.7)	1 (0.3)	~ ~
Norway	85 (0.8)	498 (1.9)	10 (0.5)	489 (6.1)	3 (0.4)	435 (10.6)	1 (0.2)	~ ~
Palestinian Nat'l Auth.	73 (1.3)	437 (3.5)	11 (0.6)	452 (6.0)	13 (1.0)	425 (5.6)	2 (0.3)	~ ~
Philippines	2 (0.3)	~ ~	4 (0.3)	385 (12.2)	80 (1.0)	385 (5.8)	14 (0.9)	343 (6.4)
Romania	86 (1.8)	469 (5.1)	8 (0.6)	483 (6.2)	4 (1.0)	451 (17.7)	2 (1.0)	~ ~
Russian Federation	86 (2.0)	514 (3.6)	10 (1.0)	531 (9.5)	4 (1.1)	471 (17.3)	1 (0.3)	~ ~
Saudi Arabia	100 (0.0)	398 (4.0)	0 (0.0)	~ ~	0 (0.0)	~ ~	0 (0.0)	~ ~
Scotland	92 (0.6)	513 (3.3)	5 (0.5)	532 (8.7)	3 (0.3)	464 (10.3)	1 (0.2)	~ ~
Serbia	93 (0.7)	468 (2.6)	5 (0.4)	484 (6.5)	2 (0.4)	~ ~	0 (0.1)	~ ~
Singapore	23 (0.6)	613 (3.9)	19 (0.6)	602 (3.9)	49 (0.8)	557 (5.1)	8 (0.4)	545 (6.7)
Slovak Republic	79 (1.6)	519 (3.3)	12 (0.7)	528 (6.1)	7 (1.0)	479 (7.5)	2 (0.4)	~ ~
Slovenia	80 (1.3)	526 (2.0)	11 (0.7)	504 (3.6)	6 (0.7)	487 (5.3)	2 (0.5)	~ ~
South Africa	18 (1.7)	347 (17.3)	9 (0.7)	310 (13.8)	57 (1.7)	225 (4.3)	15 (1.0)	153 (5.2)
Sweden	84 (1.3)	531 (2.4)	10 (0.8)	507 (5.8)	5 (0.7)	471 (9.2)	1 (0.2)	~ ~
Tunisia	51 (1.7)	399 (2.1)	13 (0.8)	422 (4.9)	28 (1.3)	401 (3.4)	9 (0.9)	409 (4.6)
United States	83 (0.9)	533 (2.9)	10 (0.5)	516 (5.5)	5 (0.4)	472 (7.0)	1 (0.2)	~ ~
‡ England	87 (1.6)	547 (4.5)	10 (1.3)	540 (7.2)	2 (0.6)	~ ~	1 (0.2)	~ ~
International Avg.	68 (0.2)	482 (0.8)	11 (0.1)	483 (1.0)	17 (0.1)	442 (1.5)	4 (0.1)	389 (2.4)
Benchmarking Participants								
Basque Country, Spain	65 (1.6)	489 (3.1)	25 (1.1)	490 (4.7)	8 (0.7)	486 (6.3)	3 (0.5)	477 (9.0)
Indiana State, US	88 (0.9)	534 (4.6)	7 (0.8)	534 (7.9)	4 (0.4)	483 (12.2)	1 (0.2)	~ ~
Ontario Province, Can.	72 (2.0)	536 (2.5)	16 (1.1)	528 (4.7)	9 (0.9)	523 (6.8)	2 (0.3)	~ ~
Quebec Province, Can.	72 (1.8)	536 (2.8)	19 (0.9)	527 (5.4)	7 (0.9)	498 (7.8)	2 (0.4)	~ ~

Background data provided by students.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

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

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 4.3: Students Speak Language of the Test at Home

Countries	Always		Almost Always		Sometimes		Never	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	84 (1.0)	440 (4.7)	11 (0.7)	448 (5.9)	4 (0.4)	413 (10.5)	1 (0.2)	~ ~
Australia	80 (1.7)	525 (4.6)	11 (0.9)	525 (4.9)	8 (1.0)	493 (8.5)	1 (0.2)	~ ~
Belgium (Flemish)	68 (1.4)	525 (1.6)	16 (0.9)	520 (2.7)	12 (1.2)	487 (5.4)	4 (0.5)	500 (6.9)
Chinese Taipei	31 (1.2)	568 (2.3)	41 (0.8)	553 (2.0)	26 (1.1)	533 (2.8)	1 (0.1)	~ ~
Cyprus	72 (1.1)	481 (2.4)	14 (0.7)	491 (4.3)	11 (0.6)	469 (5.0)	3 (0.3)	467 (7.0)
England	82 (1.3)	544 (3.7)	12 (0.8)	549 (5.8)	5 (0.7)	484 (7.2)	1 (0.2)	~ ~
Hong Kong, SAR	51 (1.3)	558 (3.5)	24 (0.8)	535 (3.3)	21 (1.0)	523 (3.6)	4 (0.4)	495 (5.4)
Hungary	91 (0.6)	531 (2.9)	8 (0.6)	540 (5.7)	1 (0.2)	~ ~	0 (0.1)	~ ~
Iran, Islamic Rep. of	53 (3.4)	434 (4.7)	6 (0.5)	438 (8.2)	21 (1.9)	407 (5.1)	20 (2.5)	368 (7.3)
Italy	88 (0.7)	520 (3.8)	3 (0.3)	494 (10.3)	6 (0.5)	486 (6.7)	2 (0.3)	~ ~
Japan	91 (0.5)	547 (1.5)	8 (0.5)	526 (5.2)	1 (0.2)	~ ~	0 (0.1)	~ ~
Latvia	78 (1.5)	535 (2.4)	15 (0.8)	537 (4.3)	6 (0.8)	496 (7.7)	2 (0.4)	~ ~
Lithuania	83 (1.0)	514 (2.6)	13 (0.8)	521 (5.2)	3 (0.6)	479 (9.7)	0 (0.1)	~ ~
Moldova, Rep. of	76 (1.8)	500 (5.0)	14 (1.0)	492 (7.4)	9 (1.1)	490 (7.0)	1 (0.3)	~ ~
Morocco	35 (2.3)	306 (8.4)	11 (0.8)	318 (9.7)	28 (1.6)	322 (7.3)	27 (2.5)	296 (11.5)
Netherlands	75 (1.2)	531 (1.8)	17 (0.9)	518 (4.7)	7 (0.8)	485 (5.0)	1 (0.3)	~ ~
New Zealand	76 (1.0)	529 (2.3)	13 (0.6)	533 (5.6)	11 (0.8)	458 (7.8)	1 (0.2)	~ ~
Norway	78 (1.0)	471 (2.6)	15 (0.8)	471 (5.1)	5 (0.5)	409 (8.8)	1 (0.2)	~ ~
Philippines	6 (0.6)	302 (15.1)	8 (0.9)	307 (23.7)	59 (1.8)	363 (10.4)	27 (2.1)	284 (7.5)
Russian Federation	81 (2.3)	526 (4.8)	8 (0.7)	544 (6.7)	8 (1.7)	515 (16.9)	2 (0.5)	~ ~
Scotland	78 (1.3)	506 (3.2)	10 (0.6)	509 (5.3)	9 (0.8)	480 (5.9)	3 (0.4)	450 (10.9)
Singapore	24 (1.2)	592 (6.0)	22 (1.0)	598 (4.5)	47 (1.5)	545 (5.6)	7 (0.6)	512 (8.1)
Slovenia	72 (1.3)	494 (2.7)	18 (1.1)	497 (4.5)	8 (1.0)	474 (6.8)	2 (0.3)	~ ~
Tunisia	43 (2.5)	318 (7.9)	9 (0.8)	313 (13.0)	36 (2.2)	325 (6.6)	12 (1.5)	325 (11.7)
United States	73 (1.1)	546 (2.4)	13 (0.5)	538 (3.8)	12 (0.8)	482 (4.4)	2 (0.1)	~ ~
International Avg.	67 (0.3)	494 (1.1)	14 (0.2)	493 (1.6)	15 (0.2)	462 (1.8)	5 (0.2)	411 (2.8)
Benchmarking Participants								
Indiana State, US	83 (0.9)	556 (3.7)	11 (0.7)	566 (5.9)	5 (0.7)	506 (8.4)	1 (0.2)	~ ~
Ontario Province, Can.	63 (1.7)	546 (3.6)	24 (1.1)	549 (5.9)	13 (1.1)	505 (5.9)	1 (0.2)	~ ~
Quebec Province, Can.	67 (1.3)	500 (2.8)	24 (0.9)	509 (3.5)	8 (0.8)	480 (5.9)	2 (0.3)	~ ~

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

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

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

Earlier IEA studies have shown that students from homes with extensive literacy resources have higher achievement than those from less advantaged backgrounds. For example, TIMSS 1999 has shown a consistent relationship between number of books in the home and student achievement in both mathematics and science at the eighth grade,[2] and PIRLS 2001 demonstrated a similar relationship with reading literacy at the fourth grade.[3] Providing further information on this topic, Exhibit 4.4 shows for each country at both eighth and fourth grades the percentage of students at each of five ranges of number of books in the home in relation to average science achievement. This exhibit reveals a wide range both across and within each country. For example, the percentage of eighth-grade students reporting more than 200 books in their homes exceeded 30 percent in Australia, Estonia, Hungary, and Sweden, whereas in Botswana, Egypt, Ghana, Indonesia, Iran, Morocco, the Philippines, and South Africa, more than 30 percent of students were from homes with 10 books or less. The situation among fourth-grade students was similar.

Across countries, on average, 15 percent of eighth-grade students were from homes with more than 200 books, 13 percent from homes with 101-200 books, 27 percent from homes with 26-100 books, 26 percent from homes with 11-25 books, and 18 percent with 0-10 books. There also was a clear-cut relationship, on average, between number of books in the home and science achievement. Eighth-grade students reporting more than 200 books in their homes had an average score of 506 on the science scale, compared with an average of just 438 for students reporting 10 books or less, a difference of 68 points. The difference at fourth grade was similar.

In addition to literacy resources such as books, TIMSS has found that having study aids such as a computer or a study desk or table at home was associated with higher student achievement. Exhibit 4.5 shows the percentage of eighth- and fourth-grade students in each country that had a computer or study desk or table, together with their average science achievement. About 60 percent

2 Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., Gregory, K.D., Garden, R.A., O'Connor, K.M, Chrostowski, S.J., and Smith, T.A. (2000), *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade*, Chestnut Hill, MA: Boston College; Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., Gregory, K.D., Smith, T.A., Chrostowski, S.J., Garden, R.A., and O'Connor, K.M. (2000), *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade*, Chestnut Hill, MA: Boston College.

3 Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., and Kennedy, A.M. (2003), *PIRLS 2001 International Report: IEA's Study of Reading Literacy Achievement in Primary Schools in 35 Countries*, Chestnut Hill, MA: Boston College.

of eighth-grade students, on average, reported having a computer at home, as did a slightly greater percentage of fourth-grade students (65%). However, there were great differences between countries. For 17 of the participants – Australia, Belgium (Flemish), Chinese Taipei, England, Hong Kong SAR, Israel, Korea, the Netherlands, New Zealand, Norway, Scotland, Singapore, Sweden, the United States, Indiana, Ontario, and Quebec – virtually all eighth-grade students (90% or more) reported having a computer at home. In contrast, less than 20 percent of eighth-grade students in Armenia, Botswana, Egypt, Indonesia, Moldova, and Morocco reported having a computer. The science achievement difference between students with a computer at home and those without was substantial on average – 35 scale score points at eighth grade and 27 points at fourth grade.

Perhaps not surprisingly, somewhat greater percentages of students reported having a study desk or table at home – 83 percent and 80 percent at eighth and fourth grades, respectively. In many countries (20 at eighth grade and 9 at fourth grade), more than 90 percent of students reported having a study desk. Having such a study facility was associated with higher average science achievement at both grades – 34 point difference at eighth grade and a 26 point difference at fourth grade.

Because having a computer at home does not necessarily mean that students have access to it, TIMSS also asked students where they actually use a computer – at home, at school, or some other place. Exhibit 4.6 summarizes these responses, presenting countries in order of the percentage of students that reported using a computer both at home and at school. On average, almost 40% of eighth-grade students reported using a computer both at home and at school. Eighteen percent reported using a computer at home but not at school, 19 percent using one at school but not at home, and 10 percent at some other place. Fourteen percent of eighth-grade students reported that they do not use a computer at all. The percentages for fourth grade were fairly similar.

Exhibit 4.4: Books in the Home

Countries	More than 200 Books		101-200 Books		26-100 Books	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	20 (1.0)	478 (5.1)	13 (0.6)	475 (4.2)	28 (0.7)	467 (3.6)
Australia	31 (1.4)	553 (4.1)	23 (0.8)	540 (3.4)	30 (1.0)	517 (4.8)
Bahrain	17 (0.5)	450 (2.7)	14 (0.6)	457 (3.4)	31 (0.8)	445 (2.1)
Belgium (Flemish)	12 (0.6)	539 (4.0)	15 (0.6)	538 (2.6)	34 (0.9)	524 (2.7)
Botswana	4 (0.5)	407 (14.6)	5 (0.3)	402 (7.4)	13 (0.6)	395 (6.2)
Bulgaria	28 (1.3)	494 (8.2)	18 (0.9)	484 (6.0)	25 (1.1)	481 (5.9)
Chile	5 (0.4)	484 (6.4)	7 (0.4)	458 (5.8)	27 (0.9)	437 (3.5)
Chinese Taipei	15 (1.0)	616 (3.5)	14 (0.6)	602 (3.8)	30 (0.7)	582 (3.2)
Cyprus	11 (0.5)	472 (5.0)	16 (0.7)	458 (3.5)	35 (0.8)	453 (3.0)
Egypt	6 (0.4)	447 (8.9)	6 (0.4)	438 (9.5)	18 (0.7)	440 (5.3)
Estonia	45 (1.2)	567 (2.9)	18 (0.6)	552 (3.6)	23 (0.7)	543 (3.1)
Ghana	10 (0.6)	259 (11.1)	6 (0.4)	276 (13.8)	16 (0.7)	277 (8.2)
Hong Kong, SAR	9 (0.6)	576 (5.6)	8 (0.4)	574 (4.2)	27 (0.6)	565 (3.0)
Hungary	31 (1.2)	578 (3.2)	22 (0.7)	551 (3.5)	29 (1.0)	531 (3.1)
Indonesia	1 (0.2)	~ ~	3 (0.3)	449 (9.6)	19 (0.7)	431 (5.1)
Iran, Islamic Rep. of	7 (0.5)	492 (6.1)	5 (0.3)	483 (5.2)	17 (0.8)	468 (3.5)
Israel	22 (0.9)	511 (4.1)	22 (0.7)	507 (3.9)	33 (0.8)	487 (3.6)
Italy	19 (0.9)	524 (4.2)	14 (0.6)	502 (4.7)	25 (0.7)	497 (3.8)
Japan	17 (0.7)	584 (3.2)	17 (0.5)	567 (2.9)	32 (0.8)	552 (2.3)
Jordan	9 (0.6)	499 (7.9)	8 (0.5)	509 (7.2)	28 (0.9)	496 (4.1)
Korea, Rep. of	19 (0.8)	596 (2.2)	22 (0.7)	572 (2.3)	33 (0.8)	556 (2.2)
Latvia	28 (1.3)	532 (3.6)	25 (0.8)	517 (3.1)	31 (1.1)	504 (3.2)
Lebanon	8 (0.6)	421 (8.9)	8 (0.8)	446 (8.6)	25 (1.0)	423 (5.0)
Lithuania	12 (0.8)	551 (4.5)	15 (0.7)	537 (4.2)	34 (0.9)	525 (2.3)
Macedonia, Rep. of	8 (0.7)	471 (7.8)	8 (0.6)	489 (6.6)	28 (0.9)	476 (3.9)
Malaysia	5 (0.5)	557 (6.4)	9 (0.6)	540 (5.2)	28 (0.8)	524 (3.6)
Moldova, Rep. of	8 (0.8)	507 (5.2)	9 (0.6)	494 (5.9)	23 (1.0)	483 (4.3)
Morocco	5 (0.6)	410 (10.3)	4 (0.3)	403 (8.8)	21 (0.9)	404 (3.6)
Netherlands	21 (1.4)	567 (4.4)	19 (0.9)	556 (3.8)	31 (1.3)	535 (3.2)
New Zealand	25 (1.5)	556 (7.4)	22 (1.1)	537 (4.4)	31 (1.0)	512 (4.5)
Norway	27 (1.2)	515 (2.6)	22 (0.7)	504 (2.8)	33 (0.9)	493 (3.1)
Palestinian Nat'l Auth.	7 (0.5)	446 (7.1)	6 (0.4)	457 (6.8)	24 (0.7)	456 (4.4)
Philippines	3 (0.3)	373 (13.1)	4 (0.3)	423 (12.3)	17 (0.8)	418 (7.8)
Romania	12 (1.2)	516 (7.2)	13 (1.1)	508 (5.3)	29 (1.2)	479 (4.3)
Russian Federation	21 (1.3)	538 (3.5)	26 (0.9)	526 (4.1)	32 (1.4)	512 (4.2)
Saudi Arabia	10 (0.7)	422 (7.4)	9 (0.9)	414 (6.0)	25 (1.0)	410 (4.9)
Scotland	17 (1.0)	564 (4.8)	16 (0.7)	541 (4.3)	29 (0.8)	516 (3.6)
Serbia	6 (0.5)	509 (4.7)	9 (0.5)	518 (5.3)	27 (1.0)	490 (3.8)
Singapore	14 (0.5)	631 (4.1)	16 (0.5)	607 (4.2)	33 (0.7)	589 (3.7)
Slovak Republic	12 (0.8)	564 (4.7)	18 (0.8)	547 (4.1)	41 (0.9)	520 (3.0)
Slovenia	13 (0.7)	545 (4.5)	15 (0.7)	542 (3.2)	38 (0.9)	527 (2.2)
South Africa	6 (0.5)	315 (20.7)	5 (0.4)	316 (22.1)	14 (0.7)	288 (13.6)
Sweden	32 (1.3)	558 (3.2)	21 (0.6)	537 (3.0)	27 (0.9)	511 (3.0)
Tunisia	4 (0.4)	433 (7.8)	6 (0.5)	426 (6.3)	22 (0.9)	415 (3.1)
United States	24 (0.9)	569 (3.6)	18 (0.5)	552 (3.4)	28 (0.6)	527 (2.9)
‡ England	24 (1.1)	588 (5.7)	18 (1.0)	564 (6.5)	27 (1.0)	541 (4.4)
International Avg.	15 (0.1)	506 (1.0)	13 (0.1)	498 (1.0)	27 (0.1)	483 (0.7)
Benchmarking Participants						
Basque Country, Spain	25 (1.4)	514 (4.6)	20 (0.9)	505 (4.6)	36 (1.3)	481 (3.2)
Indiana State, US	19 (1.6)	566 (6.4)	17 (0.9)	552 (5.7)	32 (1.0)	537 (4.4)
Ontario Province, Can.	28 (1.6)	560 (3.1)	21 (0.9)	539 (3.3)	31 (1.1)	523 (3.7)
Quebec Province, Can.	13 (0.8)	553 (4.6)	16 (0.9)	551 (4.9)	33 (0.9)	535 (3.2)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

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

Exhibit 4.4: Books in the Home

Countries	11-25 Books		0-10 Books	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	24 (0.9)	453 (4.8)	15 (0.9)	433 (5.2)
Australia	11 (0.8)	493 (5.8)	5 (0.5)	464 (8.7)
Bahrain	26 (0.8)	423 (3.0)	11 (0.5)	420 (5.0)
Belgium (Flemish)	25 (0.8)	503 (4.0)	14 (0.7)	477 (5.7)
Botswana	30 (0.9)	368 (3.4)	48 (1.3)	348 (3.0)
Bulgaria	15 (0.7)	470 (6.3)	14 (1.6)	449 (11.8)
Chile	37 (0.9)	402 (2.6)	23 (1.2)	374 (3.5)
Chinese Taipei	24 (0.9)	552 (3.8)	17 (0.9)	515 (4.2)
Cyprus	27 (0.7)	427 (3.3)	11 (0.5)	391 (4.6)
Egypt	38 (0.8)	424 (4.2)	33 (1.2)	415 (3.8)
Estonia	11 (0.6)	528 (3.8)	3 (0.3)	516 (7.4)
Ghana	34 (1.0)	264 (6.3)	34 (1.5)	246 (6.4)
Hong Kong, SAR	28 (0.7)	555 (3.6)	28 (0.7)	538 (4.2)
Hungary	13 (0.6)	499 (4.5)	5 (0.7)	466 (7.7)
Indonesia	45 (0.9)	416 (4.4)	32 (1.0)	416 (4.3)
Iran, Islamic Rep. of	31 (0.8)	454 (2.6)	39 (1.3)	437 (2.6)
Israel	17 (0.8)	460 (4.2)	6 (0.4)	448 (7.5)
Italy	29 (0.7)	474 (4.0)	13 (0.7)	457 (5.5)
Japan	22 (0.6)	539 (2.4)	13 (0.7)	517 (3.3)
Jordan	33 (0.9)	470 (4.2)	23 (0.8)	449 (4.3)
Korea, Rep. of	10 (0.6)	533 (2.9)	15 (0.7)	514 (3.0)
Latvia	12 (0.7)	491 (4.1)	4 (0.4)	479 (7.0)
Lebanon	36 (1.1)	384 (5.2)	23 (1.4)	353 (5.2)
Lithuania	30 (1.1)	503 (2.7)	10 (0.7)	483 (6.4)
Macedonia, Rep. of	40 (1.2)	443 (3.9)	17 (0.8)	401 (5.9)
Malaysia	40 (1.0)	501 (3.4)	17 (0.9)	482 (4.7)
Moldova, Rep. of	37 (1.2)	467 (4.6)	23 (1.1)	452 (5.1)
Morocco	38 (1.0)	392 (3.4)	33 (1.4)	399 (3.6)
Netherlands	19 (1.2)	508 (5.3)	10 (0.8)	492 (5.7)
New Zealand	14 (0.8)	490 (4.4)	8 (0.7)	453 (7.8)
Norway	11 (0.6)	463 (4.6)	7 (0.4)	441 (7.0)
Palestinian Nat'l Auth.	36 (0.8)	432 (3.6)	27 (1.0)	421 (3.7)
Philippines	34 (0.8)	381 (5.7)	43 (1.0)	356 (5.6)
Romania	27 (1.4)	451 (5.9)	20 (1.7)	435 (9.0)
Russian Federation	17 (1.1)	481 (5.0)	4 (0.5)	458 (9.4)
Saudi Arabia	33 (1.1)	391 (4.5)	23 (1.4)	382 (4.3)
Scotland	21 (1.0)	480 (3.3)	16 (0.9)	460 (4.8)
Serbia	38 (1.0)	458 (2.5)	21 (1.1)	428 (4.0)
Singapore	24 (0.7)	546 (6.1)	12 (0.7)	508 (6.9)
Slovak Republic	24 (1.1)	481 (3.2)	5 (0.5)	440 (7.5)
Slovenia	27 (0.7)	502 (3.5)	8 (0.6)	474 (4.7)
South Africa	31 (0.9)	241 (6.0)	44 (1.3)	218 (4.5)
Sweden	14 (0.7)	481 (4.4)	6 (0.6)	472 (6.2)
Tunisia	44 (1.1)	400 (2.0)	23 (1.1)	392 (2.3)
United States	18 (0.6)	493 (3.3)	13 (0.6)	469 (4.6)
‡ England	17 (0.9)	520 (4.8)	13 (1.1)	487 (5.0)
International Avg.	26 (0.1)	458 (0.7)	18 (0.1)	438 (1.0)
Benchmarking Participants				
Basque Country, Spain	15 (0.8)	462 (4.3)	5 (0.5)	435 (9.3)
Indiana State, US	19 (1.0)	510 (5.8)	14 (1.2)	477 (6.3)
Ontario Province, Can.	14 (0.9)	507 (5.1)	7 (0.6)	497 (5.0)
Quebec Province, Can.	24 (1.1)	519 (3.3)	14 (0.7)	501 (4.3)

Background data provided by students.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 4.4: Books in the Home

Countries	More than 200 Books		101-200 Books		26-100 Books	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia r	18 (1.0)	459 (5.3)	14 (0.7)	456 (5.7)	29 (1.1)	448 (4.9)
Australia	23 (1.3)	542 (4.5)	23 (1.1)	543 (3.7)	34 (1.1)	519 (4.0)
Belgium (Flemish)	11 (0.7)	532 (4.3)	17 (0.7)	532 (2.8)	42 (1.0)	524 (1.8)
Chinese Taipei	15 (0.8)	580 (3.6)	14 (0.6)	570 (3.1)	30 (0.7)	557 (2.2)
Cyprus	9 (0.7)	490 (4.4)	14 (0.7)	489 (4.3)	38 (1.0)	491 (3.3)
England	19 (1.2)	575 (5.8)	20 (1.0)	561 (4.6)	35 (1.2)	542 (3.3)
Hong Kong, SAR	7 (0.6)	557 (5.0)	10 (0.8)	555 (5.7)	28 (1.0)	548 (3.8)
Hungary	18 (1.1)	560 (4.9)	17 (0.8)	549 (4.3)	35 (1.0)	536 (2.8)
Iran, Islamic Rep. of	5 (0.6)	454 (11.3)	5 (0.5)	436 (9.7)	13 (0.9)	450 (6.1)
Italy	10 (0.8)	525 (4.6)	11 (0.6)	531 (5.2)	27 (0.8)	525 (4.8)
Japan	7 (0.4)	566 (5.6)	14 (0.6)	561 (3.2)	40 (0.9)	553 (2.1)
Latvia	17 (0.9)	548 (3.6)	21 (0.9)	543 (4.2)	38 (1.1)	535 (3.0)
Lithuania	8 (0.6)	527 (3.9)	11 (0.6)	534 (4.6)	36 (1.0)	526 (2.7)
Moldova, Rep. of	6 (0.6)	526 (9.9)	8 (0.7)	524 (7.1)	24 (1.2)	516 (6.1)
Morocco r	2 (0.3)	~ ~	3 (0.3)	322 (16.3)	10 (1.0)	336 (13.4)
Netherlands	14 (1.1)	548 (3.9)	18 (1.0)	533 (3.6)	37 (1.2)	529 (2.5)
New Zealand	17 (0.7)	548 (3.8)	21 (0.8)	544 (4.2)	36 (1.0)	526 (3.1)
Norway	17 (0.9)	487 (4.9)	22 (0.8)	483 (3.8)	37 (0.9)	470 (3.1)
Philippines	5 (0.6)	318 (16.8)	6 (0.6)	340 (21.1)	14 (1.1)	388 (19.8)
Russian Federation	13 (0.7)	545 (7.8)	15 (0.8)	537 (6.8)	35 (1.2)	532 (5.1)
Scotland	21 (1.1)	523 (5.0)	18 (0.8)	520 (5.3)	31 (1.0)	508 (3.4)
Singapore	10 (0.6)	609 (6.3)	17 (0.9)	595 (5.8)	40 (0.9)	578 (4.7)
Slovenia	13 (0.9)	502 (6.5)	15 (0.9)	507 (5.0)	36 (0.9)	506 (3.0)
Tunisia r	4 (0.6)	357 (16.0)	8 (0.8)	351 (11.8)	18 (1.2)	360 (8.0)
United States	15 (0.7)	563 (3.6)	17 (0.5)	568 (3.0)	34 (0.7)	545 (2.4)
International Avg.	12 (0.2)	518 (1.5)	14 (0.2)	507 (1.5)	31 (0.2)	502 (1.2)
Benchmarking Participants						
Indiana State, US	16 (1.1)	565 (6.3)	19 (1.1)	578 (5.5)	36 (1.1)	560 (3.8)
Ontario Province, Can.	20 (1.4)	566 (5.3)	22 (1.1)	558 (5.5)	35 (1.3)	539 (3.4)
Quebec Province, Can.	7 (0.5)	516 (5.4)	11 (0.7)	518 (3.3)	44 (1.0)	509 (2.9)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

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

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

An "r" indicates data are available for at least 70 but less than 85% of the students.

Exhibit 4.4: Books in the Home

Countries		11-25 Books		0-10 Books	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	r	22 (0.9)	437 (6.4)	17 (1.2)	416 (6.9)
Australia		13 (0.9)	487 (6.8)	6 (0.8)	464 (10.2)
Belgium (Flemish)		23 (0.9)	506 (2.5)	8 (0.5)	484 (5.2)
Chinese Taipei		24 (0.8)	540 (2.2)	17 (0.8)	516 (2.6)
Cyprus		29 (1.0)	476 (2.9)	11 (0.7)	453 (4.8)
England		17 (1.0)	511 (4.5)	8 (0.8)	475 (6.3)
Hong Kong, SAR		30 (0.8)	540 (3.2)	25 (1.4)	533 (4.0)
Hungary		22 (0.9)	506 (4.1)	8 (0.7)	479 (6.2)
Iran, Islamic Rep. of		22 (1.2)	439 (5.4)	55 (2.1)	396 (4.5)
Italy		33 (1.0)	511 (4.3)	18 (0.9)	498 (6.8)
Japan		28 (0.8)	529 (2.4)	12 (0.8)	514 (3.6)
Latvia		18 (0.9)	515 (3.3)	6 (0.7)	491 (6.6)
Lithuania		34 (1.1)	506 (3.2)	13 (0.9)	476 (6.0)
Moldova, Rep. of		31 (1.4)	493 (5.4)	30 (1.4)	475 (6.9)
Morocco	r	26 (1.5)	320 (7.8)	60 (2.1)	304 (8.1)
Netherlands		21 (1.1)	515 (2.8)	9 (0.8)	486 (5.6)
New Zealand		17 (0.6)	491 (4.9)	9 (0.7)	463 (6.2)
Norway		17 (0.8)	445 (4.4)	7 (0.5)	418 (7.0)
Philippines		27 (1.1)	368 (11.6)	48 (2.1)	299 (7.2)
Russian Federation		27 (1.5)	516 (5.7)	10 (0.7)	499 (8.5)
Scotland		20 (1.1)	481 (3.6)	11 (0.7)	462 (6.3)
Singapore		22 (0.9)	538 (4.8)	11 (0.8)	497 (8.6)
Slovenia		28 (1.1)	475 (3.7)	7 (0.6)	443 (7.3)
Tunisia	r	29 (1.5)	337 (7.0)	41 (2.3)	290 (7.0)
United States		22 (0.6)	509 (2.5)	13 (0.6)	491 (3.5)
International Avg.		24 (0.2)	480 (1.1)	18 (0.2)	453 (1.4)
Benchmarking Participants					
Indiana State, US		19 (1.2)	535 (4.7)	10 (0.8)	508 (7.0)
Ontario Province, Can.		16 (1.3)	513 (4.4)	7 (0.9)	496 (7.9)
Quebec Province, Can.		27 (0.8)	491 (3.0)	11 (0.7)	473 (4.9)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

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

An "r" indicates data are available for at least 70 but less than 85% of the students.

Exhibit 4.5: Computer and Study Desk/Table in the Home

Countries	Have Computer		Do Not Have Computer		Have Study Desk/Table		Do Not Have Study Desk/Table	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	19 (0.7)	461 (4.6)	81 (0.7)	463 (3.6)	64 (1.1)	472 (3.7)	36 (1.1)	444 (4.0)
Australia	96 (0.3)	530 (3.7)	4 (0.3)	480 (7.8)	92 (0.5)	529 (3.9)	8 (0.5)	511 (6.5)
Bahrain	81 (0.6)	443 (1.8)	19 (0.6)	422 (3.6)	80 (0.7)	443 (2.0)	20 (0.7)	424 (3.1)
Belgium (Flemish)	95 (0.5)	519 (2.4)	5 (0.5)	457 (10.0)	95 (0.4)	518 (2.4)	5 (0.4)	485 (6.5)
Botswana	16 (0.8)	374 (8.2)	84 (0.8)	367 (2.5)	68 (0.8)	374 (3.6)	32 (0.8)	354 (3.0)
Bulgaria	37 (1.5)	481 (8.3)	63 (1.5)	480 (5.0)	79 (1.2)	482 (5.7)	21 (1.2)	469 (7.4)
Chile	39 (1.4)	442 (3.6)	61 (1.4)	396 (2.7)	56 (1.0)	427 (3.0)	44 (1.0)	396 (3.2)
Chinese Taipei	91 (0.8)	576 (3.3)	9 (0.8)	523 (5.4)	93 (0.5)	573 (3.4)	7 (0.5)	539 (5.8)
Cyprus	82 (0.6)	450 (2.0)	18 (0.6)	407 (3.6)	95 (0.3)	445 (1.9)	5 (0.3)	386 (7.9)
Egypt	16 (0.8)	458 (5.4)	84 (0.8)	418 (4.0)	80 (1.0)	440 (3.5)	20 (1.0)	367 (5.5)
Estonia	67 (1.1)	563 (2.6)	33 (1.1)	535 (3.0)	93 (0.6)	553 (2.5)	7 (0.6)	555 (5.7)
Ghana	24 (1.1)	239 (7.7)	76 (1.1)	269 (6.2)	60 (1.5)	280 (6.4)	40 (1.5)	236 (6.7)
Hong Kong, SAR	97 (0.3)	557 (2.9)	3 (0.3)	535 (9.2)	75 (0.8)	558 (3.0)	25 (0.8)	553 (4.2)
Hungary	75 (1.0)	554 (2.7)	25 (1.0)	512 (4.4)	98 (0.3)	544 (2.8)	2 (0.3)	~ ~
Indonesia	17 (1.3)	444 (5.7)	83 (1.3)	420 (4.0)	75 (1.2)	427 (3.8)	25 (1.2)	405 (5.5)
Iran, Islamic Rep. of	27 (1.4)	468 (3.6)	73 (1.4)	451 (2.4)	50 (1.6)	466 (2.5)	50 (1.6)	443 (2.6)
Israel	92 (0.7)	494 (3.1)	8 (0.7)	436 (6.0)	97 (0.3)	491 (3.1)	3 (0.3)	450 (8.9)
Italy	84 (0.7)	497 (3.0)	16 (0.7)	463 (6.0)	88 (0.6)	493 (3.1)	12 (0.6)	477 (4.7)
Japan	82 (0.8)	558 (1.7)	18 (0.8)	529 (3.2)	96 (0.3)	554 (1.7)	4 (0.3)	526 (6.5)
Jordan	41 (1.7)	502 (4.7)	59 (1.7)	459 (3.7)	73 (1.3)	487 (3.6)	27 (1.3)	448 (5.8)
Korea, Rep. of	98 (0.3)	560 (1.6)	2 (0.3)	~ ~	97 (0.3)	560 (1.6)	3 (0.3)	513 (8.3)
Latvia	43 (1.6)	526 (2.9)	57 (1.6)	504 (2.7)	94 (0.6)	514 (2.5)	6 (0.6)	497 (6.8)
Lebanon	59 (1.5)	409 (4.9)	41 (1.5)	373 (5.5)	71 (1.2)	403 (4.5)	29 (1.2)	374 (5.1)
Lithuania	48 (1.6)	535 (2.5)	52 (1.6)	506 (2.3)	97 (0.3)	520 (2.2)	3 (0.3)	495 (13.8)
Macedonia, Rep. of	42 (1.6)	466 (4.6)	58 (1.6)	441 (3.7)	87 (0.8)	456 (3.5)	13 (0.8)	415 (6.6)
Malaysia	57 (1.4)	522 (4.4)	43 (1.4)	495 (3.5)	87 (0.6)	512 (3.8)	13 (0.6)	498 (4.5)
Moldova, Rep. of	18 (1.0)	471 (4.7)	82 (1.0)	474 (3.5)	80 (1.2)	476 (3.6)	20 (1.2)	462 (4.8)
Morocco	18 (1.2)	398 (4.9)	82 (1.2)	398 (2.6)	73 (1.4)	401 (3.0)	27 (1.4)	390 (4.9)
Netherlands	98 (0.3)	537 (3.1)	2 (0.3)	~ ~	99 (0.2)	537 (3.2)	1 (0.2)	~ ~
New Zealand	91 (0.7)	524 (5.2)	9 (0.7)	489 (5.8)	87 (0.8)	525 (5.1)	13 (0.8)	489 (7.3)
Norway	96 (0.4)	497 (2.0)	4 (0.4)	445 (8.6)	98 (0.3)	496 (2.0)	2 (0.3)	~ ~
Palestinian Nat'l Auth.	41 (1.2)	455 (4.2)	59 (1.2)	425 (3.1)	77 (1.3)	442 (3.2)	23 (1.3)	420 (4.9)
Philippines	21 (1.1)	396 (8.7)	79 (1.1)	374 (5.8)	75 (1.1)	387 (6.2)	25 (1.1)	356 (6.0)
Romania	32 (1.9)	499 (5.6)	68 (1.9)	460 (5.0)	77 (1.8)	484 (4.6)	23 (1.8)	430 (7.1)
Russian Federation	30 (2.0)	538 (4.3)	70 (2.0)	504 (3.5)	92 (0.5)	516 (3.8)	8 (0.5)	490 (6.4)
Saudi Arabia	57 (1.9)	407 (5.0)	43 (1.9)	388 (3.5)	61 (1.5)	408 (4.3)	39 (1.5)	384 (4.5)
Scotland	91 (0.7)	516 (3.4)	9 (0.7)	475 (5.6)	82 (0.8)	517 (3.4)	18 (0.8)	489 (5.0)
Serbia	44 (1.4)	487 (3.1)	56 (1.4)	455 (2.6)	91 (0.6)	472 (2.5)	9 (0.6)	437 (5.2)
Singapore	94 (0.4)	583 (4.0)	6 (0.4)	498 (9.4)	91 (0.5)	582 (4.1)	9 (0.5)	536 (7.8)
Slovak Republic	67 (1.2)	528 (3.4)	33 (1.2)	496 (3.7)	88 (0.8)	521 (3.2)	12 (0.8)	490 (4.7)
Slovenia	86 (0.9)	525 (1.7)	14 (0.9)	499 (3.9)	97 (0.4)	522 (1.8)	3 (0.4)	484 (11.8)
South Africa	37 (1.3)	277 (12.9)	63 (1.3)	227 (5.4)	58 (1.5)	265 (10.0)	42 (1.5)	220 (5.1)
Sweden	98 (0.3)	526 (2.6)	2 (0.3)	~ ~	98 (0.3)	525 (2.7)	2 (0.3)	~ ~
Tunisia	22 (1.4)	418 (3.9)	78 (1.4)	400 (2.0)	73 (1.2)	409 (2.2)	27 (1.2)	390 (2.8)
United States	93 (0.4)	532 (3.1)	7 (0.4)	471 (5.6)	86 (0.5)	533 (3.1)	14 (0.5)	496 (4.2)
‡ England	94 (0.5)	548 (4.5)	6 (0.5)	509 (7.5)	87 (1.0)	550 (4.4)	13 (1.0)	517 (6.4)
International Avg.	60 (0.2)	484 (0.7)	40 (0.2)	449 (0.9)	83 (0.1)	480 (0.6)	17 (0.1)	446 (1.2)
Benchmarking Participants								
Basque Country, Spain	89 (0.7)	492 (2.7)	11 (0.7)	465 (5.2)	93 (0.6)	491 (2.7)	7 (0.6)	471 (6.4)
Indiana State, US	92 (0.9)	535 (4.6)	8 (0.9)	487 (9.7)	84 (0.9)	535 (4.6)	16 (0.9)	509 (7.3)
Ontario Province, Can.	97 (0.4)	534 (2.6)	3 (0.4)	498 (9.3)	91 (0.7)	535 (2.6)	9 (0.7)	516 (5.5)
Quebec Province, Can.	93 (0.5)	533 (3.2)	7 (0.5)	512 (4.0)	91 (0.6)	533 (3.1)	9 (0.6)	512 (5.8)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

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

Exhibit 4.5: Computer and Study Desk/Table in the Home

Countries	Have Computer		Do Not Have Computer		Have Study Desk/Table		Do Not Have Study Desk/Table	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	28 (1.2)	446 (5.4)	72 (1.2)	438 (4.6)	60 (1.5)	447 (4.9)	40 (1.5)	430 (5.0)
Australia	92 (0.9)	526 (3.9)	8 (0.9)	478 (8.3)	85 (1.1)	526 (3.5)	15 (1.1)	501 (8.3)
Belgium (Flemish)	90 (0.5)	520 (1.9)	10 (0.5)	505 (3.5)	91 (0.5)	519 (1.9)	9 (0.5)	517 (3.0)
Chinese Taipei	89 (0.7)	555 (1.8)	11 (0.7)	524 (3.2)	87 (0.6)	554 (1.7)	13 (0.6)	539 (3.5)
Cyprus	75 (0.7)	485 (2.6)	25 (0.7)	471 (3.5)	90 (0.5)	485 (2.4)	10 (0.5)	449 (4.3)
England	91 (0.6)	545 (3.6)	9 (0.6)	508 (6.7)	80 (1.1)	544 (3.7)	20 (1.1)	529 (4.4)
Hong Kong, SAR	85 (1.0)	544 (3.0)	15 (1.0)	537 (4.2)	71 (1.1)	541 (3.2)	29 (1.1)	548 (3.4)
Hungary	71 (1.2)	543 (2.9)	29 (1.2)	510 (4.0)	96 (0.5)	533 (2.8)	4 (0.5)	482 (8.9)
Iran, Islamic Rep. of	25 (1.7)	445 (5.2)	75 (1.7)	406 (4.4)	40 (1.8)	448 (4.8)	60 (1.8)	396 (4.4)
Italy	79 (0.7)	519 (3.5)	21 (0.7)	507 (6.1)	72 (0.9)	523 (3.9)	28 (0.9)	501 (4.6)
Japan	77 (0.8)	548 (1.7)	23 (0.8)	532 (2.7)	94 (0.4)	545 (1.5)	6 (0.4)	530 (5.6)
Latvia	42 (1.4)	538 (3.1)	58 (1.4)	529 (2.9)	91 (0.7)	533 (2.5)	9 (0.7)	523 (5.3)
Lithuania	45 (1.4)	521 (3.4)	55 (1.4)	508 (2.7)	97 (0.3)	514 (2.6)	3 (0.3)	489 (10.4)
Moldova, Rep. of	20 (1.1)	499 (6.0)	80 (1.1)	499 (4.5)	81 (1.2)	502 (4.8)	19 (1.2)	478 (6.4)
Morocco	r 20 (1.2)	327 (9.4)	r 80 (1.2)	307 (7.0)	r 52 (1.8)	323 (7.6)	r 48 (1.8)	298 (8.3)
Netherlands	93 (0.6)	527 (1.8)	7 (0.6)	500 (6.8)	94 (0.5)	526 (1.9)	6 (0.5)	516 (6.9)
New Zealand	87 (0.7)	530 (2.2)	13 (0.7)	483 (5.3)	80 (0.7)	529 (2.3)	20 (0.7)	498 (4.2)
Norway	91 (0.5)	471 (2.7)	9 (0.5)	440 (4.5)	92 (0.5)	471 (2.6)	8 (0.5)	428 (6.1)
Philippines	26 (1.7)	382 (19.4)	74 (1.7)	319 (7.3)	69 (1.3)	350 (9.9)	31 (1.3)	303 (10.5)
Russian Federation	23 (1.1)	533 (6.5)	77 (1.1)	525 (5.2)	83 (0.9)	530 (5.3)	17 (0.9)	516 (6.2)
Scotland	89 (0.8)	506 (2.9)	11 (0.8)	488 (5.9)	77 (1.1)	509 (2.9)	23 (1.1)	483 (4.8)
Singapore	89 (0.8)	573 (5.4)	11 (0.8)	511 (5.9)	90 (0.7)	572 (5.3)	10 (0.7)	511 (8.8)
Slovenia	77 (1.0)	501 (3.0)	23 (1.0)	471 (3.4)	91 (0.6)	492 (2.7)	9 (0.6)	480 (7.0)
Tunisia	26 (1.3)	348 (7.7)	74 (1.3)	309 (5.9)	64 (1.8)	334 (6.4)	36 (1.8)	297 (6.8)
United States	92 (0.4)	541 (2.4)	8 (0.4)	492 (3.9)	77 (0.8)	545 (2.3)	23 (0.8)	511 (4.0)
International Avg.	65 (0.2)	499 (1.2)	35 (0.2)	472 (1.1)	80 (0.2)	496 (1.0)	20 (0.2)	470 (1.5)
Benchmarking Participants								
Indiana State, US	90 (0.8)	558 (3.6)	10 (0.8)	520 (6.3)	80 (0.9)	558 (3.8)	20 (0.9)	540 (5.4)
Ontario Province, Can.	92 (0.6)	544 (4.0)	8 (0.6)	506 (6.9)	83 (1.1)	545 (4.0)	17 (1.1)	521 (5.1)
Quebec Province, Can.	89 (0.8)	504 (2.4)	11 (0.8)	477 (5.0)	86 (0.9)	504 (2.4)	14 (0.9)	480 (4.7)

Background data provided by students.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

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

An "r" indicates data are available for at least 70 but less than 85% of the students.

Exhibit 4.6: Use of Computer

Countries	Use Computer Both at Home and at School		Use Computer at Home but Not at School		Use Computer at School but Not at Home	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Hong Kong, SAR	89 (0.7)	561 (2.7)	9 (0.6)	522 (6.7)	2 (0.2)	~ ~
Chinese Taipei	88 (0.9)	578 (3.2)	2 (0.2)	~ ~	9 (0.8)	519 (5.2)
Australia	83 (0.9)	533 (3.7)	10 (0.9)	524 (6.2)	5 (0.4)	474 (8.2)
Singapore	79 (0.7)	588 (3.9)	14 (0.5)	560 (5.5)	5 (0.4)	494 (9.5)
United States	79 (1.0)	539 (2.9)	11 (0.9)	504 (6.1)	8 (0.4)	471 (5.2)
Netherlands	78 (1.5)	540 (3.1)	19 (1.4)	531 (5.3)	1 (0.2)	~ ~
Sweden	78 (1.3)	530 (2.6)	17 (1.3)	518 (5.0)	3 (0.3)	486 (8.4)
Scotland	77 (1.1)	519 (3.5)	12 (0.9)	501 (5.0)	9 (0.6)	469 (5.0)
Israel	72 (1.8)	499 (3.5)	19 (1.6)	483 (4.3)	6 (0.5)	445 (6.6)
New Zealand	71 (1.4)	530 (5.5)	16 (1.3)	521 (5.5)	10 (0.7)	479 (5.8)
Norway	71 (1.5)	500 (2.2)	22 (1.4)	489 (3.6)	5 (0.5)	469 (6.8)
Cyprus	70 (0.7)	457 (2.0)	7 (0.5)	434 (6.6)	16 (0.6)	406 (3.8)
Belgium (Flemish)	64 (1.9)	522 (2.7)	26 (1.8)	516 (4.4)	4 (0.5)	455 (11.4)
Hungary	61 (1.4)	559 (2.8)	8 (1.0)	552 (7.2)	26 (1.1)	510 (5.1)
Japan	55 (1.3)	563 (2.4)	16 (1.1)	559 (4.6)	26 (0.8)	530 (2.5)
Slovenia	51 (1.5)	531 (2.2)	34 (1.7)	517 (2.7)	8 (0.8)	507 (4.4)
Estonia	41 (1.5)	563 (2.8)	24 (1.3)	564 (4.1)	24 (1.1)	538 (3.0)
Lebanon	39 (1.4)	427 (5.1)	16 (1.4)	379 (7.8)	21 (2.0)	383 (7.9)
Italy	39 (1.9)	505 (3.6)	39 (1.9)	498 (3.8)	9 (0.7)	456 (7.0)
Jordan	35 (1.5)	495 (5.4)	10 (0.8)	477 (6.7)	43 (1.5)	464 (3.9)
Korea, Rep. of	35 (1.6)	570 (2.3)	61 (1.7)	555 (2.1)	1 (0.2)	~ ~
Bahrain	31 (1.4)	449 (2.8)	45 (1.4)	441 (2.2)	8 (0.4)	427 (5.1)
Slovak Republic	26 (1.8)	544 (4.9)	33 (2.0)	526 (3.9)	16 (1.5)	505 (5.2)
Lithuania	26 (1.5)	539 (2.8)	22 (1.4)	533 (3.8)	35 (1.6)	507 (2.9)
Malaysia	26 (1.7)	531 (5.0)	26 (1.8)	524 (6.1)	24 (1.7)	495 (4.4)
Palestinian Nat'l Auth.	26 (1.5)	442 (5.7)	18 (1.3)	452 (5.6)	33 (1.6)	424 (3.4)
Latvia	25 (1.3)	537 (3.2)	16 (1.0)	521 (4.6)	42 (1.8)	508 (3.1)
Chile	22 (1.2)	461 (4.0)	11 (0.8)	435 (6.2)	49 (1.8)	393 (3.3)
Egypt	18 (0.7)	429 (6.2)	5 (0.5)	398 (9.3)	62 (1.4)	420 (4.1)
South Africa	16 (1.2)	270 (21.4)	11 (1.1)	313 (18.3)	18 (1.3)	222 (6.5)
Serbia	15 (1.3)	502 (4.6)	22 (1.6)	490 (4.0)	23 (2.0)	462 (4.4)
Moldova, Rep. of	15 (1.2)	466 (8.2)	4 (0.4)	467 (8.7)	63 (2.1)	473 (3.6)
Morocco	15 (1.1)	378 (5.3)	17 (1.1)	390 (4.5)	21 (1.7)	398 (5.1)
Romania	15 (1.7)	507 (7.0)	16 (1.2)	489 (6.0)	25 (2.1)	470 (7.6)
Macedonia, Rep. of	14 (1.2)	474 (6.4)	22 (1.5)	477 (5.8)	21 (2.0)	448 (5.2)
Russian Federation	12 (1.1)	543 (5.6)	19 (2.3)	534 (4.3)	28 (1.8)	511 (3.8)
Saudi Arabia	12 (1.5)	412 (12.7)	46 (2.0)	402 (4.1)	5 (0.8)	389 (7.6)
Philippines	11 (0.9)	412 (11.9)	7 (0.5)	380 (12.3)	24 (1.7)	402 (8.3)
Ghana	9 (0.7)	209 (10.3)	9 (0.7)	229 (11.8)	21 (1.6)	233 (10.8)
Armenia	7 (0.7)	466 (7.2)	14 (0.8)	460 (4.8)	15 (2.0)	474 (6.0)
Indonesia	7 (1.4)	485 (7.2)	2 (0.4)	~ ~	31 (3.2)	436 (5.1)
Tunisia	5 (0.5)	406 (5.2)	20 (1.4)	414 (4.4)	16 (1.5)	407 (2.7)
Bulgaria	5 (0.8)	504 (13.9)	22 (1.4)	483 (9.7)	8 (1.1)	470 (8.1)
Botswana r	5 (0.7)	402 (21.5)	6 (0.5)	384 (9.0)	23 (2.5)	362 (4.8)
Iran, Islamic Rep. of	2 (0.6)	~ ~	17 (1.2)	478 (4.1)	1 (0.3)	~ ~
‡ England	81 (0.8)	553 (4.8)	10 (0.7)	525 (6.5)	7 (0.7)	504 (7.5)
International Avg.	39 (0.2)	490 (1.1)	18 (0.2)	476 (1.0)	19 (0.2)	450 (0.9)
Benchmarking Participants						
Basque Country, Spain	70 (2.1)	496 (3.1)	16 (1.9)	484 (5.0)	11 (0.8)	465 (5.6)
Indiana State, US	81 (1.3)	539 (4.7)	8 (0.9)	515 (8.1)	8 (0.9)	491 (6.8)
Ontario Province, Can.	85 (1.0)	537 (2.7)	11 (1.0)	517 (5.2)	3 (0.5)	501 (9.2)
Quebec Province, Can.	70 (1.9)	539 (3.4)	21 (1.8)	517 (3.8)	6 (0.6)	512 (4.6)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

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

An "r" indicates data are available for at least 70 but less than 85% of the students.

Exhibit 4.6: Use of Computer

Countries	Use Computer Only at Places Other than Home and School		Do Not Use Computers at All	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Hong Kong, SAR	0 (0.1)	~ ~	0 (0.1)	~ ~
Chinese Taipei	0 (0.1)	~ ~	0 (0.1)	~ ~
Australia	1 (0.1)	~ ~	1 (0.2)	~ ~
Singapore	1 (0.1)	~ ~	1 (0.1)	~ ~
United States	1 (0.1)	~ ~	1 (0.1)	~ ~
Netherlands	0 (0.1)	~ ~	2 (0.3)	~ ~
Sweden	1 (0.2)	~ ~	2 (0.3)	~ ~
Scotland	1 (0.2)	~ ~	1 (0.2)	~ ~
Israel	2 (0.3)	~ ~	1 (0.1)	~ ~
New Zealand	2 (0.3)	~ ~	2 (0.3)	~ ~
Norway	1 (0.2)	~ ~	2 (0.2)	~ ~
Cyprus	2 (0.2)	~ ~	5 (0.4)	401 (7.3)
Belgium (Flemish)	5 (0.3)	501 (7.6)	1 (0.2)	~ ~
Hungary	2 (0.4)	~ ~	3 (0.4)	516 (8.1)
Japan	1 (0.2)	~ ~	2 (0.2)	~ ~
Slovenia	3 (0.4)	482 (6.2)	4 (0.4)	492 (7.1)
Estonia	6 (0.5)	532 (5.4)	4 (0.5)	517 (10.1)
Lebanon	14 (1.2)	356 (7.5)	10 (1.2)	367 (8.4)
Italy	5 (0.4)	457 (8.7)	9 (0.5)	460 (6.2)
Jordan	7 (0.8)	456 (6.8)	4 (0.5)	471 (9.5)
Korea, Rep. of	2 (0.2)	~ ~	0 (0.1)	~ ~
Bahrain	10 (0.6)	420 (5.1)	6 (0.4)	418 (6.9)
Slovak Republic	13 (0.8)	492 (4.9)	12 (1.1)	480 (5.6)
Lithuania	13 (1.0)	502 (3.9)	4 (0.6)	491 (8.3)
Malaysia	14 (1.0)	493 (5.0)	11 (1.1)	493 (4.9)
Palestinian Nat'l Auth.	13 (1.1)	427 (4.4)	10 (0.9)	442 (5.5)
Latvia	12 (0.9)	496 (4.6)	5 (0.7)	472 (7.1)
Chile	10 (0.7)	405 (3.7)	8 (0.6)	381 (3.6)
Egypt	8 (0.6)	413 (6.9)	7 (0.7)	456 (7.0)
South Africa	27 (1.3)	225 (6.8)	28 (2.0)	233 (5.9)
Serbia	19 (1.2)	450 (4.0)	20 (1.1)	445 (4.2)
Moldova, Rep. of	8 (0.8)	470 (6.2)	9 (1.4)	491 (8.1)
Morocco	28 (1.2)	409 (3.5)	20 (1.5)	406 (4.6)
Romania	24 (1.4)	453 (5.6)	20 (1.8)	454 (7.0)
Macedonia, Rep. of	32 (1.8)	444 (4.2)	10 (1.0)	425 (7.2)
Russian Federation	21 (1.1)	511 (5.7)	21 (1.7)	490 (5.1)
Saudi Arabia	12 (0.7)	387 (5.8)	25 (1.9)	394 (5.1)
Philippines	14 (0.9)	400 (8.1)	44 (1.6)	350 (5.6)
Ghana	26 (1.5)	266 (9.4)	34 (2.5)	281 (7.8)
Armenia	18 (1.1)	467 (5.1)	45 (2.1)	458 (4.0)
Indonesia	19 (1.3)	391 (6.5)	40 (2.8)	415 (5.6)
Tunisia	23 (1.1)	407 (2.5)	36 (1.7)	396 (3.0)
Bulgaria	40 (1.8)	474 (5.7)	24 (1.6)	484 (6.8)
Botswana r	5 (0.4)	377 (7.1)	61 (2.5)	372 (3.0)
Iran, Islamic Rep. of	12 (0.8)	457 (4.9)	68 (1.7)	447 (2.3)
‡ England	1 (0.2)	~ ~	1 (0.2)	~ ~
International Avg.	10 (0.1)	434 (1.1)	14 (0.2)	432 (1.2)
Benchmarking Participants				
Basque Country, Spain	2 (0.5)	~ ~	1 (0.2)	~ ~
Indiana State, US	1 (0.3)	~ ~	1 (0.3)	~ ~
Ontario Province, Can.	0 (0.1)	~ ~	0 (0.1)	~ ~
Quebec Province, Can.	2 (0.2)	~ ~	1 (0.2)	~ ~

Background data provided by students.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

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

An "r" indicates 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) 2003

Exhibit 4.6: Use of Computer

Countries	Use Computer Both at Home and at School		Use Computer at Home but Not at School		Use Computer at School but Not at Home	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Chinese Taipei	81 (1.5)	557 (1.7)	5 (1.3)	543 (6.5)	12 (0.7)	522 (3.0)
Australia	80 (1.6)	531 (3.4)	7 (0.8)	503 (8.4)	11 (1.1)	475 (10.5)
England	79 (1.0)	547 (3.6)	8 (0.6)	533 (7.7)	11 (0.8)	505 (6.1)
Netherlands	79 (2.0)	528 (2.0)	12 (1.7)	524 (3.3)	4 (0.4)	496 (13.6)
Scotland	78 (1.0)	508 (2.8)	8 (0.7)	482 (6.3)	12 (0.7)	484 (5.2)
Hong Kong, SAR	76 (1.3)	547 (3.1)	9 (0.9)	519 (5.2)	11 (0.9)	541 (4.6)
United States	73 (1.2)	547 (2.3)	12 (0.9)	525 (6.5)	11 (0.6)	491 (4.0)
Singapore	71 (1.4)	578 (5.2)	17 (1.0)	551 (6.3)	8 (0.6)	509 (7.7)
New Zealand	71 (1.1)	533 (2.3)	12 (0.8)	511 (5.7)	13 (0.7)	479 (4.6)
Belgium (Flemish)	66 (1.4)	524 (1.9)	21 (1.5)	513 (2.9)	6 (0.6)	508 (4.9)
Norway	60 (1.7)	473 (2.9)	28 (1.6)	473 (3.7)	5 (0.5)	439 (9.3)
Japan	54 (1.1)	555 (1.9)	9 (0.7)	537 (4.6)	31 (1.0)	531 (2.5)
Cyprus	36 (1.6)	488 (3.7)	27 (1.6)	489 (3.8)	16 (0.9)	470 (4.0)
Slovenia	33 (1.9)	494 (3.7)	46 (2.0)	499 (3.2)	6 (0.7)	484 (8.1)
Italy	30 (1.8)	524 (4.7)	38 (1.9)	520 (4.8)	12 (1.0)	497 (6.3)
Hungary	24 (2.1)	548 (5.0)	43 (2.1)	536 (3.3)	9 (1.0)	503 (8.1)
Morocco r	16 (1.2)	301 (10.4)	25 (1.8)	328 (8.3)	7 (0.7)	278 (13.0)
Philippines	16 (2.0)	375 (29.8)	11 (0.8)	373 (12.5)	8 (0.7)	361 (24.2)
Lithuania	11 (1.2)	526 (6.4)	35 (1.5)	521 (3.2)	18 (1.6)	504 (4.9)
Latvia	10 (1.1)	539 (6.3)	27 (1.4)	541 (3.6)	17 (1.8)	535 (5.9)
Moldova, Rep. of	8 (0.8)	453 (12.2)	14 (1.1)	497 (7.0)	10 (1.4)	504 (7.6)
Tunisia	7 (0.8)	312 (12.8)	24 (1.4)	339 (7.6)	7 (1.1)	294 (12.0)
Armenia	6 (0.5)	423 (9.2)	30 (1.2)	435 (5.2)	9 (1.2)	440 (7.4)
Russian Federation	4 (0.6)	506 (14.6)	20 (1.0)	529 (6.7)	11 (1.6)	519 (8.7)
Iran, Islamic Rep. of	2 (0.4)	~ ~	11 (1.4)	469 (6.3)	2 (0.4)	~ ~
International Avg.	43 (0.3)	496 (1.9)	20 (0.3)	492 (1.2)	11 (0.2)	474 (1.9)
Benchmarking Participants						
Indiana State, US	79 (1.3)	561 (3.4)	8 (0.7)	534 (7.4)	10 (0.9)	524 (7.4)
Ontario Province, Can.	78 (2.0)	546 (4.1)	12 (1.6)	533 (9.0)	7 (0.6)	516 (6.5)
Quebec Province, Can.	75 (1.5)	505 (2.6)	12 (1.1)	493 (4.2)	10 (0.7)	487 (5.0)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

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

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

An "r" indicates data are available for at least 70 but less than 85% of the students.

Exhibit 4.6: Use of Computer

Countries	Use Computer Only at Places Other than Home and School		Do Not Use Computers at All	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Chinese Taipei	0 (0.1)	~ ~	1 (0.1)	~ ~
Australia	1 (0.2)	~ ~	1 (0.1)	~ ~
England	1 (0.2)	~ ~	1 (0.2)	~ ~
Netherlands	1 (0.2)	~ ~	5 (0.5)	511 (6.3)
Scotland	1 (0.2)	~ ~	1 (0.2)	~ ~
Hong Kong, SAR	1 (0.2)	~ ~	2 (0.3)	~ ~
United States	2 (0.2)	~ ~	2 (0.1)	~ ~
Singapore	2 (0.2)	~ ~	2 (0.2)	~ ~
New Zealand	3 (0.3)	481 (8.7)	2 (0.3)	~ ~
Belgium (Flemish)	1 (0.2)	~ ~	5 (0.4)	504 (5.4)
Norway	2 (0.3)	~ ~	5 (0.6)	435 (8.0)
Japan	2 (0.3)	~ ~	3 (0.4)	526 (6.2)
Cyprus	8 (0.6)	461 (4.8)	14 (0.7)	475 (3.8)
Slovenia	5 (0.6)	465 (8.0)	12 (0.9)	472 (5.9)
Italy	8 (0.6)	502 (9.0)	12 (0.7)	511 (7.2)
Hungary	12 (0.8)	504 (5.7)	12 (0.8)	528 (4.8)
Morocco r	15 (1.2)	312 (9.5)	37 (3.2)	303 (9.3)
Philippines	9 (0.8)	355 (13.2)	56 (2.5)	312 (7.3)
Lithuania	24 (1.1)	508 (3.1)	13 (1.0)	508 (4.8)
Latvia	25 (1.5)	529 (4.2)	22 (1.6)	522 (4.7)
Moldova, Rep. of	25 (1.6)	507 (6.6)	43 (2.5)	502 (6.1)
Tunisia	15 (1.1)	355 (7.7)	46 (2.1)	295 (7.7)
Armenia	24 (1.0)	436 (5.7)	32 (1.5)	446 (6.1)
Russian Federation	30 (1.4)	525 (6.2)	35 (1.6)	531 (5.1)
Iran, Islamic Rep. of	8 (0.9)	436 (7.8)	76 (1.9)	406 (4.3)
International Avg.	9 (0.2)	455 (2.1)	18 (0.3)	458 (1.5)
Benchmarking Participants				
Indiana State, US	1 (0.2)	~ ~	2 (0.3)	~ ~
Ontario Province, Can.	2 (0.4)	~ ~	1 (0.2)	~ ~
Quebec Province, Can.	1 (0.2)	~ ~	2 (0.3)	~ ~

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

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

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

An "r" indicates data are available for at least 70 but less than 85% of the students.

Science achievement was positively related to computer usage, particularly at eighth grade, with average achievement highest among students reporting using computers at home and at school (490 points). Next highest was achievement among students using computers at home but not school (476 points), followed by students using computers at school but not home (450 points). Countries with the greatest percentages of eighth-grade students using computers at home and at school included Hong Kong SAR, Chinese Taipei, Australia, England, and Indiana (80% or more), as well as Singapore, the United States, The Netherlands, Sweden, Scotland, Israel, New Zealand, Norway, and Cyprus (70% or more).

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

One of the major ways that students can consolidate and extend classroom learning is to spend time out of school studying or doing homework in school subjects. Well-chosen homework assignments can reinforce classroom learning, and by providing a challenge can encourage students to extend their understanding of the subject matter. Homework also allows students who are having trouble keeping up with their classmates to review material taught in class.

To summarize the amount of time typically devoted to science homework in each country, TIMSS constructed an index of the time students spend doing science homework (TSH) that assigns students to a high, medium, or low level on the basis of the frequency and amount of science homework they are assigned each week. Students at the high level reported that they were assigned more than 30 minutes of science homework at least 3-4 times per week. Students at the low level were reportedly assigned not more than 30 minutes of science homework, twice per week. The middle level included all other response combinations.

Exhibit 4.7 presents the percentages of eighth- and fourth-grade students at the various levels of this index across countries, and their

average science achievement. Countries are ordered by the percentage of students at the high level of the index. Also, the 17 countries that taught biology, earth science, chemistry, and physics as separate science subjects at eighth grade are presented in separate panels for each subject. Twenty-seven of the countries and all four benchmarking participants at the eighth grade taught science as a single subject. Among these, 13 percent of students were at the high level of the *time spent on science homework* index, 44 percent at the medium level, and 43 percent at the low level. Countries with the greatest emphasis on homework included Ghana, Egypt, the Palestinian National Authority, and Malaysia, where 20 percent or more of the students were at the high level of the index. In these countries, homework seems to be an important part of teachers' instructional strategy. In contrast, there seems to be relatively little emphasis on homework in Australia, Chile, England, Hong Kong SAR, Iran, Japan, Korea, Saudi Arabia, Scotland, and Tunisia, as well as the Canadian provinces of Ontario and Quebec, where less than 10 percent of students were at the high level of the index. Included in this group are several of the countries with the highest achievement levels – Hong Kong SAR, Japan, and Korea.

In countries teaching eighth-grade biology as a separate subject, nine percent of students on average were at the high level of the index, compared with 10 percent for earth science, and 14 percent each for chemistry and physics. Among these separate-science-subject countries, the Russian Federation, Moldova, and Armenia had the greatest percentages of students at the high level of the science homework index. It is noteworthy that there are several high-achieving countries among those at the low level of the homework index, including Belgium (Flemish), Hungary, The Netherlands, the Slovak Republic, and Sweden.

In general, less science homework is assigned at the fourth grade, with six percent of students on average at the high level of the index, 33 percent at the middle level, and 61 percent at the low level.

Exhibit 4.7: Index of Time Students Spend Doing Science Homework (TSH) in a Normal School Week

SCIENCE Grade 8

Index of Time Students Spend Doing Science Homework

Index based on students' reports on the frequency and amount of science homework they are given. High level indicates more than 30 minutes of science homework assigned 3-4 times a week. Low level indicates no more than 30 minutes of science homework no more than twice a week. Medium level includes all other possible combinations of responses.

Countries	High TSH		Medium TSH		Low TSH	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
General/ Integrated Science						
Ghana	25 (1.2)	267 (8.5)	54 (1.0)	262 (6.0)	22 (1.0)	258 (8.1)
Egypt	23 (0.7)	416 (4.4)	64 (0.8)	436 (4.0)	13 (0.6)	430 (6.6)
Palestinian Nat'l Auth.	21 (1.1)	433 (4.4)	56 (1.3)	442 (3.4)	23 (1.3)	441 (4.8)
Malaysia	20 (1.0)	513 (4.4)	49 (0.9)	510 (3.6)	31 (1.3)	510 (4.6)
Jordan	19 (0.9)	466 (4.2)	52 (1.2)	478 (3.9)	29 (1.5)	499 (5.0)
Singapore	18 (0.7)	595 (4.1)	48 (0.7)	585 (4.4)	34 (0.9)	564 (5.5)
d Philippines	17 (0.7)	381 (7.5)	50 (0.8)	379 (5.7)	33 (1.2)	381 (7.2)
South Africa	17 (0.7)	234 (9.6)	52 (0.9)	246 (7.9)	32 (0.9)	263 (7.4)
Botswana	14 (0.7)	378 (6.1)	45 (1.0)	368 (3.2)	40 (1.2)	366 (3.6)
Italy	14 (1.0)	489 (5.9)	41 (1.1)	487 (3.7)	45 (1.4)	496 (3.7)
Morocco r	14 (0.7)	391 (5.3)	47 (1.1)	396 (3.4)	39 (1.3)	408 (3.5)
Bahrain	13 (0.7)	426 (4.1)	56 (1.3)	441 (2.5)	31 (1.4)	445 (2.6)
Norway	13 (0.8)	485 (3.7)	44 (1.2)	493 (3.1)	43 (1.7)	503 (2.3)
Israel	13 (0.9)	480 (4.7)	43 (1.6)	485 (4.3)	44 (2.0)	505 (3.4)
United States	13 (0.7)	519 (4.3)	43 (1.4)	530 (3.4)	45 (1.7)	531 (3.7)
a Chinese Taipei	12 (1.2)	588 (4.6)	37 (1.3)	581 (4.0)	51 (2.1)	561 (3.5)
New Zealand	10 (1.3)	519 (6.2)	41 (1.6)	531 (6.9)	48 (2.0)	518 (5.1)
Australia	9 (0.8)	520 (6.4)	35 (1.6)	530 (3.3)	56 (2.0)	530 (4.4)
Tunisia	9 (0.6)	398 (4.0)	35 (0.9)	400 (2.8)	56 (1.2)	411 (2.6)
Iran, Islamic Rep. of	8 (0.7)	451 (5.6)	42 (1.4)	457 (2.9)	49 (1.7)	452 (2.7)
Chile	8 (0.6)	408 (5.2)	38 (0.8)	413 (3.5)	54 (1.1)	415 (3.0)
Saudi Arabia	8 (0.7)	382 (6.0)	61 (1.5)	402 (4.6)	31 (1.7)	403 (4.6)
Hong Kong, SAR	6 (0.5)	548 (4.6)	43 (1.4)	563 (2.9)	50 (1.4)	554 (3.9)
Korea, Rep. of	4 (0.4)	549 (6.3)	26 (1.7)	562 (2.4)	70 (2.0)	559 (1.9)
Scotland	3 (0.4)	487 (14.2)	27 (1.4)	508 (5.0)	71 (1.5)	517 (3.4)
Japan	2 (0.3)	~ ~	22 (1.4)	549 (3.5)	76 (1.6)	557 (2.0)
‡ England	9 (1.3)	576 (9.6)	38 (1.5)	556 (5.0)	53 (1.8)	537 (5.2)
International Avg.	13 (0.2)	458 (1.3)	44 (0.2)	466 (0.9)	43 (0.3)	467 (0.9)
Benchmarking Participants						
Basque Country, Spain	14 (1.1)	485 (4.2)	42 (1.8)	491 (4.0)	44 (2.4)	489 (3.3)
Indiana State, US	12 (1.2)	520 (6.3)	50 (2.8)	537 (4.6)	37 (3.0)	529 (7.4)
Ontario Province, Can.	8 (0.9)	532 (5.7)	37 (1.8)	534 (3.7)	55 (2.3)	533 (2.8)
Quebec Province, Can.	6 (0.6)	524 (6.8)	26 (1.6)	529 (4.6)	68 (1.8)	534 (3.2)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

a Chinese Taipei: Students were asked about natural science; data pertain to grade 8 physics/chemistry course.

d Philippines: Students study only biology at grade 8.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

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

An "r" indicates data are available for at least 70 but less than 85% of the students.

Exhibit 4.7: Index of Time Students Spend Doing Science Homework (TSH) in a Normal School Week *(Continued...)*

Countries		High TSH		Medium TSH		Low TSH	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Biology							
Moldova, Rep. of		27 (1.1)	479 (4.4)	54 (1.1)	473 (3.9)	19 (1.1)	475 (5.4)
Russian Federation		23 (1.2)	507 (4.8)	52 (1.0)	515 (4.0)	24 (1.2)	526 (3.6)
Armenia	r	17 (1.0)	471 (5.3)	51 (1.2)	466 (4.0)	32 (1.4)	466 (4.3)
b Lebanon		16 (0.9)	376 (5.9)	45 (1.1)	387 (5.0)	39 (1.5)	417 (5.5)
Indonesia		15 (0.6)	423 (4.4)	52 (0.8)	424 (4.1)	33 (0.9)	427 (4.8)
Latvia		14 (1.0)	505 (4.1)	45 (1.2)	508 (3.2)	41 (1.5)	524 (2.9)
Lithuania		11 (0.8)	504 (5.6)	41 (1.2)	515 (2.7)	47 (1.5)	529 (2.9)
Estonia		10 (0.8)	537 (4.4)	46 (1.3)	547 (2.7)	44 (1.5)	564 (3.1)
Macedonia, Rep. of	r	6 (0.6)	417 (11.1)	31 (1.7)	431 (4.9)	63 (1.9)	475 (3.5)
Romania		6 (0.6)	443 (9.1)	24 (1.2)	459 (8.6)	70 (1.5)	483 (4.8)
Bulgaria	r	5 (0.5)	478 (9.4)	26 (1.3)	474 (5.8)	69 (1.6)	485 (5.5)
Serbia	r	4 (0.4)	427 (8.1)	24 (1.3)	452 (4.9)	72 (1.4)	481 (2.7)
Hungary		4 (0.4)	516 (8.0)	28 (1.3)	524 (4.0)	69 (1.4)	555 (2.8)
Cyprus	s	3 (0.4)	426 (8.4)	14 (0.9)	403 (4.1)	83 (1.0)	453 (2.2)
Netherlands		3 (0.3)	528 (10.2)	29 (1.6)	530 (4.9)	68 (1.7)	540 (3.1)
Sweden		2 (0.4)	~ ~	37 (1.2)	520 (4.2)	61 (1.3)	535 (2.4)
Slovak Republic		2 (0.4)	~ ~	18 (1.0)	494 (4.1)	80 (1.1)	524 (3.5)
Slovenia		2 (0.2)	~ ~	15 (1.1)	499 (3.8)	83 (1.2)	528 (1.8)
Belgium (Flemish)		1 (0.2)	~ ~	16 (1.1)	510 (5.1)	83 (1.1)	522 (2.4)
International Avg.		9 (0.2)	469 (1.8)	34 (0.3)	481 (1.2)	57 (0.3)	500 (0.9)
Earth Science							
Moldova, Rep. of		26 (1.0)	479 (4.5)	54 (1.2)	473 (3.7)	20 (1.1)	476 (4.9)
Russian Federation		24 (1.1)	510 (5.5)	50 (0.9)	516 (3.2)	26 (1.3)	522 (4.0)
Armenia	r	16 (0.9)	466 (5.0)	44 (1.0)	461 (4.0)	40 (1.4)	471 (4.4)
Lithuania		15 (0.8)	506 (3.7)	42 (1.1)	516 (3.0)	42 (1.3)	531 (2.8)
Romania		15 (1.1)	456 (7.9)	34 (1.2)	468 (6.7)	50 (1.7)	484 (5.0)
Indonesia		12 (0.6)	417 (6.1)	52 (0.8)	424 (4.1)	36 (0.9)	428 (4.3)
Estonia		11 (0.8)	537 (4.3)	44 (1.3)	546 (2.9)	45 (1.6)	566 (2.7)
Cyprus		8 (0.5)	419 (4.7)	45 (1.1)	444 (2.7)	48 (1.2)	453 (2.4)
Macedonia, Rep. of	r	7 (0.7)	404 (9.1)	31 (1.7)	434 (5.2)	62 (2.1)	477 (3.7)
Bulgaria	r	6 (0.9)	478 (10.8)	26 (1.4)	477 (6.3)	68 (1.8)	486 (5.5)
Hungary		5 (0.5)	512 (7.3)	28 (1.3)	528 (3.4)	67 (1.4)	555 (3.0)
Serbia	r	4 (0.5)	426 (8.3)	24 (1.2)	458 (5.0)	72 (1.5)	480 (2.7)
Netherlands		4 (0.5)	531 (6.6)	29 (1.6)	533 (4.4)	67 (1.8)	539 (3.3)
Sweden	r	3 (0.4)	487 (9.0)	37 (1.0)	520 (3.8)	60 (1.1)	534 (2.7)
Slovak Republic		2 (0.3)	~ ~	17 (1.0)	499 (4.6)	81 (1.1)	523 (3.3)
Belgium (Flemish)		1 (0.3)	~ ~	20 (1.3)	508 (4.9)	79 (1.4)	522 (2.5)
Latvia		– –	– –	– –	– –	– –	– –
b Lebanon		– –	– –	– –	– –	– –	– –
Slovenia		– –	– –	– –	– –	– –	– –
International Avg.		10 (0.2)	473 (1.9)	36 (0.3)	488 (1.1)	54 (0.4)	503 (0.9)

Background data provided by students.

b Lebanon: Data in biology panel pertain to grade 8 life and earth sciences course.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals 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. 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) 2003

Exhibit 4.7: Index of Time Students Spend Doing Science Homework (TSH) in a Normal School Week *(...Continued)*

SCIENCE Grade 8

Countries		High TSH		Medium TSH		Low TSH	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Chemistry							
Russian Federation		40 (1.2)	516 (4.5)	47 (1.0)	516 (3.5)	13 (0.8)	521 (5.4)
Moldova, Rep. of		31 (1.0)	479 (4.2)	52 (1.0)	473 (3.9)	18 (1.0)	472 (4.9)
Armenia	r	27 (1.1)	470 (4.8)	52 (1.1)	466 (4.0)	21 (1.0)	464 (4.2)
Lithuania		18 (0.8)	504 (3.8)	45 (1.0)	518 (2.7)	36 (1.2)	533 (3.0)
Latvia		18 (1.1)	500 (4.3)	46 (1.0)	512 (2.9)	36 (1.4)	524 (3.3)
Estonia		16 (1.2)	537 (4.1)	45 (1.0)	546 (2.6)	39 (1.6)	569 (3.1)
Lebanon		16 (1.0)	372 (5.4)	45 (1.3)	389 (5.3)	39 (1.4)	416 (5.2)
Macedonia, Rep. of	r	11 (0.9)	425 (8.2)	36 (1.3)	440 (4.4)	53 (1.7)	477 (3.9)
Romania		11 (0.9)	454 (6.3)	35 (1.3)	471 (7.2)	55 (1.7)	483 (4.7)
Serbia	r	10 (0.9)	446 (5.4)	37 (1.1)	465 (4.1)	53 (1.6)	482 (3.1)
Cyprus		10 (0.5)	424 (4.7)	43 (0.9)	442 (2.6)	48 (1.1)	455 (2.3)
Bulgaria	r	9 (0.8)	468 (8.7)	32 (1.3)	479 (5.7)	60 (1.8)	487 (5.7)
Hungary		8 (0.7)	510 (5.2)	33 (1.2)	532 (3.3)	60 (1.5)	556 (3.2)
Slovenia		5 (0.5)	485 (5.9)	22 (1.2)	502 (3.3)	73 (1.4)	530 (2.0)
Indonesia	s	4 (0.5)	385 (10.1)	14 (0.9)	389 (7.0)	83 (1.1)	435 (3.9)
Sweden		2 (0.4)	~ ~	38 (1.2)	523 (3.9)	60 (1.3)	533 (2.5)
Slovak Republic		2 (0.2)	~ ~	19 (1.1)	494 (3.9)	79 (1.2)	524 (3.5)
Belgium (Flemish)		– –	– –	– –	– –	– –	– –
c Netherlands		– –	– –	– –	– –	– –	– –
International Avg.		14 (0.2)	465 (1.4)	38 (0.3)	480 (1.1)	48 (0.3)	498 (0.9)
Physics							
Russian Federation		30 (1.1)	513 (4.5)	49 (1.0)	515 (3.7)	20 (1.1)	523 (5.1)
Armenia	r	29 (1.0)	473 (4.7)	54 (1.2)	467 (3.8)	17 (1.0)	454 (5.0)
Moldova, Rep. of		26 (1.1)	480 (4.8)	54 (1.1)	472 (3.9)	20 (1.0)	476 (4.0)
Lebanon		17 (0.9)	373 (5.6)	46 (1.1)	391 (5.0)	37 (1.4)	415 (5.6)
Latvia		17 (1.1)	502 (4.0)	45 (1.2)	510 (3.5)	38 (1.4)	525 (2.9)
Indonesia		16 (0.7)	422 (5.1)	58 (1.0)	426 (4.1)	26 (0.8)	420 (4.9)
Lithuania		16 (0.9)	505 (4.2)	45 (1.0)	516 (2.8)	40 (1.4)	531 (2.9)
Cyprus		16 (0.7)	436 (4.1)	48 (1.1)	444 (2.5)	37 (1.2)	454 (3.0)
Estonia		15 (0.9)	536 (4.2)	44 (1.0)	545 (2.7)	41 (1.5)	569 (2.8)
Macedonia, Rep. of	r	14 (0.9)	430 (6.6)	41 (1.6)	449 (5.4)	45 (2.0)	475 (3.7)
Romania		11 (0.9)	448 (7.2)	34 (1.3)	469 (7.0)	56 (1.8)	484 (4.9)
Bulgaria	r	9 (0.8)	472 (9.5)	31 (1.8)	475 (5.8)	61 (2.2)	487 (5.7)
Serbia	r	8 (0.7)	442 (6.2)	38 (1.2)	463 (3.6)	53 (1.5)	483 (3.0)
Slovenia		8 (0.6)	496 (5.0)	35 (1.4)	512 (3.0)	57 (1.5)	533 (2.2)
c Netherlands		7 (0.8)	514 (8.3)	35 (1.7)	530 (4.4)	58 (2.2)	545 (3.3)
Hungary		6 (0.6)	500 (6.4)	30 (1.0)	530 (3.4)	64 (1.3)	556 (2.9)
Slovak Republic		3 (0.3)	493 (7.7)	23 (1.3)	493 (4.7)	74 (1.4)	526 (3.3)
Sweden		2 (0.4)	~ ~	38 (1.1)	521 (3.9)	60 (1.2)	534 (2.6)
Belgium (Flemish)		x x	x x	x x	x x	x x	x x
International Avg.		14 (0.2)	473 (1.5)	42 (0.3)	485 (1.1)	45 (0.4)	500 (0.9)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

c Netherlands: Data in physics panel pertain to grade 8 physics/chemistry course.

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

Exhibit 4.7: Index of Time Students Spend Doing Science Homework (TSH) in a Normal School Week

Countries		High TSH		Medium TSH		Low TSH	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Philippines		16 (1.0)	307 (8.0)	51 (1.2)	335 (8.4)	33 (1.4)	354 (15.2)
Armenia	r	15 (0.8)	434 (8.4)	50 (1.3)	441 (5.3)	35 (1.6)	453 (4.7)
Tunisia	s	14 (1.8)	337 (10.9)	40 (2.3)	332 (7.7)	46 (2.9)	347 (8.4)
Morocco	s	13 (1.2)	319 (10.2)	45 (2.4)	321 (6.5)	42 (2.9)	320 (10.8)
Singapore		11 (0.8)	555 (6.9)	46 (0.9)	564 (6.0)	43 (1.3)	574 (5.2)
Iran, Islamic Rep. of		10 (1.0)	410 (7.3)	42 (2.1)	412 (5.6)	48 (2.4)	422 (5.9)
Moldova, Rep. of		9 (1.3)	476 (6.5)	45 (1.9)	496 (5.6)	45 (2.1)	511 (5.0)
Italy		8 (0.5)	488 (7.5)	35 (1.1)	508 (5.1)	57 (1.2)	528 (3.5)
Slovenia		7 (0.7)	466 (7.3)	41 (1.6)	487 (3.2)	52 (1.9)	503 (2.8)
Lithuania		7 (0.5)	495 (5.4)	34 (1.2)	509 (3.7)	59 (1.3)	522 (2.4)
Hong Kong, SAR		7 (0.6)	520 (6.8)	52 (2.0)	547 (3.6)	41 (2.2)	545 (2.9)
Russian Federation		6 (0.6)	498 (7.9)	37 (1.3)	516 (5.9)	58 (1.5)	539 (5.2)
Latvia		5 (0.5)	515 (5.7)	32 (1.1)	523 (3.2)	62 (1.2)	542 (2.7)
United States		4 (0.3)	494 (7.4)	24 (0.9)	526 (4.1)	71 (1.1)	547 (2.4)
Cyprus		4 (0.4)	451 (5.8)	26 (1.1)	464 (3.6)	70 (1.3)	493 (2.4)
Hungary		4 (0.4)	487 (11.9)	30 (1.2)	518 (3.9)	66 (1.4)	544 (2.8)
New Zealand		3 (0.4)	478 (10.7)	31 (1.0)	519 (3.3)	66 (1.1)	531 (2.6)
Chinese Taipei		3 (0.2)	506 (7.1)	29 (0.9)	542 (2.7)	68 (1.0)	557 (1.8)
Belgium (Flemish)		2 (0.3)	~ ~	23 (1.3)	507 (2.9)	75 (1.4)	525 (1.8)
Scotland		2 (0.2)	~ ~	16 (1.0)	494 (5.0)	82 (1.1)	508 (3.1)
Australia		2 (0.3)	~ ~	20 (1.2)	522 (7.7)	78 (1.3)	527 (3.9)
Norway	r	2 (0.3)	~ ~	18 (1.1)	457 (4.7)	80 (1.1)	481 (2.8)
England		2 (0.2)	~ ~	26 (1.8)	551 (6.7)	73 (1.9)	544 (3.5)
Japan		1 (0.2)	~ ~	16 (1.1)	534 (3.3)	82 (1.1)	546 (1.7)
Netherlands		1 (0.2)	~ ~	8 (0.9)	506 (5.3)	92 (0.9)	528 (2.1)
International Avg.		6 (0.1)	458 (1.8)	33 (0.3)	485 (1.1)	61 (0.3)	500 (1.1)
Benchmarking Participants							
Indiana State, US		3 (0.4)	510 (11.8)	24 (2.0)	543 (6.2)	73 (2.2)	562 (3.5)
Ontario Province, Can.		5 (0.5)	521 (12.4)	31 (1.3)	539 (5.6)	65 (1.5)	544 (3.2)
Quebec Province, Can.		3 (0.4)	464 (8.9)	18 (0.9)	486 (4.2)	79 (1.1)	508 (2.5)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

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

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

An "r" indicates 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: How Students Spend Their Leisure Time on a Normal School Day

Countries	Average Hours Spent Each Day*							
	Watch Television and Videos	Play Computer Games	Play or Talk with Friends	Do Jobs at Home	Play Sports	Read a Book for Enjoyment	Use the Internet	Work at a Paid Job
Armenia	1.8 (0.03)	r 0.9 (0.03)	r 1.6 (0.03)	r 0.4 (0.02)	r 1.2 (0.03)	r 1.6 (0.03)	r 0.7 (0.03)	r 1.0 (0.04)
Australia	2.0 (0.03)	0.9 (0.02)	1.7 (0.04)	1.0 (0.02)	1.6 (0.03)	0.7 (0.02)	1.3 (0.04)	0.4 (0.03)
Bahrain	2.0 (0.03)	1.2 (0.02)	1.6 (0.03)	1.2 (0.02)	1.5 (0.03)	0.9 (0.02)	1.4 (0.03)	0.6 (0.02)
Belgium (Flemish)	2.1 (0.03)	1.0 (0.03)	1.9 (0.03)	0.9 (0.02)	1.6 (0.03)	0.5 (0.01)	1.3 (0.03)	0.2 (0.02)
Botswana	1.4 (0.03)	0.5 (0.02)	2.1 (0.04)	2.3 (0.03)	1.5 (0.02)	1.8 (0.03)	0.7 (0.02)	0.6 (0.03)
Bulgaria	2.5 (0.04)	1.1 (0.04)	2.6 (0.05)	1.5 (0.03)	1.2 (0.04)	0.7 (0.03)	1.0 (0.04)	0.3 (0.02)
Chile	2.2 (0.02)	0.7 (0.02)	2.3 (0.02)	1.5 (0.02)	1.8 (0.03)	0.6 (0.01)	0.7 (0.02)	0.3 (0.02)
Chinese Taipei	1.7 (0.03)	1.4 (0.04)	1.4 (0.03)	0.7 (0.01)	1.0 (0.02)	1.0 (0.02)	1.4 (0.04)	0.2 (0.01)
Cyprus	2.1 (0.03)	1.3 (0.02)	2.1 (0.03)	1.0 (0.03)	1.7 (0.03)	0.9 (0.02)	1.2 (0.02)	0.6 (0.02)
Egypt	0.8 (0.02)	0.7 (0.02)	0.8 (0.02)	1.3 (0.03)	1.1 (0.02)	1.0 (0.02)	0.6 (0.02)	0.6 (0.02)
Estonia	2.3 (0.03)	1.1 (0.03)	2.8 (0.03)	1.1 (0.02)	1.4 (0.03)	0.7 (0.02)	1.5 (0.04)	0.4 (0.02)
Ghana	0.7 (0.02)	0.6 (0.02)	1.2 (0.03)	1.5 (0.03)	1.3 (0.02)	1.7 (0.03)	0.8 (0.03)	0.8 (0.03)
Hong Kong, SAR	2.3 (0.03)	2.0 (0.04)	1.6 (0.03)	0.7 (0.01)	1.0 (0.02)	1.1 (0.02)	2.0 (0.03)	0.1 (0.01)
Hungary	2.1 (0.03)	1.1 (0.03)	2.2 (0.03)	1.1 (0.02)	1.5 (0.03)	0.8 (0.02)	0.6 (0.03)	0.2 (0.02)
Indonesia	1.5 (0.03)	0.5 (0.02)	1.3 (0.03)	2.2 (0.03)	1.1 (0.02)	1.1 (0.02)	0.3 (0.02)	0.8 (0.03)
Iran, Islamic Rep. of	1.6 (0.03)	0.4 (0.02)	1.4 (0.03)	1.5 (0.03)	1.4 (0.04)	1.0 (0.02)	0.2 (0.02)	0.7 (0.05)
Israel	2.5 (0.04)	1.9 (0.03)	2.3 (0.03)	1.4 (0.03)	1.6 (0.03)	0.9 (0.02)	1.8 (0.04)	0.6 (0.02)
Italy	1.8 (0.03)	1.0 (0.02)	2.6 (0.03)	1.1 (0.03)	1.8 (0.03)	0.7 (0.02)	0.6 (0.02)	0.9 (0.02)
Japan	2.7 (0.03)	0.9 (0.02)	1.6 (0.04)	0.6 (0.01)	1.3 (0.03)	0.9 (0.02)	0.6 (0.02)	0.1 (0.01)
Jordan	1.5 (0.03)	0.9 (0.03)	1.2 (0.03)	1.3 (0.03)	1.2 (0.03)	0.9 (0.02)	0.6 (0.03)	0.6 (0.03)
Korea, Rep. of	1.7 (0.03)	1.5 (0.03)	1.8 (0.03)	0.7 (0.01)	0.7 (0.02)	0.6 (0.01)	1.7 (0.03)	0.1 (0.01)
Latvia	2.4 (0.03)	1.0 (0.02)	2.8 (0.03)	1.6 (0.03)	1.3 (0.03)	0.8 (0.03)	0.8 (0.03)	0.5 (0.02)
Lebanon	1.8 (0.04)	1.3 (0.03)	1.6 (0.04)	1.3 (0.03)	1.6 (0.03)	1.0 (0.02)	1.0 (0.03)	0.8 (0.03)
Lithuania	2.1 (0.03)	1.1 (0.03)	2.6 (0.04)	1.6 (0.04)	1.1 (0.03)	0.6 (0.02)	0.7 (0.03)	0.3 (0.02)
Macedonia, Rep. of	2.3 (0.04)	1.3 (0.03)	2.2 (0.03)	1.6 (0.03)	1.8 (0.03)	1.0 (0.02)	0.9 (0.03)	0.7 (0.03)
Malaysia	2.1 (0.04)	0.8 (0.03)	1.5 (0.03)	1.7 (0.02)	1.1 (0.02)	1.2 (0.02)	0.6 (0.02)	0.3 (0.02)
Moldova, Rep. of	1.9 (0.04)	0.7 (0.03)	2.0 (0.04)	2.2 (0.06)	1.3 (0.03)	1.1 (0.03)	0.7 (0.03)	0.5 (0.03)
Morocco	1.3 (0.04)	2.3 (0.06)	1.3 (0.03)	1.8 (0.03)	1.5 (0.03)	r 1.3 (0.03)	r 2.6 (0.06)	r 2.8 (0.06)
Netherlands	2.1 (0.05)	1.2 (0.04)	2.0 (0.05)	0.8 (0.02)	1.7 (0.04)	0.5 (0.02)	1.5 (0.04)	0.8 (0.05)
New Zealand	2.1 (0.04)	1.0 (0.04)	1.8 (0.05)	1.0 (0.02)	1.5 (0.03)	0.7 (0.03)	1.3 (0.04)	0.6 (0.03)
Norway	2.2 (0.03)	1.2 (0.03)	2.7 (0.03)	1.0 (0.03)	1.8 (0.03)	0.6 (0.02)	1.2 (0.03)	0.7 (0.02)
Palestinian Nat'l Auth.	1.2 (0.02)	0.7 (0.02)	1.3 (0.03)	1.5 (0.03)	1.1 (0.03)	1.0 (0.02)	0.5 (0.02)	0.6 (0.03)
Philippines	1.6 (0.04)	0.6 (0.02)	1.7 (0.03)	1.9 (0.03)	1.4 (0.02)	1.2 (0.02)	0.5 (0.03)	0.8 (0.04)
Romania	2.0 (0.04)	0.9 (0.03)	2.1 (0.03)	1.7 (0.05)	1.3 (0.03)	1.0 (0.03)	0.8 (0.04)	0.5 (0.04)
Russian Federation	2.0 (0.03)	1.0 (0.03)	2.5 (0.04)	1.6 (0.03)	1.3 (0.02)	1.1 (0.03)	0.4 (0.02)	0.2 (0.02)
Saudi Arabia	1.6 (0.05)	1.1 (0.03)	1.3 (0.03)	1.5 (0.04)	1.2 (0.04)	0.9 (0.02)	0.8 (0.05)	0.8 (0.03)
Scotland	2.2 (0.03)	1.4 (0.04)	2.7 (0.03)	0.8 (0.02)	1.7 (0.03)	0.6 (0.02)	1.4 (0.03)	0.5 (0.03)
Serbia	2.1 (0.03)	1.0 (0.03)	2.1 (0.03)	1.3 (0.03)	1.7 (0.03)	0.8 (0.02)	0.6 (0.03)	0.3 (0.02)
Singapore	2.3 (0.02)	1.4 (0.02)	1.7 (0.02)	0.7 (0.02)	1.4 (0.02)	0.9 (0.02)	1.6 (0.02)	0.2 (0.02)
Slovak Republic	2.5 (0.03)	1.1 (0.03)	2.8 (0.03)	1.5 (0.03)	1.9 (0.04)	0.9 (0.02)	0.6 (0.03)	0.4 (0.02)
Slovenia	2.2 (0.03)	1.3 (0.03)	2.0 (0.03)	1.2 (0.03)	1.7 (0.03)	0.8 (0.02)	1.1 (0.03)	0.4 (0.02)
South Africa	1.5 (0.03)	0.7 (0.02)	2.0 (0.03)	1.8 (0.03)	1.6 (0.02)	1.6 (0.03)	0.8 (0.02)	0.8 (0.02)
Sweden	2.1 (0.03)	1.1 (0.03)	2.8 (0.03)	1.0 (0.02)	1.6 (0.03)	0.6 (0.02)	1.7 (0.04)	0.4 (0.02)
Tunisia	1.4 (0.02)	0.8 (0.03)	1.5 (0.02)	1.9 (0.03)	1.5 (0.02)	1.3 (0.02)	0.7 (0.02)	0.6 (0.02)
United States	2.2 (0.03)	1.1 (0.02)	2.4 (0.03)	1.2 (0.02)	1.8 (0.02)	0.7 (0.01)	1.8 (0.03)	0.6 (0.02)
‡ England	2.0 (0.04)	1.1 (0.04)	2.4 (0.05)	0.8 (0.03)	1.4 (0.05)	0.5 (0.02)	1.4 (0.04)	0.5 (0.04)
International Avg.	1.9 (0.00)	1.1 (0.00)	1.9 (0.00)	1.3 (0.00)	1.4 (0.00)	0.9 (0.00)	1.0 (0.00)	0.6 (0.00)
Benchmarking Participants								
Basque Country, Spain	1.6 (0.04)	0.9 (0.03)	2.4 (0.04)	0.9 (0.03)	1.5 (0.03)	0.7 (0.02)	0.8 (0.03)	0.4 (0.03)
Indiana State, US	2.2 (0.06)	1.0 (0.04)	2.4 (0.06)	1.2 (0.04)	1.8 (0.04)	0.7 (0.03)	1.7 (0.04)	0.6 (0.05)
Ontario Province, Can.	2.1 (0.04)	1.2 (0.04)	2.0 (0.04)	0.9 (0.02)	1.7 (0.03)	0.8 (0.02)	1.9 (0.04)	0.6 (0.03)
Quebec Province, Can.	2.0 (0.03)	1.4 (0.03)	2.0 (0.04)	0.9 (0.02)	1.7 (0.04)	0.6 (0.02)	1.5 (0.04)	0.6 (0.02)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

* Number of hours based on: No time = 0; Less than 1 hour = 0.5; 1-2 hours = 1.5; More than 2 but less than 4 hours = 3; 4 or more hours = 4.5. Activities are not necessarily exclusive; students may have reported engaging in more than one activity at the same time.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

An "r" indicates data are available for at least 70 but less than 85% of the students.

Exhibit 4.8: How Students Spend Their Leisure Time on a Normal School Day

Countries	Average Hours Spent Each Day*						
	Watch Television and Videos	Play Computer Games	Play or Talk with Friends	Do Jobs at Home	Play Sports	Read a Book for Enjoyment	Use the Internet
Armenia	r 1.6 (0.04)	r 1.0 (0.04)	r 1.3 (0.03)	s 0.5 (0.05)	r 1.4 (0.03)	r 1.9 (0.04)	s 0.5 (0.04)
Australia	1.9 (0.04)	1.1 (0.03)	1.8 (0.04)	1.3 (0.03)	1.8 (0.04)	1.2 (0.03)	0.9 (0.04)
Belgium (Flemish)	1.8 (0.03)	1.0 (0.02)	2.0 (0.03)	1.2 (0.02)	1.6 (0.03)	0.9 (0.02)	0.8 (0.02)
Chinese Taipei	1.3 (0.03)	1.0 (0.03)	1.0 (0.02)	0.9 (0.02)	1.3 (0.02)	1.1 (0.02)	1.0 (0.03)
Cyprus	1.9 (0.03)	1.1 (0.03)	2.1 (0.03)	1.3 (0.03)	1.7 (0.03)	1.2 (0.02)	0.6 (0.02)
England	2.0 (0.04)	1.5 (0.04)	2.1 (0.04)	1.0 (0.03)	1.9 (0.03)	1.0 (0.03)	1.0 (0.03)
Hong Kong, SAR	1.9 (0.03)	1.2 (0.03)	1.2 (0.03)	0.9 (0.02)	1.1 (0.02)	1.0 (0.02)	0.9 (0.03)
Hungary	1.9 (0.03)	1.2 (0.03)	2.2 (0.03)	1.3 (0.03)	1.7 (0.03)	1.0 (0.02)	0.4 (0.02)
Iran, Islamic Rep. of	1.1 (0.04)	0.3 (0.03)	1.2 (0.05)	1.6 (0.05)	1.4 (0.04)	1.3 (0.04)	0.2 (0.02)
Italy	1.4 (0.03)	0.8 (0.02)	1.9 (0.03)	1.3 (0.03)	1.6 (0.02)	0.9 (0.02)	0.4 (0.02)
Japan	2.0 (0.03)	0.9 (0.02)	1.9 (0.03)	0.8 (0.02)	1.3 (0.02)	0.8 (0.02)	0.4 (0.01)
Latvia	2.0 (0.04)	0.9 (0.03)	2.6 (0.04)	1.7 (0.04)	1.5 (0.03)	1.1 (0.03)	0.5 (0.03)
Lithuania	1.7 (0.04)	1.1 (0.03)	2.7 (0.03)	1.8 (0.04)	1.2 (0.03)	1.1 (0.02)	0.5 (0.02)
Moldova, Rep. of	1.6 (0.04)	r 0.6 (0.03)	1.8 (0.05)	1.9 (0.05)	1.2 (0.03)	1.2 (0.03)	r 0.4 (0.03)
Morocco	r 1.0 (0.05)	r 0.8 (0.05)	r 1.2 (0.05)	r 1.3 (0.04)	r 1.2 (0.04)	r 1.1 (0.05)	r 0.8 (0.04)
Netherlands	1.6 (0.04)	1.2 (0.03)	2.4 (0.05)	0.9 (0.03)	1.7 (0.04)	0.8 (0.03)	0.8 (0.04)
New Zealand	1.9 (0.03)	1.1 (0.03)	1.8 (0.03)	1.3 (0.03)	1.6 (0.03)	1.3 (0.03)	1.0 (0.02)
Norway	1.5 (0.02)	1.0 (0.02)	2.4 (0.04)	1.1 (0.02)	1.5 (0.03)	1.0 (0.03)	0.6 (0.02)
Philippines	1.2 (0.04)	0.8 (0.03)	1.3 (0.03)	1.5 (0.05)	1.4 (0.04)	1.4 (0.04)	0.7 (0.04)
Russian Federation	1.5 (0.03)	0.8 (0.03)	2.2 (0.04)	1.5 (0.03)	1.2 (0.03)	1.2 (0.02)	0.3 (0.02)
Scotland	2.0 (0.04)	1.6 (0.04)	2.1 (0.04)	1.1 (0.03)	2.0 (0.04)	1.0 (0.02)	1.1 (0.03)
Singapore	2.0 (0.02)	1.2 (0.02)	1.2 (0.02)	1.0 (0.03)	1.5 (0.03)	1.3 (0.02)	0.9 (0.02)
Slovenia	1.6 (0.05)	1.3 (0.04)	1.7 (0.04)	1.5 (0.04)	1.9 (0.04)	1.2 (0.03)	0.6 (0.02)
Tunisia	r 0.8 (0.03)	r 0.8 (0.04)	r 0.9 (0.04)	r 1.5 (0.04)	r 1.4 (0.04)	r 1.3 (0.05)	r 0.8 (0.05)
United States	2.1 (0.03)	1.1 (0.02)	2.0 (0.02)	1.2 (0.01)	1.9 (0.02)	1.2 (0.02)	1.2 (0.02)
International Avg.	1.7 (0.01)	1.0 (0.01)	1.8 (0.01)	1.3 (0.01)	1.5 (0.01)	1.1 (0.01)	0.7 (0.01)
Benchmarking Participants							
Indiana State, US	2.0 (0.04)	1.1 (0.03)	2.2 (0.03)	1.1 (0.03)	2.0 (0.03)	1.1 (0.03)	1.2 (0.04)
Ontario Province, Can.	2.0 (0.04)	1.2 (0.04)	1.8 (0.05)	1.2 (0.02)	1.7 (0.04)	1.2 (0.03)	1.2 (0.03)
Quebec Province, Can.	1.8 (0.03)	1.2 (0.03)	2.0 (0.04)	1.4 (0.03)	2.2 (0.03)	1.0 (0.02)	1.2 (0.03)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

* Number of hours based on: No time = 0; Less than 1 hour = 0.5; 1-2 hours = 1.5; More than 2 but less than 4 hours = 3; 4 or more hours = 4.5. Activities are not necessarily exclusive; students may have reported engaging in more than one activity at the same time.

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

With the exception of Singapore, the countries assigning most science homework are not among those with the highest achievement levels.

On average, internationally, spending a lot of time studying was not associated with higher achievement. Particularly among separate-science-subject countries, students at the high level of the index had the lowest average achievement. This pattern is also apparent at fourth grade, and suggests that, compared with their higher-achieving counterparts, the lower-performing students may be assigned more homework as a remedial strategy in an effort to keep up academically.

To provide a fuller picture of how students spend their out-of-school time on a school day, Exhibit 4.8 gives students' reports on how they spend their daily leisure time. The two most popular activities were watching television or videos and playing or talking with friends (each about two hours per day at eighth grade and a little less at fourth grade). Students reported spending more than one hour per day playing sports and working at jobs at home, and about one hour playing computer games and using the internet.

How Confident Are Students in Their Ability to Learn Science?

To investigate how students think of their abilities in science, TIMSS created an index of students' self-confidence in learning science (SCS). This index is based on students' responses to four statements about their science ability:

- I usually do well in science;
- Science is more difficult for me than for many of my classmates;*
- Science is not one of my strengths;
- I learn things quickly in science.*

In countries where the sciences are taught as separate subjects, students were asked about each subject separately.

* The response categories for this statement were reversed in constructing the index.

Students who agreed a little or agreed a lot with all four statements on average were assigned to the high level of the index, while students who disagreed a little or disagreed a lot with all four on average were assigned to the low level. The medium level includes all other possible combinations of responses. The percentages of students at each level of this index, and their average science achievement, are presented in Exhibit 4.9 for both eighth and fourth grades. This four-page display summarizes the data in one panel for the countries that teach science as a single subject at the eighth grade, and in separate panels for earth science, biology, physics, and chemistry for countries that teach the sciences separately. There is a single panel also displaying the fourth-grade data.

On average, internationally, almost half (48 percent) of the eighth-grade students in the single-science countries had high self-confidence in learning science. The percentages ranged from a high of 69 percent in Tunisia to a low of 20 percent in Japan. Although there was a clear positive association between self-confidence in learning science and science achievement internationally and in every country, at the country level the relationship was more complex. It is noteworthy that the four countries with lowest percentages of students in the high self-confidence category – Chinese Taipei, Hong Kong SAR, Japan, and Korea – all had high average science achievement. Since all of these are Asian Pacific countries, they may share cultural traditions that encourage modest self-confidence.

In countries teaching the sciences as separate subjects at the eighth grade, the percentage of students at the high level of the self-confidence in learning science index was greatest for biology and earth science, with 59 percent and 56 percent of students in the high category on average for these subjects, respectively. The percentage was lower for physics and chemistry (40 percent each). Although there was some variation, generally countries with high percentages of students in the high category for one subject had high percentages in the other subjects also. Serbia had the highest percentages in the high category for

Exhibit 4.9: Index of Students' Self-Confidence in Learning Science (SCS)

SCIENCE Grade 8

Index of Students' Self-Confidence in Learning Science

Index based on students' responses to four statements about science:1) I usually do well in science; 2) Science is more difficult for me than for many of my classmates (Reversed); 3) Science is not one of my strengths (Reversed); 4) I learn things quickly in science.

Average is computed across the four items based on a 4-point scale: 1. Agree a lot; 2. Agree a little; 3. Disagree a little; 4. Disagree a lot. Students agreeing a little or a lot on average across the four statements are assigned to the high level. Students disagreeing a little or a lot on average are assigned to the low level. All other students are assigned to the middle level.

Countries	High SCS		Medium SCS		Low SCS	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
General/ Integrated Science						
Tunisia	69 (1.1)	412 (2.0)	26 (0.9)	389 (3.4)	5 (0.4)	383 (5.0)
Egypt	64 (1.1)	452 (3.3)	33 (1.0)	389 (4.4)	4 (0.3)	354 (8.9)
Norway	60 (1.3)	512 (2.2)	30 (0.9)	475 (2.5)	10 (0.7)	456 (4.5)
Israel	59 (1.0)	515 (2.9)	31 (0.9)	458 (4.1)	9 (0.6)	452 (6.1)
Scotland	59 (1.5)	539 (3.3)	28 (1.1)	481 (3.5)	14 (0.9)	459 (3.9)
Saudi Arabia	58 (1.7)	418 (4.3)	36 (1.3)	378 (4.4)	6 (0.7)	366 (7.3)
Jordan	57 (1.0)	503 (3.3)	36 (1.0)	447 (4.4)	6 (0.5)	434 (10.2)
Italy	57 (1.1)	509 (3.2)	32 (1.0)	471 (4.1)	11 (0.6)	459 (5.2)
Ghana	57 (1.4)	294 (6.1)	36 (1.2)	224 (6.2)	7 (0.6)	173 (11.7)
Palestinian Nat'l Auth.	56 (1.1)	462 (3.3)	37 (0.9)	409 (3.8)	7 (0.5)	384 (6.5)
Bahrain	56 (1.0)	456 (1.9)	36 (0.9)	419 (2.3)	8 (0.5)	413 (5.3)
United States	56 (0.9)	548 (3.4)	31 (0.7)	507 (3.4)	13 (0.6)	495 (3.4)
Australia	49 (1.4)	550 (4.0)	34 (1.1)	513 (3.6)	17 (0.9)	499 (4.8)
Morocco	48 (1.6)	416 (2.9)	42 (1.7)	386 (3.5)	10 (0.9)	379 (6.9)
Iran, Islamic Rep. of	47 (1.1)	473 (2.5)	45 (0.9)	438 (2.7)	8 (0.5)	429 (3.5)
Botswana	46 (1.0)	391 (2.9)	44 (0.8)	353 (3.4)	10 (0.6)	337 (5.3)
Chile	46 (1.0)	434 (3.0)	44 (0.7)	393 (3.4)	10 (0.6)	407 (4.9)
Singapore	45 (0.8)	601 (4.4)	37 (0.6)	562 (4.9)	18 (0.6)	553 (5.0)
South Africa	45 (1.1)	282 (8.3)	46 (1.0)	215 (5.7)	9 (0.4)	207 (10.2)
d Philippines	43 (1.1)	408 (6.1)	52 (0.9)	359 (5.5)	5 (0.4)	334 (10.3)
New Zealand	41 (1.4)	548 (5.7)	41 (0.9)	509 (5.2)	19 (1.2)	489 (5.4)
Malaysia	38 (1.2)	530 (3.9)	48 (1.0)	500 (3.5)	14 (0.6)	496 (4.7)
Hong Kong, SAR	32 (1.1)	582 (3.3)	47 (0.8)	546 (3.6)	21 (1.0)	540 (2.9)
a Chinese Taipei	28 (1.0)	616 (3.3)	38 (0.7)	560 (4.3)	34 (1.1)	548 (3.3)
Korea, Rep. of	20 (0.7)	612 (2.2)	42 (0.7)	556 (2.0)	38 (0.9)	533 (2.1)
Japan	20 (0.9)	595 (2.7)	46 (0.8)	551 (1.8)	34 (1.0)	529 (2.3)
‡ England	53 (1.5)	569 (4.9)	32 (1.3)	525 (5.2)	15 (0.9)	513 (6.3)
International Avg.	48 (0.2)	490 (0.8)	38 (0.2)	445 (0.9)	13 (0.1)	430 (1.2)
Benchmarking Participants						
Basque Country, Spain	50 (1.8)	513 (3.5)	34 (1.2)	469 (3.4)	16 (1.2)	455 (4.6)
Indiana State, US	53 (1.8)	554 (5.0)	31 (1.0)	512 (5.1)	16 (1.3)	495 (5.9)
Ontario Province, Can.	52 (1.5)	553 (2.8)	34 (1.1)	517 (2.9)	15 (1.0)	497 (4.7)
Quebec Province, Can.	50 (1.7)	551 (3.4)	31 (1.1)	518 (3.7)	19 (1.2)	503 (3.2)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

a Chinese Taipei: Students were asked about natural science; data pertain to grade 8 physics/chemistry course.

d Philippines: Students study only biology at grade 8.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

Exhibit 4.9: Index of Students' Self-Confidence in Learning Science (SCS) *(Continued...)*

Countries	High SCS		Medium SCS		Low SCS	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Biology						
Serbia	74 (1.1)	480 (2.9)	18 (0.8)	444 (3.8)	7 (0.6)	436 (5.8)
Estonia	71 (1.1)	558 (2.6)	24 (1.0)	542 (3.1)	5 (0.5)	536 (5.9)
Russian Federation	70 (2.1)	526 (3.4)	23 (1.5)	492 (4.0)	7 (0.7)	478 (6.6)
Macedonia, Rep. of	68 (1.1)	473 (3.6)	27 (0.9)	411 (4.9)	5 (0.5)	417 (8.4)
Lithuania	63 (1.3)	531 (2.5)	29 (1.1)	499 (2.8)	7 (0.5)	497 (5.4)
Slovenia	63 (1.2)	530 (2.1)	30 (0.9)	505 (2.6)	7 (0.6)	505 (4.2)
Slovak Republic	63 (1.5)	530 (3.4)	31 (1.1)	495 (3.6)	7 (0.7)	496 (5.1)
Belgium (Flemish)	60 (1.5)	537 (2.4)	28 (0.9)	514 (3.6)	12 (0.8)	493 (5.0)
Latvia	60 (1.2)	522 (2.5)	30 (0.9)	502 (3.9)	10 (0.7)	493 (4.8)
Hungary	60 (1.4)	556 (2.9)	30 (1.0)	524 (3.9)	10 (0.7)	522 (6.3)
Bulgaria	60 (1.5)	496 (5.3)	34 (1.3)	460 (5.5)	7 (0.8)	451 (9.5)
Sweden	58 (1.1)	543 (2.7)	33 (1.0)	510 (3.5)	8 (0.5)	481 (6.1)
Armenia	57 (1.2)	479 (3.6)	36 (1.1)	448 (4.3)	7 (0.5)	437 (6.8)
Netherlands	54 (1.7)	546 (4.0)	34 (1.2)	522 (3.9)	13 (0.9)	518 (4.8)
[b] Lebanon	49 (1.3)	422 (5.1)	43 (1.1)	369 (4.3)	8 (0.6)	365 (7.5)
Moldova, Rep. of	49 (1.3)	489 (3.7)	45 (1.2)	462 (3.5)	6 (0.5)	433 (7.8)
Romania	46 (1.3)	491 (4.5)	45 (1.3)	456 (6.0)	9 (0.6)	459 (8.3)
Indonesia	40 (1.3)	418 (4.4)	53 (1.2)	421 (3.9)	7 (0.5)	442 (5.8)
Cyprus	x x	x x	x x	x x	x x	x x
International Avg.	59 (0.3)	507 (0.9)	33 (0.3)	477 (1.0)	8 (0.1)	470 (1.5)
Earth Science						
Serbia	70 (1.2)	483 (2.8)	21 (0.9)	444 (3.9)	9 (0.6)	435 (5.5)
Macedonia, Rep. of	63 (1.2)	475 (3.5)	31 (1.1)	415 (5.0)	5 (0.4)	423 (7.2)
Sweden	63 (1.3)	539 (2.7)	30 (1.0)	506 (4.1)	7 (0.5)	488 (6.4)
Lithuania	63 (1.1)	530 (2.5)	30 (0.9)	502 (3.0)	6 (0.5)	495 (5.1)
Slovak Republic	62 (1.5)	530 (3.4)	30 (1.1)	495 (4.0)	8 (0.6)	502 (5.8)
Cyprus	59 (0.9)	464 (1.9)	31 (0.9)	414 (3.2)	10 (0.5)	408 (4.8)
Russian Federation	58 (1.8)	529 (3.8)	32 (1.3)	498 (3.5)	10 (0.7)	484 (5.7)
Estonia	58 (1.2)	564 (2.6)	33 (1.0)	538 (3.0)	9 (0.6)	538 (4.4)
Bulgaria	57 (1.4)	498 (4.8)	36 (1.2)	463 (5.6)	7 (0.5)	427 (9.4)
Hungary	55 (1.4)	555 (3.2)	31 (1.0)	531 (3.8)	14 (0.8)	525 (4.0)
Armenia	54 (1.2)	479 (3.9)	40 (1.1)	449 (4.1)	6 (0.4)	431 (7.2)
Netherlands	49 (1.7)	543 (3.3)	38 (1.2)	530 (3.8)	13 (1.0)	527 (5.5)
Belgium (Flemish)	49 (1.6)	534 (2.8)	33 (0.8)	516 (3.5)	18 (1.3)	508 (4.1)
Moldova, Rep. of	45 (1.5)	490 (3.5)	48 (1.4)	464 (4.0)	7 (0.5)	441 (5.7)
Romania	41 (1.3)	498 (4.6)	46 (1.3)	455 (5.5)	12 (0.8)	450 (7.4)
Indonesia	– –	– –	– –	– –	– –	– –
Latvia	– –	– –	– –	– –	– –	– –
[b] Lebanon	– –	– –	– –	– –	– –	– –
Slovenia	– –	– –	– –	– –	– –	– –
International Avg.	56 (0.4)	514 (0.9)	34 (0.3)	481 (1.2)	9 (0.2)	472 (1.6)

Background data provided by students.

Does not include students who report that they do not study the content area.

b Lebanon: Data in biology panel pertain to grade 8 life and earth sciences course.

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

A dash (–) indicates comparable data are not available.

An "x" indicates data are available for less than 50% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 4.9: Index of Students' Self-Confidence in Learning Science (SCS) *(...Continued)*

Countries	High SCS		Medium SCS		Low SCS	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Chemistry						
Slovak Republic	49 (1.4)	535 (3.5)	38 (1.1)	499 (3.4)	12 (0.8)	499 (4.9)
Lebanon	48 (1.3)	420 (5.2)	45 (1.3)	372 (4.7)	7 (0.6)	365 (9.6)
Sweden	47 (1.1)	549 (2.9)	38 (1.0)	513 (3.4)	14 (0.8)	496 (5.1)
Cyprus	46 (0.8)	473 (2.4)	39 (0.8)	420 (3.1)	15 (0.6)	413 (3.4)
Slovenia	46 (1.1)	541 (2.3)	39 (1.0)	505 (2.8)	15 (0.8)	502 (2.7)
Russian Federation	41 (1.4)	540 (3.7)	36 (1.0)	503 (3.5)	22 (1.0)	492 (3.7)
Serbia	40 (1.3)	490 (3.7)	32 (0.8)	453 (3.1)	27 (1.3)	460 (3.1)
Macedonia, Rep. of	40 (1.3)	475 (4.3)	44 (1.2)	436 (4.5)	16 (0.8)	452 (5.1)
Lithuania	39 (1.2)	542 (3.2)	39 (0.9)	505 (2.4)	22 (0.8)	504 (3.1)
Estonia	38 (1.3)	572 (3.0)	37 (0.9)	542 (2.8)	25 (1.1)	542 (2.9)
Armenia	36 (1.3)	482 (4.8)	49 (1.2)	454 (3.9)	14 (0.7)	457 (4.6)
Bulgaria	36 (1.6)	502 (5.2)	45 (1.5)	467 (5.2)	19 (1.0)	474 (6.2)
Latvia	35 (1.4)	536 (3.4)	40 (1.0)	506 (2.7)	25 (1.1)	493 (3.4)
Hungary	34 (1.2)	570 (3.6)	35 (0.9)	532 (3.4)	31 (1.3)	527 (3.2)
Moldova, Rep. of	30 (1.1)	490 (4.9)	54 (1.0)	468 (3.4)	16 (0.7)	464 (4.8)
Romania	26 (1.1)	497 (5.1)	53 (1.1)	461 (5.5)	21 (1.0)	472 (6.6)
Belgium (Flemish)	– –	– –	– –	– –	– –	– –
Indonesia	– –	– –	– –	– –	– –	– –
[c] Netherlands	– –	– –	– –	– –	– –	– –
International Avg.	40 (0.3)	513 (1.0)	42 (0.3)	477 (1.0)	19 (0.2)	476 (1.2)
Physics						
Russian Federation	51 (1.4)	536 (3.5)	35 (0.9)	497 (4.0)	15 (0.8)	485 (5.1)
Serbia	50 (1.4)	490 (2.7)	32 (0.9)	449 (3.3)	19 (1.0)	450 (3.7)
Armenia	48 (1.4)	483 (4.1)	45 (1.2)	450 (3.9)	7 (0.4)	438 (6.2)
Sweden	47 (1.3)	552 (2.7)	39 (0.9)	510 (3.3)	14 (0.8)	493 (5.0)
Macedonia, Rep. of	47 (1.5)	476 (4.2)	41 (1.2)	434 (4.5)	12 (0.9)	447 (6.6)
Hungary	46 (1.2)	568 (3.0)	35 (1.0)	525 (3.6)	19 (0.9)	518 (3.7)
Lebanon	44 (1.3)	425 (5.5)	50 (1.1)	371 (4.3)	7 (0.5)	383 (7.6)
Cyprus	43 (0.8)	477 (2.2)	43 (0.8)	421 (2.8)	14 (0.6)	414 (3.9)
Slovak Republic	43 (1.2)	541 (3.3)	39 (0.9)	499 (3.5)	18 (1.0)	502 (4.6)
Bulgaria	43 (1.9)	503 (4.8)	46 (1.5)	467 (5.8)	12 (0.8)	454 (8.2)
[c] Netherlands	40 (1.6)	554 (3.4)	40 (1.4)	528 (3.7)	19 (1.2)	521 (5.0)
Estonia	38 (1.4)	573 (3.0)	40 (0.9)	545 (2.8)	22 (1.3)	535 (3.2)
Lithuania	36 (1.3)	545 (2.9)	42 (0.9)	506 (2.5)	22 (1.0)	503 (3.5)
Latvia	36 (1.4)	535 (3.1)	44 (1.0)	504 (2.7)	20 (1.1)	495 (4.0)
Moldova, Rep. of	34 (1.1)	493 (4.1)	53 (1.0)	464 (3.6)	13 (0.9)	462 (5.2)
Slovenia	34 (1.0)	546 (2.9)	43 (1.0)	510 (2.5)	23 (1.0)	506 (2.3)
Indonesia	27 (1.1)	415 (5.3)	58 (0.8)	418 (4.0)	15 (0.9)	446 (4.0)
Romania	24 (0.9)	503 (5.4)	56 (1.1)	461 (5.4)	20 (0.9)	467 (6.4)
Belgium (Flemish)	x x	x x	x x	x x	x x	x x
International Avg.	40 (0.3)	512 (0.9)	43 (0.2)	475 (1.0)	16 (0.2)	473 (1.2)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

Does not include students who report that they do not study the content area.

c Netherlands: Data in physics panel pertain to grade 8 physics/chemistry course.

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

A dash (–) indicates comparable data are not available.

An "x" indicates data are available for less than 50% of the students.

Exhibit 4.9: Index of Students' Self-Confidence in Learning Science (SCS)

Countries	High SCS		Medium SCS		Low SCS	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Slovenia	78 (1.0)	503 (2.6)	18 (0.8)	454 (4.4)	4 (0.5)	461 (8.4)
Netherlands	71 (1.2)	535 (2.1)	22 (0.8)	507 (2.7)	7 (0.6)	496 (4.6)
Cyprus	71 (1.0)	492 (2.6)	24 (0.8)	457 (3.5)	5 (0.5)	441 (5.7)
Hungary	70 (1.1)	546 (2.7)	23 (0.9)	496 (4.6)	7 (0.6)	498 (6.5)
Lithuania	69 (0.8)	524 (2.6)	26 (0.9)	490 (4.1)	5 (0.4)	497 (7.4)
Italy	69 (1.1)	529 (3.8)	26 (1.0)	493 (4.6)	5 (0.4)	481 (7.5)
Australia	66 (1.2)	535 (3.8)	27 (1.1)	501 (6.2)	7 (0.5)	491 (5.8)
United States	66 (0.9)	553 (2.5)	25 (0.7)	512 (3.3)	9 (0.4)	501 (3.6)
Norway	64 (1.2)	482 (2.9)	29 (1.0)	451 (3.8)	7 (0.5)	430 (5.4)
Russian Federation	63 (1.3)	542 (5.7)	27 (1.2)	506 (5.8)	10 (0.8)	499 (6.3)
Tunisia	60 (1.6)	349 (5.7)	33 (1.4)	287 (7.3)	7 (0.6)	240 (12.5)
Hong Kong, SAR	60 (1.4)	556 (2.9)	32 (1.1)	523 (3.3)	8 (0.5)	525 (5.2)
Armenia s	59 (1.2)	467 (4.0)	34 (1.0)	425 (5.9)	7 (0.6)	399 (10.5)
Moldova, Rep. of	58 (1.6)	519 (4.7)	35 (1.3)	471 (5.0)	6 (0.6)	456 (9.8)
Belgium (Flemish)	58 (1.0)	530 (1.7)	30 (0.9)	507 (2.7)	12 (0.7)	492 (3.1)
Scotland	58 (1.3)	514 (3.3)	30 (1.1)	490 (3.7)	12 (0.6)	480 (4.6)
Latvia	56 (1.3)	547 (2.8)	34 (1.0)	514 (3.1)	11 (0.8)	512 (5.1)
England	54 (1.1)	560 (3.8)	32 (0.9)	522 (4.6)	14 (0.7)	514 (5.0)
Morocco r	53 (2.0)	335 (9.0)	39 (1.8)	289 (7.4)	8 (1.2)	290 (18.8)
Iran, Islamic Rep. of	52 (1.6)	436 (4.8)	42 (1.4)	394 (4.8)	5 (0.6)	380 (11.3)
New Zealand	51 (1.0)	545 (2.5)	40 (0.9)	499 (3.3)	9 (0.5)	493 (5.0)
Chinese Taipei	50 (1.0)	568 (2.2)	37 (0.8)	534 (2.2)	13 (0.8)	540 (3.9)
Japan	46 (1.0)	562 (1.9)	41 (0.9)	531 (2.0)	13 (0.7)	529 (3.7)
Philippines	39 (1.4)	382 (12.4)	51 (1.1)	314 (8.6)	10 (0.7)	271 (9.0)
Singapore	32 (0.9)	592 (5.3)	41 (0.8)	554 (6.2)	27 (0.8)	552 (5.8)
International Avg.	59 (0.2)	508 (1.0)	32 (0.2)	469 (1.1)	9 (0.1)	459 (1.5)
Benchmarking Participants						
Indiana State, US	66 (1.8)	567 (3.8)	25 (1.2)	532 (4.5)	9 (1.0)	522 (6.4)
Ontario Province, Can.	67 (1.3)	556 (4.4)	24 (1.1)	513 (4.1)	9 (0.7)	506 (5.3)
Quebec Province, Can.	69 (1.2)	513 (2.4)	23 (1.0)	479 (3.3)	8 (0.5)	468 (5.8)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

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

biology and earth science, while the Slovak Republic had the highest in chemistry and the Russian Federation in physics. Romania had the lowest percentage in the high category for earth science, chemistry, and physics. The positive association between self-confidence in learning science and science achievement that was found for science as a single subject was also evident in each of the science subject areas.

At fourth grade, 59 percent of students were at the high level of the self-confidence in learning science index, compared with 32 percent at the medium and just nine percent at the low. The countries with the greatest percentages included Slovenia, The Netherlands, Cyprus, and Hungary, each with 70 percent or more. Countries with relatively lower percentages included Japan, the Philippines, and Singapore, each with less than 50 percent at the high level. Again, there was a positive relationship, on average, between self-confidence in learning science and science achievement.

What Value Do Students Place on Science?

Students' motivation to learn science can be affected by whether they find the subject enjoyable, place value on the subject, and think it is important for success in school and for future career aspirations. In addition, developing such positive attitudes towards science among students is an important goal of science education in many countries. To gain some understanding about the value eighth- and fourth-grade students place on science, TIMSS created an index of students valuing science (SVS). Students were asked to state their agreement with the following seven statements about science:

- I would like to take more science in school;
- I enjoy learning 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 would like a job that involved using science;
- I need to do well in science to get the job I want.

In countries where the sciences are taught as separate subjects, students were asked about each subject area separately.

Students who agreed a little or agreed a lot, on average, with all seven statements were assigned to the high level of the index, while students who, on average, disagreed a little or disagreed a lot with all seven were assigned to the low level. Students between these extremes were placed in the medium category. The percentages of students at each level of this index, and their average science achievement, are presented in Exhibit 4.10 for both eighth and fourth grades. This three-page display summarizes the data in one panel for the countries that teach science as a single subject at the eighth grade, and in separate panels for earth science, biology, physics, and chemistry for countries that teach the sciences separately.

In countries where eighth-grade science is taught as a single subject, students generally placed a high value on science, with 57 percent on average across countries in the high category, and a further 31 percent in the medium category. Only 12 percent of students were in the low category. Countries with large percentages of students at the high level included Botswana, Egypt, Ghana, Jordan, Tunisia, the Palestinian National Authority, and Morocco, with 80 percent or more in this category. Among countries placing less value on science were Chinese Taipei, Japan, and Korea. Since these are countries with high average science achievement, it may be that the students follow a demanding science curriculum, one that leads to high achievement but little enthusiasm for the subject matter. Within almost all the single-science-subject countries at the eighth grade, there was a positive association between valuing science and average science achievement. However,

Exhibit 4.10: Index of Students' Valuing Science (SVS)

SCIENCE Grade 8

Index of Students' Valuing Science

Index based on students' responses to seven statements about science: 1) I would like to take more science in school; 2) I enjoy learning science; 3) I think learning science will help me in my daily life; 4) I need science to learn other school subjects; 5) I need to do well in science to get into the university of my choice; 6) I would like a job that involved using science; 7) I need to do well in science to get the job I want. Average is computed across the seven items based on a 4-point scale: 1. Agree a lot; 2. Agree a little; 3. Disagree a little; 4. Disagree a lot.

Students agreeing a little or a lot on average across the seven statements are assigned to the high level. Students disagreeing a little or a lot on average are assigned to the low level. All other students are assigned to the middle level.

Countries	High SVS		Medium SVS		Low SVS	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
General/ Integrated Science						
Botswana	85 (0.6)	379 (2.7)	13 (0.6)	315 (6.6)	2 (0.2)	~ ~
Egypt	83 (0.9)	438 (3.6)	16 (0.9)	384 (6.1)	1 (0.2)	~ ~
Ghana	83 (1.1)	279 (5.5)	16 (1.0)	173 (8.4)	1 (0.2)	~ ~
Jordan	83 (0.9)	484 (3.3)	15 (0.8)	450 (6.9)	3 (0.3)	450 (17.1)
Tunisia	80 (0.9)	406 (2.1)	16 (0.7)	400 (3.5)	4 (0.3)	396 (6.3)
Palestinian Nat'l Auth.	80 (0.9)	448 (3.0)	17 (0.8)	395 (5.4)	3 (0.3)	385 (11.1)
Morocco	80 (1.3)	400 (3.0)	17 (1.2)	397 (4.8)	3 (0.4)	405 (11.0)
South Africa	76 (0.9)	242 (6.1)	19 (0.7)	246 (11.6)	5 (0.4)	270 (16.0)
[d] Philippines	75 (0.9)	390 (5.8)	22 (0.9)	342 (7.2)	2 (0.2)	~ ~
Malaysia	73 (1.2)	520 (3.5)	25 (1.1)	488 (4.2)	2 (0.2)	~ ~
Saudi Arabia	71 (1.1)	403 (4.1)	23 (0.8)	393 (4.7)	7 (0.6)	394 (7.9)
Bahrain	70 (0.9)	442 (2.0)	23 (0.7)	433 (2.9)	7 (0.5)	431 (4.4)
Singapore	62 (1.0)	599 (3.9)	33 (0.9)	551 (4.6)	6 (0.4)	505 (7.3)
Iran, Islamic Rep. of	60 (1.1)	452 (2.7)	31 (0.7)	457 (2.6)	9 (0.5)	455 (3.7)
Chile	53 (0.9)	409 (3.6)	34 (0.7)	414 (3.1)	13 (0.6)	427 (4.0)
Scotland	49 (1.0)	528 (3.5)	33 (0.9)	506 (3.8)	17 (0.9)	479 (5.0)
United States	47 (0.8)	543 (3.6)	37 (0.6)	520 (3.2)	16 (0.6)	503 (3.8)
Israel	42 (1.3)	499 (3.7)	32 (0.9)	489 (4.1)	26 (1.1)	480 (4.7)
New Zealand	40 (1.5)	535 (6.5)	40 (1.1)	517 (5.0)	21 (1.0)	502 (4.4)
Hong Kong, SAR	40 (0.9)	574 (3.1)	51 (0.8)	549 (3.3)	9 (0.5)	523 (4.9)
Australia	36 (1.2)	551 (3.7)	37 (1.0)	522 (4.1)	27 (1.0)	506 (5.0)
Norway	35 (1.2)	506 (3.4)	43 (0.8)	496 (2.5)	22 (1.0)	478 (2.7)
Italy	29 (0.9)	507 (4.0)	55 (0.8)	488 (3.5)	16 (0.7)	473 (4.2)
[a] Chinese Taipei	26 (1.0)	600 (4.5)	49 (0.8)	571 (3.6)	25 (1.0)	544 (3.8)
Korea, Rep. of	19 (0.7)	600 (2.1)	55 (0.7)	559 (1.8)	26 (0.8)	529 (2.6)
Japan	17 (0.8)	586 (3.3)	56 (0.8)	555 (1.8)	27 (1.0)	526 (2.8)
[‡] England	38 (1.5)	562 (6.3)	41 (1.1)	544 (5.0)	22 (1.4)	522 (4.8)
International Avg.	57 (0.2)	477 (0.8)	31 (0.2)	450 (1.0)	12 (0.1)	463 (1.6)
Benchmarking Participants						
Basque Country, Spain	36 (1.3)	495 (3.5)	36 (1.0)	493 (3.8)	27 (1.4)	476 (3.2)
Indiana State, US	45 (1.7)	544 (5.4)	37 (1.1)	528 (4.9)	19 (1.4)	506 (4.7)
Ontario Province, Can.	50 (1.5)	546 (3.0)	35 (1.1)	523 (2.8)	15 (0.9)	514 (4.4)
Quebec Province, Can.	30 (1.5)	550 (4.5)	48 (1.1)	528 (2.9)	23 (1.2)	514 (3.4)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

a Chinese Taipei: Students were asked about natural science; data pertain to grade 8 physics/chemistry course.

d Philippines: Students study only biology at grade 8.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

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

Exhibit 4.10: **Index of Students' Valuing Science (SVS)** *(Continued...)*

Countries	High SVS		Medium SVS		Low SVS	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Biology						
Indonesia	66 (1.3)	415 (4.1)	33 (1.3)	434 (4.1)	1 (0.2)	~ ~
[b] Lebanon	65 (1.1)	403 (4.6)	27 (1.0)	382 (5.6)	8 (0.6)	375 (8.8)
Macedonia, Rep. of	61 (1.2)	446 (4.0)	29 (0.9)	466 (4.3)	10 (0.7)	468 (6.8)
Armenia	51 (1.2)	461 (4.4)	35 (0.8)	470 (3.9)	14 (0.9)	464 (4.7)
Moldova, Rep. of	49 (1.4)	474 (3.8)	46 (1.4)	474 (3.8)	5 (0.5)	469 (7.9)
Bulgaria	45 (1.5)	477 (5.8)	38 (1.1)	481 (4.8)	17 (1.1)	492 (7.5)
Russian Federation	38 (0.9)	511 (5.8)	47 (1.0)	517 (3.3)	15 (0.7)	516 (3.9)
Romania	36 (1.4)	466 (6.7)	41 (1.0)	473 (4.9)	23 (1.2)	479 (6.0)
Lithuania	33 (1.2)	519 (2.9)	43 (1.0)	518 (2.7)	24 (1.0)	521 (3.4)
Serbia	33 (1.3)	465 (4.0)	38 (1.1)	468 (2.8)	29 (1.3)	478 (3.3)
Slovenia	27 (1.0)	519 (3.5)	51 (0.9)	521 (2.4)	22 (1.2)	522 (3.0)
Hungary	26 (1.1)	540 (4.1)	44 (1.2)	537 (3.2)	30 (1.5)	554 (3.4)
Latvia	25 (1.2)	508 (3.2)	47 (1.2)	513 (3.1)	27 (1.3)	518 (3.4)
Slovak Republic	25 (1.3)	511 (4.3)	42 (1.2)	516 (3.7)	33 (1.5)	523 (3.6)
Estonia	21 (0.9)	546 (3.7)	51 (0.8)	553 (2.7)	27 (1.1)	559 (3.0)
Sweden	19 (1.0)	534 (4.0)	58 (1.1)	529 (3.1)	23 (1.0)	515 (3.9)
Netherlands	18 (1.2)	528 (6.2)	52 (1.3)	538 (3.5)	30 (1.3)	531 (4.1)
Belgium (Flemish)	18 (0.8)	532 (3.4)	41 (1.0)	529 (3.3)	41 (1.5)	519 (2.9)
Cyprus	x x	x x	x x	x x	x x	x x
International Avg.	37 (0.3)	492 (1.1)	42 (0.3)	496 (0.9)	21 (0.3)	500 (1.2)
Earth Science						
Macedonia, Rep. of	54 (1.3)	437 (4.4)	32 (1.0)	472 (4.0)	14 (0.8)	472 (5.2)
Romania	44 (1.5)	471 (5.5)	37 (0.9)	473 (5.4)	20 (1.0)	474 (6.1)
Armenia	43 (1.6)	463 (3.6)	38 (1.1)	465 (4.2)	18 (0.9)	466 (6.0)
Moldova, Rep. of	43 (1.5)	472 (4.1)	51 (1.4)	476 (3.8)	6 (0.5)	470 (6.4)
Lithuania	38 (1.1)	522 (3.0)	43 (1.0)	518 (2.4)	19 (0.9)	516 (3.5)
Bulgaria	36 (1.3)	476 (5.8)	42 (1.3)	484 (5.0)	22 (1.3)	481 (6.7)
Russian Federation	30 (1.0)	512 (5.7)	49 (1.0)	517 (3.8)	21 (1.0)	513 (3.6)
Serbia	26 (1.2)	457 (4.0)	36 (1.0)	474 (3.0)	38 (1.4)	475 (3.0)
Cyprus	23 (0.8)	436 (3.0)	44 (0.9)	446 (2.6)	32 (0.9)	444 (3.3)
Slovak Republic	23 (1.1)	508 (4.5)	45 (0.9)	518 (3.8)	32 (1.3)	522 (3.2)
Sweden	22 (1.1)	529 (4.6)	61 (1.3)	530 (3.1)	17 (1.0)	508 (4.2)
Hungary	19 (0.8)	538 (4.5)	47 (1.1)	541 (3.0)	34 (1.3)	549 (3.5)
Estonia	18 (0.8)	556 (3.9)	50 (1.0)	554 (2.9)	32 (1.2)	551 (2.8)
Netherlands	7 (0.6)	521 (7.8)	50 (1.4)	541 (3.1)	43 (1.4)	532 (3.6)
Belgium (Flemish)	6 (0.5)	509 (9.2)	34 (1.3)	526 (3.9)	59 (1.5)	523 (2.6)
Indonesia	– –	– –	– –	– –	– –	– –
Latvia	– –	– –	– –	– –	– –	– –
[b] Lebanon	– –	– –	– –	– –	– –	– –
Slovenia	– –	– –	– –	– –	– –	– –
International Avg.	29 (0.3)	494 (1.4)	44 (0.3)	502 (1.0)	27 (0.3)	500 (1.2)

Background data provided by students.

Does not include students who report that they do not study the content area.

b Lebanon: Data in biology panel pertain to grade 8 life and earth sciences course.

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

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

An "x" indicates data are not available for less than 50% of the students.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 4.10: **Index of Students' Valuing Science (SVS)** *(...Continued)*

Countries	High SVS		Medium SVS		Low SVS	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Chemistry						
Lebanon	62 (1.4)	396 (4.3)	30 (1.1)	388 (6.2)	8 (0.6)	403 (9.4)
Macedonia, Rep. of	48 (1.4)	440 (4.6)	29 (0.9)	466 (4.3)	23 (1.0)	470 (4.4)
Moldova, Rep. of	39 (1.3)	476 (4.0)	48 (1.0)	475 (4.2)	13 (0.8)	463 (4.7)
Armenia	38 (1.4)	464 (5.0)	35 (0.9)	464 (3.8)	28 (1.2)	467 (3.6)
Russian Federation	35 (0.9)	521 (5.4)	44 (0.8)	514 (3.4)	21 (0.9)	509 (3.6)
Bulgaria	29 (1.6)	473 (6.5)	36 (1.1)	484 (5.3)	35 (1.7)	483 (5.5)
Latvia	29 (1.1)	516 (3.5)	47 (0.9)	515 (3.0)	25 (1.1)	506 (3.6)
Lithuania	27 (1.1)	524 (3.7)	42 (1.0)	519 (2.7)	31 (1.0)	515 (2.8)
Cyprus	27 (0.7)	452 (3.4)	37 (0.8)	445 (2.8)	37 (0.7)	436 (3.0)
Romania	26 (1.2)	467 (6.3)	36 (1.0)	473 (5.8)	38 (1.6)	476 (5.2)
Slovenia	22 (0.9)	529 (3.7)	48 (1.0)	521 (2.3)	31 (1.2)	516 (2.4)
Serbia	21 (1.0)	461 (4.6)	28 (0.8)	467 (3.5)	51 (1.4)	475 (2.7)
Slovak Republic	21 (1.0)	511 (4.1)	41 (0.9)	516 (4.0)	37 (1.3)	522 (3.4)
Estonia	17 (0.9)	555 (3.9)	42 (1.0)	558 (2.8)	41 (1.3)	548 (2.8)
Sweden	15 (0.9)	541 (5.4)	52 (1.0)	532 (3.3)	33 (1.1)	515 (3.2)
Hungary	15 (0.8)	543 (4.8)	38 (1.1)	539 (3.5)	47 (1.3)	546 (3.1)
Belgium (Flemish)	– –	– –	– –	– –	– –	– –
Indonesia	– –	– –	– –	– –	– –	– –
[c] Netherlands	– –	– –	– –	– –	– –	– –
International Avg.	29 (0.3)	492 (1.2)	40 (0.2)	492 (1.1)	31 (0.3)	491 (1.1)
Physics						
Lebanon	57 (1.1)	401 (4.4)	33 (0.9)	385 (5.7)	10 (0.7)	401 (8.4)
Indonesia	56 (1.5)	413 (4.3)	41 (1.4)	432 (3.7)	3 (0.3)	440 (8.3)
Macedonia, Rep. of	50 (1.3)	443 (4.4)	28 (0.9)	465 (3.9)	22 (1.2)	468 (5.2)
Armenia	48 (1.4)	468 (4.3)	34 (0.9)	462 (4.0)	18 (1.1)	463 (4.1)
Moldova, Rep. of	40 (1.2)	474 (3.8)	49 (1.2)	475 (4.3)	11 (0.8)	465 (5.3)
Russian Federation	37 (0.9)	522 (4.9)	46 (0.8)	513 (3.6)	17 (0.7)	502 (4.1)
Bulgaria	35 (1.6)	481 (6.1)	38 (1.1)	480 (5.5)	27 (1.7)	481 (6.7)
Cyprus	33 (0.9)	457 (2.7)	38 (0.8)	440 (2.4)	29 (0.9)	435 (3.3)
Latvia	31 (1.2)	518 (3.6)	46 (1.1)	515 (2.8)	23 (1.1)	505 (3.5)
Romania	27 (1.2)	471 (7.0)	37 (1.0)	472 (5.4)	35 (1.5)	473 (5.3)
Lithuania	25 (1.1)	525 (3.2)	43 (0.9)	521 (2.7)	31 (1.1)	512 (2.9)
Slovak Republic	21 (1.2)	524 (4.7)	40 (1.0)	513 (3.8)	39 (1.3)	517 (3.9)
Serbia	21 (0.9)	464 (4.3)	29 (0.8)	469 (3.2)	50 (1.2)	472 (2.9)
Hungary	19 (0.9)	558 (4.4)	41 (1.1)	541 (3.2)	40 (1.4)	540 (3.4)
Estonia	18 (0.9)	558 (3.8)	43 (0.9)	559 (3.0)	39 (1.1)	545 (2.5)
Slovenia	16 (0.9)	526 (3.8)	45 (1.1)	524 (2.7)	38 (1.3)	516 (2.3)
Sweden	16 (0.9)	548 (5.4)	51 (0.9)	534 (2.8)	33 (1.0)	508 (3.4)
[c] Netherlands	12 (1.0)	547 (5.6)	48 (1.2)	542 (3.2)	39 (1.5)	527 (3.6)
Belgium (Flemish)	x x	x x	x x	x x	x x	x x
International Avg.	31 (0.3)	494 (1.1)	41 (0.2)	491 (0.9)	28 (0.3)	487 (1.1)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

Does not include students who report that they do not study the content area.

c Netherlands: Data in physics panel pertain to grade 8 physics/chemistry course.

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

A dash (–) indicates comparable data are not available.

An "x" indicates data are not available for less than 50% of the students.

the relationship averaged across countries appears curvilinear, primarily because the countries with the highest percentages of students in the high index category had low average achievement, and those with the lowest percentages had high achievement.

Eighth-grade students in the separate-science countries appear to place less value on the individual sciences. Greater percentages of students were in the high index category for biology (37 percent, on average) and physics (31 percent), and lower percentages for earth science and chemistry (29 percent each). Countries with relatively large percentages of students at the high level in all subject areas included Armenia, Macedonia, Moldova, and Indonesia and Lebanon where applicable. The relationship between valuing science and science achievement was even less consistent for the separate science subject areas than for science as a single subject, partly because relatively high-achieving countries such as Belgium (Flemish), Estonia, Hungary, the Netherlands, and Sweden had low percentages of students in the high index category. Only for physics was there a positive relationship between valuing physics and science achievement.

To provide more information on changes from 1995 and 1999 in an important component of the *students valuing science index*, Exhibit 4.11 displays the percentages of eighth-grade students in 2003, 1999, and 1995 that "agree a lot," "agree a little," or "disagree" that they enjoy learning science. This four-page display summarizes the data in one panel for the countries that teach science as a single subject at the eighth grade, and in separate panels for earth science, biology, physics, and chemistry for countries that teach the sciences separately. Comparable data at fourth grade are shown in a single panel for 2003 and 1995 only.

Among countries where eighth-grade science is taught as a single subject, there has been an increase from 1995 and 1999 in the average percentage of students agreeing a lot that they enjoy learning science, from 23 percent in 1995 to 32 percent in 1999 to 44 percent in 2003. Countries showing a significant increase in 2003 over either 1995

Exhibit 4.11: Trends in "I Enjoy Learning Science"

Countries	Agree A Lot			Agree A Little			Disagree		
	2003 Percent of Students	1999 Percent of Students	1995 Percent of Students	2003 Percent of Students	1999 Percent of Students	1995 Percent of Students	2003 Percent of Students	1999 Percent of Students	1995 Percent of Students
General/ Integrated Science									
Australia	29 (1.2)	– –	16 (0.6) ▲	38 (0.9)	– –	50 (0.9) ▼	33 (1.2)	– –	35 (0.9)
Bahrain	54 (1.1)	✧ ✧	✧ ✧	30 (0.8)	✧ ✧	✧ ✧	17 (0.9)	✧ ✧	✧ ✧
Botswana	72 (1.0)	✧ ✧	✧ ✧	17 (0.8)	✧ ✧	✧ ✧	11 (0.5)	✧ ✧	✧ ✧
Chile	46 (1.1)	41 (1.2) ▲	✧ ✧	32 (0.7)	47 (0.9) ▼	✧ ✧	22 (0.8)	12 (0.7) ▲	✧ ✧
[a] Chinese Taipei	16 (0.8)	18 (0.7)	✧ ✧	34 (0.8)	53 (0.7) ▼	✧ ✧	49 (1.2)	29 (0.9) ▲	✧ ✧
Egypt	68 (1.1)	✧ ✧	✧ ✧	22 (0.9)	✧ ✧	✧ ✧	10 (0.5)	✧ ✧	✧ ✧
Ghana	65 (1.2)	✧ ✧	✧ ✧	21 (0.9)	✧ ✧	✧ ✧	13 (0.8)	✧ ✧	✧ ✧
Hong Kong, SAR	21 (0.8)	17 (0.7) ▲	15 (0.8) ▲	48 (1.0)	56 (0.9) ▼	53 (1.0) ▼	31 (1.1)	27 (1.2) ▲	32 (1.3)
Iran, Islamic Rep. of	59 (1.1)	50 (1.1) ▲	53 (1.4) ▲	28 (0.8)	42 (1.0) ▼	41 (1.3) ▼	13 (0.7)	8 (0.5) ▲	7 (0.7) ▲
Israel	34 (1.4)	28 (1.2) ▲	– –	30 (0.9)	42 (1.0) ▼	– –	36 (1.3)	30 (1.3) ▲	– –
Italy	23 (0.9)	22 (1.0)	– –	50 (1.0)	52 (0.9)	– –	27 (1.0)	26 (1.1)	– –
Japan	19 (1.0)	8 (0.4) ▲	8 (0.5) ▲	40 (0.8)	42 (1.2)	45 (1.0) ▼	41 (1.4)	49 (1.3) ▼	47 (1.2) ▼
Jordan	59 (1.4)	49 (1.6) ▲	✧ ✧	28 (1.0)	39 (1.1) ▼	✧ ✧	13 (0.8)	12 (0.9)	✧ ✧
Korea, Rep. of	9 (0.5)	5 (0.4) ▲	6 (0.5) ▲	29 (0.8)	28 (0.9)	34 (1.1) ▼	62 (0.9)	67 (1.1) ▼	60 (1.3)
Malaysia	42 (1.1)	43 (1.2)	✧ ✧	44 (0.8)	51 (1.0) ▼	✧ ✧	13 (0.8)	5 (0.5) ▲	✧ ✧
Morocco	63 (1.4)	– –	✧ ✧	23 (0.9)	– –	✧ ✧	14 (0.9)	– –	✧ ✧
New Zealand	33 (1.5)	22 (1.0) ▲	21 (1.1) ▲	38 (1.3)	50 (0.9) ▼	51 (0.9) ▼	29 (1.3)	27 (1.2)	29 (1.1)
Norway	38 (1.4)	✧ ✧	21 (1.0) ▲	39 (0.9)	✧ ✧	54 (1.1) ▼	23 (1.2)	✧ ✧	25 (1.4)
Palestinian Nat'l Auth.	59 (1.2)	✧ ✧	✧ ✧	27 (0.7)	✧ ✧	✧ ✧	14 (0.7)	✧ ✧	✧ ✧
[d] Philippines	54 (1.2)	52 (1.1)	✧ ✧	35 (0.9)	42 (1.0) ▼	✧ ✧	12 (0.8)	6 (0.5) ▲	✧ ✧
Saudi Arabia	54 (1.7)	✧ ✧	✧ ✧	29 (1.2)	✧ ✧	✧ ✧	17 (1.0)	✧ ✧	✧ ✧
Scotland	37 (1.0)	✧ ✧	30 (1.2) ▲	37 (0.8)	✧ ✧	51 (1.0) ▼	26 (1.0)	✧ ✧	19 (1.1) ▲
Singapore	42 (0.9)	33 (1.1) ▲	31 (1.4) ▲	41 (0.7)	54 (0.9) ▼	59 (1.1) ▼	17 (0.6)	13 (1.1) ▲	10 (0.8) ▲
South Africa	64 (1.0)	54 (1.6) ▲	– –	22 (0.8)	32 (1.2) ▼	– –	15 (0.6)	14 (1.6)	– –
Tunisia	66 (1.1)	51 (1.2) ▲	✧ ✧	23 (0.7)	41 (0.9) ▼	✧ ✧	10 (0.6)	8 (0.6) ▲	✧ ✧
United States	35 (0.8)	25 (0.8) ▲	24 (1.0) ▲	37 (0.6)	50 (0.8) ▼	50 (0.8) ▼	27 (0.9)	25 (0.8)	27 (1.2)
[‡] England	28 (1.4)	29 (1.1)	27 (1.3)	41 (1.1)	56 (1.0) ▼	55 (1.4) ▼	32 (1.5)	15 (0.8) ▲	18 (1.1) ▲
International Avg.	44 (0.2)	32 (0.2) ▲	23 (0.3) ▲	33 (0.2)	47 (0.2) ▼	49 (0.3) ▼	23 (0.2)	21 (0.2) ▲	28 (0.3) ▼
Benchmarking Participants									
Basque Country, Spain	26 (1.6)	✧ ✧	✧ ✧	33 (1.1)	✧ ✧	✧ ✧	41 (1.9)	✧ ✧	✧ ✧
Indiana State, US	34 (1.7)	24 (1.7) ▲	✧ ✧	36 (1.1)	50 (1.5) ▼	✧ ✧	31 (1.7)	26 (1.8) ▲	✧ ✧
Ontario Province, Can.	36 (1.5)	23 (1.2) ▲	19 (1.1) ▲	38 (1.2)	50 (1.1) ▼	55 (1.2) ▼	26 (1.3)	27 (1.5)	26 (1.5)
Quebec Province, Can.	23 (1.3)	14 (1.5) ▲	19 (1.6) ▲	41 (1.0)	41 (4.4)	47 (2.9)	36 (1.7)	45 (5.3)	34 (3.0)

▲ 2003 significantly higher

▼ 2003 significantly lower

Background data provided by students.

a Chinese Taipei: Students were asked about natural science; data pertain to grade 8 physics/chemistry course.

d Philippines: Students study only biology at grade 8.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

Trend notes: Because of differences in population coverage, 1999 data are not shown for Australia, Latvia, Morocco, and Slovenia, and 1995 data are not shown for Israel, Italy, Latvia, and South Africa. Korea tested later in 2003 than in 1999 and 1995, at the beginning of the next school year. Similarly, Lithuania tested later in 1999 than in 2003 and 1995.

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

A dash (–) indicates comparable data are not available.

A diamond (✧) indicates the country did not participate in the assessment.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 4.11: **Trends in "I Enjoy Learning Science"** *(Continued...)*

Countries	Agree A Lot			Agree A Little			Disagree		
	2003 Percent of Students	1999 Percent of Students	1995 Percent of Students	2003 Percent of Students	1999 Percent of Students	1995 Percent of Students	2003 Percent of Students	1999 Percent of Students	1995 Percent of Students
Biology									
Armenia	60 (1.2)	✧ ✧	✧ ✧	23 (0.8)	✧ ✧	✧ ✧	17 (0.9)	✧ ✧	✧ ✧
Belgium (Flemish)	27 (1.2)	14 (0.8) ▲	20 (1.1) ▲	38 (0.9)	46 (1.0) ▼	47 (1.6) ▼	35 (1.4)	40 (1.2) ▼	34 (2.0)
Bulgaria	52 (1.8)	37 (1.5) ▲	– –	33 (1.2)	44 (1.5) ▼	– –	15 (1.0)	19 (1.1) ▼	– –
Cyprus	x x	– –	– –	x x	– –	– –	x x	– –	– –
Estonia	27 (1.0)	✧ ✧	✧ ✧	43 (0.9)	✧ ✧	✧ ✧	30 (1.3)	✧ ✧	✧ ✧
Hungary	29 (1.2)	16 (0.9) ▲	15 (0.9) ▲	37 (1.1)	47 (1.2) ▼	52 (1.4) ▼	34 (1.5)	37 (1.4)	33 (1.7)
Indonesia	33 (1.4)	– –	✧ ✧	58 (1.1)	– –	✧ ✧	8 (0.7)	– –	✧ ✧
Latvia	28 (1.4)	– –	– –	39 (1.1)	– –	– –	33 (1.6)	– –	– –
[b] Lebanon	52 (1.2)	✧ ✧	✧ ✧	27 (1.0)	✧ ✧	✧ ✧	21 (0.9)	✧ ✧	✧ ✧
Lithuania	32 (1.4)	19 (1.0) ▲	25 (1.3) ▲	37 (0.9)	54 (1.2) ▼	52 (1.1) ▼	31 (1.2)	27 (1.4) ▲	23 (1.4) ▲
Macedonia, Rep. of	67 (1.2)	49 (1.3) ▲	✧ ✧	22 (0.9)	41 (1.1) ▼	✧ ✧	11 (0.6)	10 (0.6)	✧ ✧
Moldova, Rep. of	33 (1.2)	32 (1.5)	✧ ✧	52 (1.1)	57 (1.4) ▼	✧ ✧	16 (0.8)	11 (0.8) ▲	✧ ✧
Netherlands r	9 (0.9)	22 (2.3) ▼	20 (1.4) ▼	31 (1.4)	53 (2.0) ▼	55 (1.4) ▼	60 (1.9)	25 (2.1) ▲	25 (1.7) ▲
Romania	34 (1.2)	27 (1.2) ▲	31 (1.2) ▲	38 (0.9)	55 (1.1) ▼	52 (1.1) ▼	28 (1.2)	18 (1.3) ▲	17 (1.1) ▲
Russian Federation	36 (1.3)	28 (1.6) ▲	26 (1.0) ▲	43 (1.1)	51 (1.5) ▼	51 (0.9) ▼	21 (1.0)	21 (1.1)	23 (1.2)
Serbia	41 (1.5)	✧ ✧	✧ ✧	30 (0.9)	✧ ✧	✧ ✧	29 (1.3)	✧ ✧	✧ ✧
Slovak Republic	26 (1.5)	12 (0.8) ▲	11 (0.7) ▲	42 (1.0)	55 (1.3) ▼	61 (1.1) ▼	32 (1.5)	32 (1.3)	28 (1.3) ▲
Slovenia	22 (1.1)	– –	21 (1.2)	39 (1.2)	– –	47 (1.2) ▼	39 (1.5)	– –	32 (1.7) ▲
Sweden	17 (1.0)	✧ ✧	20 (1.5)	52 (0.9)	✧ ✧	57 (1.3) ▼	31 (1.1)	✧ ✧	23 (1.6) ▲
International Avg.	35 (0.3)	28 (0.4) ▲	21 (0.4) ▲	38 (0.2)	49 (0.4) ▼	53 (0.4) ▼	27 (0.3)	23 (0.4) ▲	26 (0.5)
Earth Science									
Armenia	55 (1.3)	✧ ✧	✧ ✧	24 (0.8)	✧ ✧	✧ ✧	20 (1.0)	✧ ✧	✧ ✧
Belgium (Flemish)	12 (0.8)	9 (0.6) ▲	11 (0.9)	29 (1.1)	35 (1.1) ▼	39 (1.4) ▼	59 (1.6)	57 (1.5)	50 (1.9) ▲
Bulgaria	43 (1.3)	30 (1.5) ▲	– –	36 (1.0)	43 (2.1) ▼	– –	21 (1.3)	27 (2.5) ▲	– –
Cyprus	41 (1.0)	– –	– –	33 (0.7)	– –	– –	25 (0.9)	– –	– –
Estonia	20 (1.0)	✧ ✧	✧ ✧	39 (1.1)	✧ ✧	✧ ✧	42 (1.4)	✧ ✧	✧ ✧
Hungary	23 (1.0)	11 (0.6) ▲	12 (0.8) ▲	34 (1.0)	40 (1.1) ▼	38 (1.4) ▼	43 (1.3)	49 (1.4) ▲	50 (1.7) ▼
Indonesia	– –	– –	✧ ✧	– –	– –	✧ ✧	– –	– –	✧ ✧
Latvia	– –	– –	– –	– –	– –	– –	– –	– –	– –
[b] Lebanon	– –	✧ ✧	✧ ✧	– –	✧ ✧	✧ ✧	– –	✧ ✧	✧ ✧
Lithuania	35 (1.5)	– –	24 (1.5) ▲	37 (0.9)	– –	51 (1.2) ▼	28 (1.2)	– –	24 (1.3) ▲
Macedonia, Rep. of	60 (1.3)	49 (1.7) ▲	✧ ✧	24 (1.0)	40 (1.2) ▼	✧ ✧	16 (0.8)	12 (1.0) ▼	✧ ✧
Moldova, Rep. of	28 (1.4)	37 (1.4) ▼	✧ ✧	53 (1.3)	51 (1.2)	✧ ✧	20 (1.2)	12 (0.8) ▼	✧ ✧
Netherlands	5 (0.6)	14 (1.4) ▼	10 (1.0) ▼	23 (1.4)	50 (1.8) ▼	46 (2.4) ▼	71 (1.6)	37 (2.2) ▼	44 (2.9) ▲
Romania	40 (1.3)	33 (1.4) ▲	31 (1.2) ▲	33 (0.9)	53 (1.2) ▼	48 (1.2) ▼	28 (1.3)	14 (1.3) ▼	21 (1.0) ▲
Russian Federation	27 (1.1)	19 (1.4) ▲	16 (0.8) ▲	42 (1.1)	47 (1.2) ▼	45 (1.1) ▼	32 (1.5)	34 (1.7)	39 (1.3) ▼
Serbia	37 (1.3)	✧ ✧	✧ ✧	27 (0.8)	✧ ✧	✧ ✧	35 (1.3)	✧ ✧	✧ ✧
Slovak Republic	25 (1.3)	18 (1.0) ▲	17 (1.1) ▲	39 (1.2)	53 (1.6) ▼	56 (1.2) ▼	36 (1.7)	29 (2.0) ▼	27 (1.4) ▲
Slovenia	– –	– –	– –	– –	– –	– –	– –	– –	– –
Sweden r	19 (0.9)	✧ ✧	22 (1.2)	52 (1.0)	✧ ✧	56 (1.4)	29 (1.2)	✧ ✧	23 (1.4) ▲
International Avg.	31 (0.3)	24 (0.4) ▲	18 (0.4) ▲	35 (0.3)	46 (0.5) ▼	47 (0.5) ▼	34 (0.3)	30 (0.6) ▼	35 (0.6)

▲ 2003 significantly higher

▼ 2003 significantly lower

Background data provided by students.

Does not include students who report that they do not study the content area.

b Lebanon: Data in biology panel pertain to grade 8 life and earth sciences course.

Trend notes: Because of differences in population coverage, 1999 data are not shown for Australia, Latvia, Morocco, and Slovenia, and 1995 data are not shown for Israel, Italy, Latvia, and South Africa. Korea tested later in 2003 than in 1999 and 1995, at the beginning of the next school year. Similarly, Lithuania tested later in 1999 than in 2003 and 1995.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals 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 "x" indicates data are available for less than 50% of the students.

A diamond (✧) indicates the country did not participate in the assessment.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 4.11: **Trends in "I Enjoy Learning Science"** *(...Continued)*

Countries	Agree A Lot			Agree A Little			Disagree		
	2003 Percent of Students	1999 Percent of Students	1995 Percent of Students	2003 Percent of Students	1999 Percent of Students	1995 Percent of Students	2003 Percent of Students	1999 Percent of Students	1995 Percent of Students
Chemistry									
Armenia	36 (1.3)	✧ ✧	✧ ✧	27 (0.9)	✧ ✧	✧ ✧	37 (1.3)	✧ ✧	✧ ✧
Belgium (Flemish)	– –	– –	– –	– –	– –	– –	– –	– –	– –
Bulgaria	27 (1.6)	21 (1.0) ▲	– –	31 (1.1)	38 (1.7) ▼	– –	41 (1.9)	41 (2.0)	– –
Cyprus	36 (0.8)	– –	– –	29 (0.8)	– –	– –	34 (0.8)	– –	– –
Estonia	17 (0.9)	✧ ✧	✧ ✧	31 (1.0)	✧ ✧	✧ ✧	53 (1.6)	✧ ✧	✧ ✧
Hungary	13 (0.9)	7 (0.6) ▲	10 (0.9) ▲	25 (1.0)	28 (1.4) ▼	30 (1.4) ▼	63 (1.5)	64 (1.5)	60 (1.7)
Indonesia	– –	– –	✧ ✧	– –	– –	✧ ✧	– –	– –	✧ ✧
Latvia	23 (1.1)	– –	– –	36 (0.7)	– –	– –	41 (1.3)	– –	– –
Lebanon	51 (1.6)	✧ ✧	✧ ✧	29 (1.1)	✧ ✧	✧ ✧	20 (1.2)	✧ ✧	✧ ✧
Lithuania	22 (1.2)	7 (0.7) ▲	12 (0.8) ▲	30 (1.0)	34 (1.3) ▼	40 (1.4) ▼	48 (1.4)	59 (1.4) ▼	48 (1.6)
Macedonia, Rep. of	43 (1.4)	32 (1.7) ▲	✧ ✧	29 (0.9)	43 (1.1) ▼	✧ ✧	28 (1.2)	25 (1.4)	✧ ✧
Moldova, Rep. of	22 (1.1)	23 (1.3)	✧ ✧	46 (1.0)	47 (1.3)	✧ ✧	33 (1.2)	30 (1.5)	✧ ✧
c Netherlands	– –	– –	– –	– –	– –	– –	– –	– –	– –
Romania	19 (1.0)	18 (0.9)	23 (1.0) ▼	32 (1.2)	44 (1.3) ▼	47 (1.3) ▼	49 (1.6)	38 (1.5) ▲	30 (1.3) ▲
Russian Federation	27 (1.1)	17 (0.7) ▲	14 (0.8) ▲	37 (1.0)	42 (1.3) ▼	41 (1.1) ▼	36 (1.1)	41 (1.7) ▼	45 (1.4) ▼
Serbia	21 (1.2)	✧ ✧	✧ ✧	23 (0.8)	✧ ✧	✧ ✧	56 (1.5)	✧ ✧	✧ ✧
Slovak Republic	22 (1.2)	16 (1.1) ▲	7 (0.6) ▲	35 (1.0)	47 (1.4) ▼	41 (1.4) ▼	43 (1.5)	37 (1.9) ▲	51 (1.6) ▼
Slovenia	16 (0.8)	– –	15 (0.9)	32 (1.0)	– –	38 (1.4) ▼	52 (1.3)	– –	47 (1.7) ▲
Sweden r	15 (0.8)	✧ ✧	20 (1.4) ▼	44 (1.1)	✧ ✧	47 (1.6) ▼	42 (1.4)	✧ ✧	33 (1.6) ▲
International Avg.	26 (0.3)	18 (0.4) ▲	15 (0.4) ▲	32 (0.2)	40 (0.5) ▼	41 (0.5) ▼	42 (0.3)	42 (0.6)	45 (0.6) ▼
Physics									
Armenia	48 (1.3)	✧ ✧	✧ ✧	26 (0.9)	✧ ✧	✧ ✧	26 (1.0)	✧ ✧	✧ ✧
Belgium (Flemish)	x x	x x	x x	x x	x x	x x	x x	x x	x x
Bulgaria	31 (2.0)	29 (1.6)	– –	35 (1.4)	39 (1.3) ▼	– –	34 (2.0)	32 (1.8)	– –
Cyprus	33 (1.0)	– –	– –	31 (0.7)	– –	– –	36 (0.9)	– –	– –
Estonia	11 (0.6)	✧ ✧	✧ ✧	30 (0.9)	✧ ✧	✧ ✧	59 (1.2)	✧ ✧	✧ ✧
Hungary	15 (0.8)	9 (0.6) ▲	8 (0.6) ▲	27 (1.0)	30 (1.3) ▼	28 (1.3)	58 (1.3)	61 (1.5)	65 (1.6) ▼
Indonesia	21 (1.1)	– –	✧ ✧	61 (0.9)	– –	✧ ✧	19 (1.1)	– –	✧ ✧
Latvia	19 (1.0)	– –	– –	38 (1.1)	– –	– –	44 (1.5)	– –	– –
Lebanon	44 (1.4)	✧ ✧	✧ ✧	32 (1.0)	✧ ✧	✧ ✧	25 (1.1)	✧ ✧	✧ ✧
Lithuania	15 (0.8)	10 (0.8) ▲	12 (1.0) ▲	28 (1.0)	41 (1.4) ▼	37 (1.5) ▼	57 (1.5)	49 (1.6) ▲	51 (1.7) ▲
Macedonia, Rep. of	44 (1.5)	36 (1.4) ▲	✧ ✧	29 (0.9)	40 (1.2) ▼	✧ ✧	27 (1.3)	24 (1.2)	✧ ✧
Moldova, Rep. of	21 (1.0)	23 (1.3)	✧ ✧	48 (1.1)	49 (1.3)	✧ ✧	31 (1.1)	28 (1.5)	✧ ✧
c Netherlands	6 (0.7)	13 (1.1) ▼	13 (1.3) ▼	25 (1.4)	44 (1.6) ▼	45 (1.9) ▼	69 (1.9)	42 (1.9) ▲	42 (2.5) ▲
Romania	17 (0.9)	15 (0.9)	22 (1.1) ▼	32 (1.0)	44 (1.2) ▼	45 (1.2) ▼	51 (1.5)	41 (1.7) ▲	33 (1.6) ▲
Russian Federation	23 (1.0)	18 (0.9) ▲	18 (0.9) ▲	41 (0.9)	46 (1.1) ▼	42 (1.1)	36 (1.1)	36 (1.3)	40 (1.4) ▼
Serbia	19 (1.0)	✧ ✧	✧ ✧	24 (1.0)	✧ ✧	✧ ✧	57 (1.3)	✧ ✧	✧ ✧
Slovak Republic	14 (0.7)	10 (0.7) ▲	10 (0.6) ▲	33 (1.2)	37 (1.2) ▼	41 (1.4) ▼	53 (1.4)	53 (1.5)	50 (1.7)
Slovenia	9 (0.7)	– –	11 (0.7)	24 (1.1)	– –	33 (1.5) ▼	66 (1.3)	– –	56 (1.8) ▲
Sweden r	12 (0.8)	✧ ✧	16 (1.1) ▼	40 (1.1)	✧ ✧	44 (1.3) ▼	48 (1.4)	✧ ✧	40 (1.8) ▲
International Avg.	22 (0.3)	23 (0.4) ▼	14 (0.3) ▲	33 (0.2)	40 (0.4) ▼	39 (0.5) ▼	44 (0.3)	37 (0.5) ▲	47 (0.6) ▼

▲ 2003 significantly higher

▼ 2003 significantly lower

Background data provided by students.

Does not include students who report that they do not study the content area.

c Netherlands: Data in physics panel pertain to grade 8 physics/chemistry course.

Trend notes: Because of differences in population coverage, 1999 data are not shown for Australia, Latvia, Morocco, and Slovenia, and 1995 data are not shown for Israel, Italy, Latvia, and South Africa. Korea tested later in 2003 than in 1999 and 1995, at the beginning of the next school year. Similarly, Lithuania tested later in 1999 than in 2003 and 1995.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals 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 "x" indicates data are available for less than 50% of the students.

A diamond (') indicates the country did not participate in the assessment.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 4.11: **Trends in "I Enjoy Learning Science"**

Countries	Agree A Lot		Agree A Little		Disagree	
	2003 Percent of Students	1995 Percent of Students	2003 Percent of Students	1995 Percent of Students	2003 Percent of Students	1995 Percent of Students
Armenia	72 (1.4)	✧ ✧	15 (0.7)	✧ ✧	13 (1.0)	✧ ✧
Australia	64 (1.3)	39 (1.2) ▲	23 (0.9)	42 (1.0) ▼	14 (0.9)	19 (0.9) ▼
Belgium (Flemish)	31 (1.1)	✧ ✧	38 (0.9)	✧ ✧	31 (1.2)	✧ ✧
Chinese Taipei	49 (1.3)	✧ ✧	29 (0.8)	✧ ✧	21 (0.9)	✧ ✧
Cyprus	59 (1.2)	56 (1.5)	22 (0.7)	32 (1.3) ▼	19 (1.1)	12 (0.9) ▲
England	39 (1.4)	41 (1.1)	29 (1.1)	39 (1.1) ▼	32 (1.2)	21 (1.0) ▲
Hong Kong, SAR	50 (1.2)	43 (1.4) ▲	36 (0.9)	44 (1.3) ▼	14 (0.9)	13 (1.6)
Hungary	54 (1.2)	36 (1.3) ▲	26 (0.9)	41 (1.1) ▼	20 (0.9)	24 (1.4) ▼
Iran, Islamic Rep. of r	81 (1.3)	70 (1.4) ▲	11 (0.8)	22 (1.3) ▼	8 (0.8)	7 (0.8)
Italy	50 (1.0)	– –	37 (0.9)	– –	13 (0.8)	– –
Japan	45 (1.2)	38 (1.1) ▲	36 (0.8)	50 (0.9) ▼	19 (1.0)	12 (0.8) ▲
Latvia	57 (1.5)	– –	28 (1.0)	– –	15 (1.0)	– –
Lithuania	62 (1.2)	✧ ✧	24 (0.9)	✧ ✧	14 (0.8)	✧ ✧
Moldova, Rep. of	48 (1.2)	✧ ✧	39 (1.2)	✧ ✧	13 (0.8)	✧ ✧
Morocco	68 (1.6)	✧ ✧	18 (1.1)	✧ ✧	14 (1.0)	✧ ✧
Netherlands	40 (1.5)	29 (1.4) ▲	37 (1.1)	42 (1.3) ▼	23 (1.3)	29 (1.4) ▼
New Zealand	60 (1.0)	47 (1.4) ▲	26 (0.8)	36 (1.5) ▼	14 (0.7)	17 (1.1) ▼
Norway	53 (1.3)	42 (1.6) ▲	28 (1.0)	38 (1.2) ▼	19 (0.8)	20 (1.3)
Philippines	51 (1.6)	✧ ✧	30 (1.0)	✧ ✧	20 (1.2)	✧ ✧
Russian Federation	57 (1.2)	✧ ✧	27 (1.0)	✧ ✧	16 (0.9)	✧ ✧
Scotland	57 (1.6)	– –	24 (1.1)	– –	19 (1.0)	– –
Singapore	51 (0.9)	41 (1.3) ▲	28 (0.6)	47 (1.1) ▼	21 (0.7)	12 (0.6) ▲
Slovenia	46 (1.3)	49 (1.5)	30 (1.2)	36 (1.2) ▼	23 (1.4)	15 (1.2) ▲
Tunisia	69 (1.7)	✧ ✧	18 (1.5)	✧ ✧	13 (0.8)	✧ ✧
United States	62 (0.9)	48 (1.0) ▲	21 (0.6)	35 (0.8) ▼	16 (0.7)	17 (0.9)
International Avg.	55 (0.3)	44 (0.4) ▲	27 (0.2)	39 (0.3) ▼	18 (0.2)	17 (0.3) ▲
Benchmarking Participants						
Indiana State, US	60 (1.5)	✧ ✧	25 (1.3)	✧ ✧	15 (1.3)	✧ ✧
Ontario Province, Can.	55 (1.5)	38 (1.3) ▲	28 (1.1)	44 (1.0) ▼	18 (1.1)	19 (1.0)
Quebec Province, Can.	57 (1.2)	40 (3.2) ▲	28 (0.9)	40 (2.2) ▼	14 (0.8)	20 (3.4)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

Trend notes: Because of differences between 1995 and 2003 in population coverage, 1995 data are not shown for Italy and Latvia. 1995 data for New Zealand in this exhibit include students in English medium instruction only (>98% of the estimated population).

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

A dash (–) indicates comparable data are not available.

"r" indicates data are available for at least 70 but less than 85% of the students.

A diamond (✧) indicates the country did not participate in the assessment.

or 1999 included Australia, Chile, Hong Kong SAR, Iran, Israel, Japan, Jordan, Korea, New Zealand, Norway, Scotland, Singapore, South Africa, Tunisia, the United States, Indiana, Ontario, and Quebec. A similar trend was apparent among separate-science countries in biology, earth science, and chemistry, with greater percentages of students in 2003 than in 1995 or 1999 agreeing a lot that they enjoy learning the subject. For physics, the percentage of students in this category in 2003 was greater than in 1995 but slightly less than in 1999.

At fourth grade, the average percentage of students agreeing a lot that they enjoy learning science increased from 44 percent in 1995 to 55 percent in 2003. Participants showing a significant increase included Australia, Hong Kong SAR, Hungary, Iran, Japan, the Netherlands, New Zealand, Norway, Singapore, the United States, Ontario, and Quebec.

5

Chapter 5

The Science Curriculum

The first part of Chapter 5 presents information about the curricular goals in the TIMSS 2003 countries, referred to as the intended curriculum. Information is provided about the science subjects offered in each country, whether the participating countries have national curricula and public examinations in science, how the curriculum is supported and monitored within each country, whether countries differentiate the curricula for students with different levels of ability, and the approaches and processes that are emphasized in the intended curriculum. The second part of the chapter presents data about the coverage of the TIMSS science topics in the intended curriculum for each country, as well as teachers' reports about the science topics actually taught to their students, also known as the implemented curriculum.

In comparing achievement across countries, it is important to consider differences in students' curricular experiences and how they may affect the science they have studied. Students' opportunity to learn the content, skills, and processes tested in the TIMSS 2003 science assessment depends to a large degree on the curricular goals and intentions inherent in each country's policies for science education. Just as important as what students are expected to learn, however, is what their teachers choose to teach them. The lessons provided by the teacher ultimately determine the science students are taught.

This chapter presents information about the curricular goals in science in the TIMSS 2003 countries and teachers' reports about the science content studied. Teachers' instructional programs for their classes are usually guided by an "official curriculum" that describes the science education that should be provided. The official curriculum can be communicated by means of documents or statements of various types (often called guides, guidelines, or frameworks) prepared by the education ministry or by national or regional education departments. These documents or statements, together with supporting material such as instructional guides or mandated textbooks, are referred to as the *intended curriculum*. To collect information about the intended science curriculum in each of the TIMSS 2003 countries, the National Research Coordinators (NRCs) responsible for implementing the study completed curriculum questionnaires, often with the assistance of curriculum specialists, and responded to follow-up queries.

In many cases, teachers need to interpret and adapt the intended curriculum according to their perceptions of the needs, abilities, and interests of their students, and this evolves into the *implemented curriculum*. Research has shown that the implemented curriculum, even in highly regulated educational systems, is not identical to the intended curriculum. To collect data about the implemented curriculum, the science teachers of the students tested in TIMSS 2003 completed questionnaires about whether the students had been taught the various science topics included in the assessment.

Which Science Subjects Are Offered Up To and Including Eighth Grade?

One of the primary differences among science curricula of the TIMSS 2003 countries in eighth and earlier grades is that the sciences are taught as separate subjects in some countries and integrated to form a general science course in others. Exhibit 5.1 shows how science instruction is organized in these grades in the TIMSS countries. By the eighth grade, most of the continental European countries, as well as Chinese

Taipei, Indonesia, Lebanon, Morocco, and the Philippines, were teaching some or all of biology, chemistry, physics, and earth science as separate subjects (in some cases chemistry and physics or biology and earth science are combined), although not necessarily contemporaneously. Elsewhere, the common practice was to integrate the sciences into a general science curriculum.

Exhibit 5.1: Science Subjects Offered Up To and Including Eighth Grade

SCIENCE Grade 8

Countries	Separate Science Courses Offered	Science Subjects and Grades Taught
Armenia	●	Biology 8; Chemistry 8; Physics 8; Earth Science 8
Australia	○	General/integrated science
Bahrain	○	General/integrated science
Belgium (Flemish)	●	Biology 8; Physics 8; Earth Science 8
Botswana	○	General/integrated science
Bulgaria	●	Biology 6,7,8; Chemistry 7,8; Physics 7,8; Earth Science 8
Chile	○	General/integrated science
Chinese Taipei	●	Biology 7; Physics/Chemistry 8
Cyprus	●	Biology 7; Chemisty 8; Physics 8; Geography 8
Egypt	○	General/integrated science
England	○	General/integrated science
Estonia	●	Biology 7,8; Geography 7,8; Chemistry 8; Physics 8
Ghana	○	General/integrated science
Hong Kong, SAR	○	General/integrated science
Hungary	●	Biology 7,8; Chemistry 7,8; Physics 7,8; Earth Science 7,8
Indonesia	●	Biology 7,8; Physics, 7,8
Iran, Islamic Rep. of	○	General/integrated science
Israel	○	General/integrated science
Italy	○	General/integrated science
Japan	○	General/integrated science
Jordan	○	General/integrated science
Korea, Rep. of	○	General/integrated science
Latvia	●	Biology 6-8; Chemistry 8; Physics 8
Lebanon	●	Life and Earth Sciences 7,8; Chemistry 7,8; Physics 7,8
Lithuania	●	Integrated science "Nature and man" 5,6; Geography 6,7,8; Biology 7,8; Physics 7,8; Chemistry 8
Macedonia, Rep. of	●	Natural Science 1-4; Biology 5-8; Geography 5-8; Chemistry 7,8; Physics 7,8
Malaysia	○	General/integrated science
Moldova, Rep. of	●	Biology 5-8; Geography 5-8; Physics 6-8; Chemistry 7,8
Morocco	●	Biology 8; Chemistry 8; Physics 8; Earth Science 8
Netherlands	●	General/integrated science K-6; Biology 7,8; Physics/Chemistry 7,8; Geography 7,8
New Zealand	○	General/integrated science
Norway	○	General/integrated science
Palestinian Nat'l Auth.	○	General/integrated science
Philippines	●	Integrated science 7; Biology 8
Romania	●	Geography 4-8; Biology 5-8; Physics 6-8; Chemistry 7,8
Russian Federation	●	Biology 6,7,8; Geography 6,7,8; Physics 7,8; Chemistry 8
Saudi Arabia	○	General/integrated science
Scotland	○	General/integrated science
Serbia	●	Biology 5-8; Geography 5-8; Physics 6-8; Chemistry 7,8
Singapore	○	General/integrated science
Slovak Republic	●	Biology and Environmental Science 5-8; Earth Science 5-8; Physics 6-8; Chemistry 8
Slovenia	●	General Science and Technology 7; Biology 8; Chemistry 8; Physics 8
South Africa	○	General/integrated science
Sweden	●	Integrated Science Studies K-6; either Integrated Natural Science 7,8 or Biology 7,8; Chemistry 7,8; Physics 7,8; Social Science/Geography 7,8
Syrian Arab Republic	●	Biology 7,8; Chemistry 7,8; Physics 7,8
Tunisia	○	General/integrated science
United States	○	Varies by state; usually general/integrated science
Benchmarking Participants		
Basque Country, Spain	○	General/integrated science
Indiana State, US	○	General/integrated science
Ontario Province, Can.	○	General/integrated science
Quebec Province, Can.	○	General/integrated science

● Country reported Yes for the particular option

○ Country reported No for the particular option

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

Which Countries Have a National Curriculum and Public Examinations in Science?

A common feature of many countries' educational systems is that curricular decisions are made at the national level, with the ministry of education (or highest authority in the system) being primarily responsible for the major decisions governing the direction of education. Some countries, on the other hand, have less centralized systems, with such decisions made at the regional or local level. Centralized decision making can add coherence and uniformity to curriculum coverage, whereas less centralized decision making may give a school or teacher more flexibility in tailoring instruction to the needs of students.

Exhibit 5.2 shows that, of the 47 countries that participated in TIMSS 2003 at the eighth grade,[1] all but 3 reported that the specifications for students' curricular goals in science at this level were developed as national curricula. In Australia and the United States, curricula were determined at the state level. In Belgium (Flemish), although there was no national curriculum, there were officially defined final attainment levels, and school boards developed their own curricula based on these. Among benchmarking participants, the US state of Indiana and the Canadian provinces of Ontario and Quebec had system-wide curricula determined at the state and provincial level, respectively, while in the Basque Country of Spain, 55 percent of the curriculum was determined at the national level and 45 percent at the community level.

In the recent past, it has become common for countries' intended curricula to be updated regularly. At the time of the TIMSS 2003 testing, the official eighth-grade science curriculum in 27 of the participants had been in place for five years or less, and more than half of those were in revision. Of the 24 participants with an eighth-grade science curriculum of more than five years standing, 18 were revising it at the time of the assessment. For Australia and the United States, with less centralized educational systems, curriculum renewal varied by state and was generally an ongoing process.

1 Curriculum data are presented for the Syrian Arab Republic at the eighth grade, and for Yemen at the fourth grade, because these data are not dependent upon the countries' samples.

At the fourth grade, Exhibit 5.2 shows that of the 26 countries that participated in TIMSS 2003 at this level, all but 3 reported having national curricula in fourth-grade science. Similar to the eighth grade, fourth-grade science curricula in Australia and the United States were determined at the state level, and school boards in Belgium (Flemish) developed their own curricula based on officially defined final attainment levels. Among benchmarkers, Indiana, Ontario, and Quebec had system-wide curricula determined at the state or provincial level, respectively.

At the time of the TIMSS 2003 assessment, the official fourth-grade science curriculum had been in place for five years or less in 20 of the participants, and nearly half of those were in revision. Of the nine participating entities with a fourth-grade science curriculum of more than five years standing, five were revising it at the time of the assessment. As at the eighth grade, curriculum renewal in Australia and the United States varied by state and was generally an ongoing process.

Public examinations with consequences for individual students are another common feature of many countries' educational systems. Although public examinations can provide information of interest to national and regional policymakers, their main purpose is to make decisions about individual students, such as promotion from one grade to another, entry to a higher school system, or graduation from secondary school. Among all TIMSS 2003 participants, 39 countries and one benchmarking entity reported having public examinations in science at one or more grades. Grade 12 was the most prevalent, with 33 countries giving students public examinations in science at this level.

Exhibit 5.2: Intended Science Curriculum

Countries	National Curriculum	Year Curriculum Introduced	Curriculum Under Revision	Public Exams with Consequences for Individual Students	Grades Tested in Public Exams
Armenia	●	2000	○	●	10
Australia	○	Varies by state; generally ongoing process	●	●	12
Bahrain	●	2001	●	●	9,10,11,12
1 Belgium (Flemish)	○	1997	○	○	-
Botswana	●	1996	●	●	7,10,12
Bulgaria	●	1997	●	●	12
Chile	●	2002	●	●	12
Chinese Taipei	●	1997	●	●	9,12
Cyprus	●	1990	●	●	12
Egypt	●	2002	●	●	5,8,10,11
England	●	2000	○	●	10,11,12
Estonia	●	1997, revised 2002	●	●	9,12
Ghana	●	1987, revised 2001	○	●	9
Hong Kong, SAR	●	2000	○	●	Biology 11,13; Chemistry 11,13; Physics 11,13; Human Biology 11,13
Hungary	●	2000	○	●	12
Indonesia	●	1994	●	●	6,9,12
Iran, Islamic Rep. of	●	2002	○	●	5,8,11,12
Israel	●	1998	○	●	11,12
2 Italy	●	1979, revised 2002	○	●	5,8,13
Japan	●	2002	○	○	-
Jordan	●	1994	●	●	12
Korea, Rep. of	●	2002	○	●	9,12
Latvia	●	1997 and 2001	●	●	6,9,12
Lebanon	●	1999	●	○	-
Lithuania	●	1997, revised 2003	●	●	Biology 12; Chemistry 12; Physics 12; Geography 12
Macedonia, Rep. of	●	1994	○	●	12
Malaysia	●	1990	●	●	6,9,11,13
Moldova, Rep. of	●	2003-2004	○	●	9,11,12
Morocco	●	1992-1993	●	●	12
Netherlands	●	1998	●	●	10,11,12
New Zealand	●	1995	●	●	10,11,12
Norway	●	1997	○	○	-
Palestinian Nat'l Auth.	●	2002-2003	●	●	12
Philippines	●	2002	○	●	4,8
Romania	●	1999	●	●	12
Russian Federation	●	1998	●	●	By choice: Biology 9,11; Chemistry 9,11; Physics 9,11; Geography 9,11
Saudi Arabia	●	1999	●	●	12
Scotland	●	2000	○	●	10,11,12
Serbia	●	1984-1985	●	○	-
Singapore	●	2001	●	●	6,10,12
Slovak Republic	●	1999	●	○	-
Slovenia	●	1999 for sample of schools; 2003 for all schools	●	○	-
South Africa	●	2001 (introduced in 1998 for prior grades)	●	●	12
Sweden	●	1994, revised 2000	○	○	-
Syrian Arab Republic	●	1987 for Physics and Chemistry; 2003 for Biology	○	●	9
Tunisia	●	2000	●	●	9,12
United States	○	Varies by state; generally ongoing process	●	○	-
Benchmarking Participants					
Basque Country, Spain	●	1992	●	○	-
Indiana State, US	●	2000	○	○	-
Ontario Province, Can.	●	1998	○	●	3,6,9
Quebec Province, Can.	●	1987	●	○	-

● Country reported Yes for the particular option

○ Country reported No for the particular option

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

1 Belgium (Flemish): Although there is no national curriculum there are officially defined final attainment levels (comparable to educational standards); based on the final attainment levels, school boards develop their own curricula.

2 Italy: Beginning with the 2004-05 academic year, students in grade 5 will not be tested in public examinations.

A dash (–) indicates comparable data are not available.

Exhibit 5.2: Intended Science Curriculum

SCIENCE Grade 8

Countries	National Curriculum	Year Curriculum Introduced	Curriculum Under Revision	Public Exams with Consequences for Individual Students	Grades Tested in Public Exams
Armenia	●	2000	○	●	10
Australia	○	Varies by state; generally ongoing process	●	●	12
1 Belgium (Flemish)	○	2001-2002	○	○	-
Chinese Taipei	●	2002	●	●	9,12
Cyprus	●	1996	○	●	12
England	●	2000	○	●	10,11,12
Hong Kong, SAR	●	1996	●	●	Biology 11,13; Chemistry 11,13; Physics 11,13; Human Biology 11,13
Hungary	●	2000	○	●	12
Iran, Islamic Rep. of	●	1997	●	●	5,8,11,12
2 Italy	●	1985, revised 2002	●	●	5,8,13
Japan	●	2002	○	○	-
Latvia	●	2001	○	●	6,9,12
Lithuania	●	1997, revised 2003	●	●	Biology 12; Chemistry 12; Physics 12; Geography 12
Moldova, Rep. of	●	1999-2000	○	●	9,11,12
Morocco	●	2002-2003	○	●	12
Netherlands	●	1998	●	●	10,11,12
New Zealand	●	1995	●	●	10,11,12
Norway	●	1997	○	○	-
Philippines	●	2002-2003	●	○	-
Russian Federation	●	1998	●	●	By choice: Biology 9,11; Chemistry 9,11; Physics 9,11; Geography 9,11
Scotland	●	2000	○	●	10,11,12
Singapore	●	2002	●	●	6,10,12
Slovenia	●	1999 for sample of schools; 2003 for all schools	●	○	-
Tunisia	●	2000	●	●	9,12
United States	○	Varies by state; generally ongoing process	●	○	-
Yemen	●	2000-2001	●	●	9,12
Benchmarking Participants					
Indiana State, US	●	2000	○	○	-
Ontario Province, Can.	●	1998	○	●	3,6,9
Quebec Province, Can.	●	2001	○	○	-

● Country reported Yes for the particular option

○ Country reported No for the particular option

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

1 Belgium (Flemish): Although there is no national curriculum there are officially defined final attainment levels (comparable to educational standards); based on the final attainment levels, school boards develop their own curricula.

2 Italy: Beginning with the 2004-05 academic year, students in grade 5 will not be tested in public examinations.

A dash (–) indicates comparable data are not available.

How Do Countries Support and Monitor Curriculum Implementation?

Education systems use different ways to achieve the best match between the intended and the implemented curriculum. The use of public examinations as a mechanism to support and monitor implementation of the intended curriculum is prevalent among many countries, as noted above. Another way to help ensure alignment is to develop instructional materials, such as textbooks, instructional guides, and ministry notes, tailored to the curriculum. In addition, countries can also monitor curriculum implementation by means of national assessments based on student samples, and by systems of school inspection or audit. The different methods used by the TIMSS 2003 countries are shown in Exhibit 5.3, first for countries that participated at the eighth grade and then for those at the fourth grade.

Of the methods for supporting and monitoring curriculum implementation shown in Exhibit 5.3, at the eighth grade, 11 participants reported using all 7, and an additional 25 used 5 or 6. The most widely used methods were instructional or pedagogical guides (47 participants) and ministry notes and directives (40 participants). Also commonly used were a system of school inspection or audit (38 participants), mandated or recommended textbooks (38 participants), curricular evaluation during or after implementation (35 participants), and the use of specifically developed or recommended instructional activities (33 participants). The least widely used method was national assessments based on student samples (21 participants).

At the fourth grade, three participants reported using all seven methods shown in Exhibit 5.3 to support and monitor curriculum implementation, and 21 participants used five or six. The most widely used methods were instructional or pedagogical guides (28 participants), ministry notes and directives (23 participants), and specifically developed or recommended instructional activities (23 participants). The use of curriculum evaluation during or after implementation as a means of monitoring the fourth-grade science curriculum was reported

by 22 participants. A system of school inspection or audit was used by 21 participants and mandated or recommended textbooks also by 21 participants. Similar to the eighth grade, the least widely used method at the fourth grade was national assessment based on student samples (10 participants).

An additional method countries often use to support curriculum implementation is to provide science teachers with specific preparation in how to teach the intended curriculum as part of their pre-service and/or in-service education. These data are given in Exhibit 6.5 of the next chapter.

Exhibit 5.3: Methods Used to Support or Monitor Implementation of the Intended Science Curriculum

Countries	Mandated or Recommended Textbook(s)	Instructional or Pedagogical Guide	Ministry Notes and Directives	Curriculum Evaluation During or After Implementation	Specifically Developed or Recommended Instructional Activities	National Assessments Based on Student Samples	A System of School Inspection or Audit
Armenia	●	●	●	○	●	○	○
Australia	○	●	●	●	●	○	○
Bahrain	●	●	●	●	●	○	○
Belgium (Flemish)	○	●	●	●	●	○	●
Botswana	●	●	●	●	●	○	●
Bulgaria	●	●	●	○	○	○	●
Chile	●	●	●	●	●	●	○
Chinese Taipei	●	●	●	○	●	○	●
Cyprus	●	●	●	○	○	○	●
Egypt	●	●	●	●	●	●	●
England	○	●	●	●	●	○	●
Estonia	●	○	●	●	●	●	●
Ghana	●	●	○	●	●	●	●
Hong Kong, SAR	●	●	●	○	●	○	●
Hungary	●	●	●	●	○	○	○
Indonesia	●	●	●	●	●	●	●
Iran, Islamic Rep. of	●	●	●	●	●	○	●
Israel	●	●	●	●	●	●	●
Italy	○	●	●	●	○	●	●
Japan	●	●	●	●	●	●	●
Jordan	●	●	●	●	●	●	●
Korea, Rep. of	●	●	●	○	○	●	●
Latvia	●	○	●	●	●	○	●
Lebanon	○	●	●	●	●	○	●
Lithuania	●	●	●	●	●	●	●
Macedonia, Rep. of	●	●	○	○	●	●	●
Malaysia	●	●	●	●	●	●	●
Moldova, Rep. of	●	●	●	●	●	●	●
Morocco	●	●	●	○	●	○	●
Netherlands	○	●	●	●	○	○	●
New Zealand	○	○	○	●	○	○	●
Norway	●	●	○	●	●	●	○
Palestinian Nat'l Auth.	○	●	●	●	●	●	●
Philippines	●	●	●	●	●	●	●
Romania	●	●	●	○	●	○	●
Russian Federation	●	●	●	●	●	○	●
Saudi Arabia	●	●	●	●	●	○	●
Scotland	○	●	○	●	●	●	●
Serbia	●	●	●	●	●	●	●
Singapore	●	●	○	○	○	○	○
Slovak Republic	●	●	○	○	○	○	●
Slovenia	●	●	●	●	●	○	○
South Africa	○	●	●	○	○	○	○
Sweden	○	●	○	○	○	○	●
Syrian Arab Republic	-	-	-	-	-	-	-
Tunisia	●	●	●	○	○	○	●
United States	●	●	○	●	●	●	○
Benchmarking Participants							
Basque Country, Spain	○	●	●	○	○	●	●
Indiana State, US	●	●	○	○	●	○	●
Ontario Province, Can.	●	●	●	●	●	○	○
Quebec Province, Can.	●	●	●	○	●	○	○

● Country reported Yes for the particular option

○ Country reported No for the particular option

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

A dash (–) indicates comparable data are not available.

Exhibit 5.3: Methods Used to Support or Monitor Implementation of the Intended Science Curriculum

Countries	Mandated or Recommended Textbook(s)	Instructional or Pedagogical Guide	Ministry Notes and Directives	Curriculum Evaluation During or After Implementation	Specifically Developed or Recommended Instructional Activities	National Assessments Based on Student Samples	A System of School Inspection or Audit
Armenia	●	●	●	●	●	○	○
Australia	○	●	●	●	●	●	●
Belgium (Flemish)	○	●	●	●	●	○	●
Chinese Taipei	●	●	●	○	●	○	●
Cyprus	●	●	●	●	●	○	●
England	○	●	●	●	●	○	●
Hong Kong, SAR	●	●	●	○	●	○	●
Hungary	○	●	●	●	○	○	○
Iran, Islamic Rep. of	●	●	●	●	●	○	●
Italy	○	●	●	●	○	●	●
Japan	●	●	●	●	●	●	●
Latvia	●	○	●	●	●	○	●
Lithuania	●	●	●	●	○	●	●
Moldova, Rep. of	●	●	●	●	●	●	●
Morocco	●	●	●	○	●	○	●
Netherlands	○	●	○	○	○	●	○
New Zealand	○	●	○	●	●	○	●
Norway	●	●	○	●	○	●	○
Philippines	●	●	●	●	●	●	●
Russian Federation	●	●	●	●	●	○	●
Scotland	○	●	○	●	●	●	●
Singapore	●	●	●	●	●	○	●
Slovenia	●	●	●	●	●	○	○
Tunisia	●	●	●	○	●	○	●
United States	●	●	○	●	●	●	○
Yemen	●	●	●	●	○	○	●
Benchmarking Participants							
Indiana State, US	●	●	○	○	●	○	●
Ontario Province, Can.	●	●	●	●	●	○	○
Quebec Province, Can.	●	●	●	●	●	○	○

● Country reported Yes for the particular option

○ Country reported No for the particular option

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

How Much Instructional Time is Intended for Science?

Many countries designate in their intended curriculum the percentage of total instructional time that should be devoted to science and other subjects at different grade levels. The percentage of instructional time designated for science in the intended curriculum for grades 2, 4, 6, and 8 is shown in Exhibit 5.4 for all TIMSS 2003 participants.[2] These data provide a good estimate of students' intended instructional time for science across the primary and middle school years. The general pattern across countries shows that the percentage of time increases or remains the same from grade 2 to grade 4, from grade 4 to grade 6, and from grade 6 to grade 8, with the largest increase usually between grades 6 and 8. Interestingly, the reverse pattern holds for mathematics, with proportionally less instructional time designated at the higher than at the lower grades.[3] Where decreases occurred in the percentage of instructional time designated for science, they generally were between grades 2 and 4. Not all countries conformed to this general pattern, however. The percentage of total instructional time specified for science ranged from 4 to 20 percent at second grade, from 4 to 28 percent at fourth grade, from 5 to 28 percent at sixth grade, and from 7 to 32 percent at eighth grade. Schools' and teachers' reports of the percentage of instructional time actually devoted to science at grades 4 and 8, shown in Exhibit 7.3, generally correspond with the intended percentages reported in Exhibit 5.4, although slightly more so at eighth grade than at fourth grade.

2 Some of the countries that teach science as separate subjects at eighth grade provided the percentages individually for each subject, rather than as a total.

3 Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., and Chrostowski, S.J., (2004), *TIMSS 2003 International Mathematics Report: Findings from IEA's Trends in International Mathematics and Science Study at the Eighth and Fourth Grades,* Chestnut Hill, MA: Boston College.

Exhibit 5.4: Percentage of Total Instructional Time Intended for Science

Countries	Grade 2	Grade 4	Grade 6	Grade 8
Armenia	○	1 hour per week	5 hours per week	Biology, Chemistry, Physics, Earth Science 2 hours each per week
Australia	○	○	○	○
Bahrain	-	10	10	13
Belgium (Flemish)	5	10	15	○
Botswana	12	8	10	13
Bulgaria	5	6	12	Biology 5.8; Chemistry 5.8; Physics 5.8; Earth Science 5.8
Chile	8	10	10	7
Chinese Taipei	12	12	12	Physics/Chemistry 12
Cyprus	5	5	5	Chemistry 2.8; Physics 5.7; Earth Science 5.7
Egypt	-	9	11	11
England	○	○	○	○
Estonia	-	9	8	Biology 5.2; Chemistry 6.25; Physics 6.25; Geography 5.2
Ghana	-	13	13	10
Hong Kong, SAR	5	5	5	10-15
Hungary	5	9	8	Biology 5.4; Chemistry 5.5; Physics 5.4; Earth Science 5.4
Indonesia	-	20	20	Biology 7.5; Physics 7.5
Iran, Islamic Rep. of	11	11	14.3	14.3
Israel	-	10	-	10.3
Italy	10	15	20	20
Japan	○	10	10	11
Jordan	10	12	12	15
Korea, Rep. of	-	10.3	9.3	11.8
Latvia	8	7	6	17
Lebanon	-	15	15	Life and Earth Sciences 5; Chemistry 5; Physics 5
Lithuania	20	20	10	Biology 4; Chemistry 8; Physics 8; Geography 8
Macedonia, Rep. of	-	10	6.5	Biology 7.6; Chemistry 7.6; Physics 7.6; Geography 7.6
Malaysia	-	13	13	13
Moldova, Rep. of	4.3	4	14	25
Morocco	6	6	6	14
Netherlands	○	○	○	Biology 6; Physics/Chemistry 6; Geography 3
New Zealand	○	○	○	○
Norway	5	5	8	10
Palestinian Nat'l Auth.	13	10	14	Environment and Hygiene 5.6; Technology and Applied Sciences 5.6
Philippines	○	-	-	Biology 20

○ Country reported that the national curriculum does not specify the percentage of total instructional time intended for science

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

A dash (–) indicates comparable data are not available.

Exhibit 5.4: Percentage of Total Instructional Time Intended for Science

Countries	Grade 2	Grade 4	Grade 6	Grade 8
Romania	-	5-9	12-14	Biology 3-7; Chemistry 7; Physics 7; Geography 7
Russian Federation	5	5	14	Biology 6.25; Chemistry 6.25; Physics 6.25; Geography 6.25
Saudi Arabia	7	7	10	12
Scotland	5	5	5	10
Serbia	-	10	24	Biology 8; Chemistry 8; Physics 8; Geography 8
Singapore	-	8	10	14
Slovak Republic	-	Biology and Env. Science 7.1; Chemistry 7.1; Physics 7.1; Earth Science 7.1	Biology and Env. Science 7.1; Chemistry 7.1; Physics 7.1; Earth Science 7.1	Biology and Env. Science 7.1; Chemistry 7.1; Physics 7.1; Earth Science 7.1
Slovenia	9	13	6	Biology 5; Chemistry 7; Physics 7
South Africa	-	15	15	15
[1] Sweden	-	12	12	12
Syrian Arab Republic	-	15	15	20
Tunisia	10	5	7	8
United States	○	○	○	○
Yemen	6.8	-	-	-
Benchmarking Participants				
Basque Country, Spain	-	5	5	6.6
Indiana State, US	150 min/wk	180 min/wk	180 min/wk	200 min/wk
Ontario Province, Can.	○	○	○	○
Quebec Province, Can.	○	-	-	11

○ Country reported that the national curriculum does not specify the percentage of total instructional time intended for science

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

A dash (–) indicates comparable data are not available.

1 Sweden: Figure shown represents an average across the nine years of compulsory school.

Do Countries Differentiate the Intended Science Curriculum for Students with Different Levels of Ability?

The challenge of maximizing opportunity to learn for students with widely varying abilities is met differently in different countries. Exhibit 5.5 indicates how countries addressed this issue in organizing the intended science curriculum, first for countries that participated at the eighth grade and then for those at the fourth grade.

The most common approach at the eighth grade, reported by 39 participants, was to have the same intended curriculum for all students with no grouping of students. Nine countries reported having one curriculum for all students, but at different difficulty levels for groups of students with different ability levels. Four countries – Belgium (Flemish), the Netherlands, the Russian Federation, and Singapore – had different curricula for different groups of students according to their ability level.

At the fourth grade, all participants reported having just one science curriculum for all students, and in most cases with no grouping by ability level. Five countries, Australia, England, New Zealand, Scotland, and the United States, had just one curriculum for all students, but provide different levels of difficulty for students of differing ability levels.

Exhibit 5.5: The Way the Intended Science Curriculum Addresses the Issue of Students with Different Levels of Ability

Countries	One Curriculum for All Students with No Grouping	One Curriculum for All Students, but Different Groups of Students Have Different Difficulty Levels	Different Curricula for Different Groups of Students According to Ability Level
Armenia	●	○	○
Australia	○	●	○
Bahrain	●	○	○
Belgium (Flemish)	○	●	○
Botswana	●	○	○
Bulgaria	●	○	○
Chile	●	○	○
Chinese Taipei	●	○	○
Cyprus	●	○	○
Egypt	●	○	○
England	○	●	○
Estonia	●	○	○
Ghana	●	○	○
Hong Kong, SAR	○	●	○
Hungary	●	○	○
Indonesia	●	○	○
Iran, Islamic Rep. of	●	○	○
Israel	○	●	○
Italy	●	○	○
Japan	●	○	○
Jordan	●	○	○
Korea, Rep. of	●	○	○
Latvia	●	○	○
Lebanon	●	○	○
Lithuania	●	○	○
Macedonia, Rep. of	●	○	○
Malaysia	●	○	○
Moldova, Rep. of	●	○	○
Morocco	●	○	○
Netherlands	○	○	●
New Zealand	○	●	○
Norway	●	○	○
Palestinian Nat'l Auth.	●	○	○
Philippines	○	●	○
Romania	●	○	○
Russian Federation	●	○	○
Saudi Arabia	●	○	○
Scotland	○	●	○
Serbia	○	●	○
Singapore	○	○	●
Slovak Republic	●	○	○
Slovenia	●	○	○
South Africa	●	○	○
Sweden	●	○	○
Syrian Arab Republic	●	○	○
Tunisia	●	○	○
United States	○	●	○
Benchmarking Participants			
Basque Country, Spain	●	○	○
Indiana State, US	●	○	○
Ontario Province, Can.	●	○	○
Quebec Province, Can.	●	○	○

● Country reported Yes for the particular option

○ Country reported No for the particular option

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

Exhibit 5.5: The Way the Intended Science Curriculum Addresses the Issue of Students with Different Levels of Ability

Countries	One Curriculum for All Students with No Grouping	One Curriculum for All Students, but Different Groups of Students Have Different Difficulty Levels	Different Curricula for Different Groups of Students According to Ability Level
Armenia	●	○	○
Australia	○	●	○
Belgium (Flemish)	●	○	○
Chinese Taipei	●	○	○
Cyprus	●	○	○
England	○	●	○
Hong Kong, SAR	●	○	○
Hungary	●	○	○
Iran, Islamic Rep. of	●	○	○
Italy	●	○	○
Japan	●	○	○
Latvia	●	○	○
Lithuania	●	○	○
Moldova, Rep. of	●	○	○
Morocco	●	○	○
Netherlands	●	○	○
New Zealand	○	●	○
Norway	●	○	○
Philippines	●	○	○
Russian Federation	●	○	○
Scotland	○	●	○
Singapore	●	○	○
Slovenia	●	○	○
Tunisia	●	○	○
United States	○	●	○
Yemen	●	○	○
Benchmarking Participants			
Indiana State, US	●	○	○
Ontario Province, Can.	●	○	○
Quebec Province, Can.	●	○	○

● Country reported Yes for the particular option

○ Country reported No for the particular option

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

What Approaches and Processes Do Countries Emphasize in their Intended Science Curriculum?

Exhibit 5.6 indicates the relative emphasis given to various aspects of science instruction in the intended curriculum of participating countries, for both eighth and fourth grade. At the eighth grade, "a lot of emphasis" was most commonly placed on understanding science concepts (34 participants) and knowing basic science facts (35 participants). Considerable emphasis also was placed on writing explanations about what was observed and why it happened (20 participants).

Less emphasis was placed internationally on experimental work, with conducting experiments or investigations emphasized a lot in the curricula of 16 participants, formulating hypotheses or predictions to be tested in the curricula of 12 participants, and designing and planning experiments or investigations in the curricula of 9 participants.

Understanding human impact on the environment was given a lot of emphasis in the intended eighth-grade curriculum of 16 participants, and learning about technology and its impact on society in that of 9 participants. Learning about the nature of science and inquiry received a lot of emphasis in 10 participating entities.

Relative to the other approaches and processes, participants reported placing less emphasis on integrating science with other subjects and incorporating the experiences of different ethnic/cultural groups. Only four participants (Botswana, Israel, Italy, and South Africa) reported placing a lot of emphasis on integrating science, and just two countries – South Africa and Sweden – reported placing a lot of emphasis on the multicultural approach in the intended curriculum.

In the intended science curriculum at the fourth grade, most emphasis was placed on understanding science concepts (15 participants emphasized a lot), knowing basic science facts (13 participants), and writing explanations about what was observed and why it happened (13 participants). Conducting experiments or investigations was given a lot of emphasis in 11 participating entities. Designing and

Exhibit 5.6: Emphasis on Approaches and Processes in the Intended Science Curriculum

SCIENCE Grade 8

Countries	Knowing Basic Science Facts	Understanding Science Concepts	Writing Explanations About What Was Observed and Why it Happened	Formulating Hypotheses or Predictions To Be Tested	Designing and Planning Experiments or Investigations	Conducting Experiments or Investigations
Armenia	●	◉	◉	⊙	⊙	⊙
Australia	●	●	●	◉	◉	●
Bahrain	●	●	●	●	◉	●
Belgium (Flemish)	●	◉	◉	⊙	⊙	⊙
Botswana	●	●	⊙	⊙	◉	◉
Bulgaria	◉	⊙	◉	⊙	◉	⊙
Chile	●	●	◉	◉	⊙	●
Chinese Taipei	●	●	◉	⊙	⊙	⊙
Cyprus	●	◉	◉	◉	⊙	◉
Egypt	●	●	●	●	●	●
England	●	●	◉	◉	●	●
Estonia	●	◉	◉	⊙	⊙	◉
Ghana	●	●	●	◉	◉	◉
Hong Kong, SAR	●	●	◉	◉	◉	◉
Hungary	●	◉	⊙	⊙	⊙	⊙
Indonesia	◉	◉	◉	⊙	◉	◉
Iran, Islamic Rep. of	◉	◉	●	◉	◉	◉
Israel	◉	●	◉	◉	◉	◉
Italy	●	●	●	●	●	●
Japan	●	●	●	●	●	●
Jordan	●	●	◉	◉	⊙	●
Korea, Rep. of	●	●	●	◉	◉	◉
Latvia	◉	◉	◉	⊙	⊙	◉
Lebanon	◉	◉	◉	⊙	◉	◉
Lithuania	●	●	◉	◉	◉	◉
Macedonia, Rep. of	◉	●	⊙	⊙	⊙	◉
Malaysia	●	●	◉	◉	◉	◉
Moldova, Rep. of	●	◉	◉	◉	◉	◉
Morocco	◉	●	◉	◉	◉	⊙
Netherlands	◉	◉	◉	◉	◉	◉
New Zealand	◉	●	●	●	●	●
Norway	◉	◉	◉	⊙	◉	●
Palestinian Nat'l Auth.	◉	●	◉	⊙	◉	◉
Philippines	◉	●	●	●	◉	◉
Romania	●	●	◉	◉	⊙	◉
Russian Federation	●	●	◉	⊙	⊙	◉
Saudi Arabia	●	●	●	◉	◉	●
Scotland	●	●	●	◉	◉	◉
Serbia	●	●	⊙	⊙	⊙	⊙
Singapore	●	●	●	⊙	◉	●
Slovak Republic	●	●	●	●	◉	◉
Slovenia	⊙	●	●	⊙	◉	◉
South Africa	◉	◉	⊙	⊙	◉	◉
Sweden	●	●	◉	●	●	●
Syrian Arab Republic	●	◉	●	⊙	○	○
Tunisia	◉	◉	◉	◉	⊙	⊙
United States	●	●	●	●	●	●
Benchmarking Participants						
Basque Country, Spain	●	●	◉	⊙	⊙	⊙
Indiana State, US	●	●	●	●	●	◉
Ontario Province, Can.	◉	●	●	●	●	●
Quebec Province, Can.	●	●	●	●	◉	●

● A Lot of Emphasis

◉ Some Emphasis

⊙ Very Little Emphasis

○ No Emphasis

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

Exhibit 5.6: Emphasis on Approaches and Processes in the Intended Science Curriculum

SCIENCE Grade 8

Countries	Learning About the Nature of Science and Inquiry	Integrating Science with Other Subjects	Learning About Technology and its Impact on Society	Understanding Human Impact on the Environment	Incorporating the Experiences of Different Ethnic/Cultural Groups
Armenia	◉	○	⊙	◉	⊙
Australia	◉	⊙	◉	◉	⊙
Bahrain	◉	◉	●	⊙	○
Belgium (Flemish)	⊙	⊙	◉	◉	○
Botswana	◉	●	◉	◉	○
Bulgaria	●	◉	⊙	⊙	○
Chile	⊙	⊙	●	●	○
Chinese Taipei	⊙	⊙	⊙	●	○
Cyprus	⊙	○	◉	⊙	○
Egypt	●	◉	◉	●	⊙
England	◉	⊙	◉	◉	⊙
Estonia	◉	◉	⊙	◉	⊙
Ghana	●	◉	⊙	◉	⊙
Hong Kong, SAR	◉	◉	◉	◉	⊙
Hungary	⊙	○	⊙	⊙	○
Indonesia	◉	⊙	◉	●	○
Iran, Islamic Rep. of	◉	◉	◉	◉	○
Israel	●	●	◉	●	⊙
Italy	◉	●	●	●	○
Japan	●	◉	◉	◉	○
Jordan	◉	⊙	◉	◉	○
Korea, Rep. of	⊙	⊙	◉	◉	○
Latvia	◉	◉	◉	◉	○
Lebanon	●	⊙	◉	⊙	⊙
Lithuania	◉	◉	◉	●	⊙
Macedonia, Rep. of	⊙	◉	⊙	◉	⊙
Malaysia	◉	⊙	⊙	◉	⊙
Moldova, Rep. of	◉	◉	●	◉	○
Morocco	⊙	◉	◉	◉	◉
Netherlands	⊙	◉	●	●	⊙
New Zealand	●	◉	●	◉	◉
Norway	◉	⊙	◉	●	⊙
Palestinian Nat'l Auth.	◉	⊙	◉	◉	⊙
Philippines	◉	⊙	◉	●	⊙
Romania	○	⊙	◉	◉	○
Russian Federation	⊙	◉	◉	◉	○
Saudi Arabia	◉	◉	◉	●	○
Scotland	⊙	◉	◉	◉	⊙
Serbia	⊙	◉	⊙	⊙	⊙
Singapore	⊙	◉	⊙	⊙	◉
Slovak Republic	●	◉	◉	●	◉
Slovenia	⊙	◉	◉	⊙	⊙
South Africa	◉	●	●	◉	●
Sweden	●	⊙	⊙	●	●
Syrian Arab Republic	⊙	○	○	⊙	⊙
Tunisia	⊙	○	⊙	⊙	○
United States	◉	⊙	⊙	●	⊙
Benchmarking Participants					
Basque Country, Spain	⊙	◉	⊙	◉	⊙
Indiana State, US	●	◉	●	●	⊙
Ontario Province, Can.	⊙	◉	●	●	◉
Quebec Province, Can.	◉	⊙	◉	◉	○

● A Lot of Emphasis

◉ Some Emphasis

⊙ Very Little Emphasis

○ No Emphasis

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

Exhibit 5.6: Emphasis on Approaches and Processes in the Intended Science Curriculum

Countries	Knowing Basic Science Facts	Understanding Science Concepts	Writing Explanations About What Was Observed and Why it Happened	Designing and Planning Experiments or Investigations	Conducting Experiments or Investigations	Integrating Science with Other Subjects
Armenia	●	●	◉	⊙	⊙	◉
Australia	◉	●	◉	◉	●	⊙
Belgium (Flemish)	●	⊙	○	○	⊙	⊙
Chinese Taipei	●	◉	◉	⊙	◉	⊙
Cyprus	◉	●	●	○	●	◉
England	●	●	◉	●	●	◉
Hong Kong, SAR	◉	◉	⊙	⊙	⊙	◉
Hungary	●	⊙	⊙	⊙	⊙	⊙
Iran, Islamic Rep. of	◉	◉	●	⊙	◉	◉
Italy	●	●	●	●	●	●
Japan	●	●	●	●	●	◉
Latvia	◉	⊙	◉	⊙	⊙	⊙
Lithuania	◉	◉	◉	◉	◉	◉
Moldova, Rep. of	●	●	●	◉	●	⊙
Morocco	◉	●	●	◉	⊙	⊙
Netherlands	⊙	⊙	○	⊙	○	○
New Zealand	◉	◉	●	◉	●	●
Norway	◉	◉	◉	⊙	●	◉
Philippines	●	●	⊙	⊙	⊙	⊙
Russian Federation	◉	◉	⊙	⊙	◉	●
Scotland	●	●	◉	●	●	◉
Singapore	●	●	●	◉	◉	◉
Slovenia	⊙	●	●	◉	◉	◉
Tunisia	◉	◉	◉	⊙	⊙	○
United States	●	●	●	◉	⊙	⊙
Yemen	◉	◉	⊙	⊙	○	⊙
Benchmarking Participants						
Indiana State, US	●	●	●	◉	◉	◉
Ontario Province, Can.	◉	●	●	◉	●	◉
Quebec Province, Can.	◉	◉	●	●	●	●

● A Lot of Emphasis

◉ Some Emphasis

⊙ Very Little Emphasis

○ No Emphasis

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

Exhibit 5.6: Emphasis on Approaches and Processes in the Intended Science Curriculum

Countries	Learning About Technology and its Impact on Society	Understanding Human Impact on the Environment	Incorporating the Experiences of Different Ethnic/Cultural Groups
Armenia	⊙	◎	◎
Australia	⊙	◎	⊙
Belgium (Flemish)	⊙	●	○
Chinese Taipei	⊙	◎	⊙
Cyprus	⊙	◎	○
England	◎	⊙	⊙
Hong Kong, SAR	◎	◎	⊙
Hungary	○	⊙	○
Iran, Islamic Rep. of	◎	◎	⊙
Italy	◎	●	◎
Japan	⊙	⊙	○
Latvia	⊙	◎	○
Lithuania	⊙	◎	⊙
Moldova, Rep. of	◎	◎	○
Morocco	⊙	◎	◎
Netherlands	◎	◎	○
New Zealand	◎	●	◎
Norway	⊙	◎	⊙
Philippines	⊙	⊙	⊙
Russian Federation	○	⊙	○
Scotland	◎	◎	⊙
Singapore	⊙	⊙	◎
Slovenia	◎	⊙	⊙
Tunisia	○	⊙	○
United States	⊙	⊙	⊙
Yemen	⊙	⊙	⊙
Benchmarking Participants			
Indiana State, US	●	●	⊙
Ontario Province, Can.	●	●	◎
Quebec Province, Can.	●	◎	○

● A Lot of Emphasis

◎ Some Emphasis

⊙ Very Little Emphasis

○ No Emphasis

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

planning experiments or investigations, integrating science with other subjects, understanding human impact on the environment, and learning about technology and its impact on the environment were among the approaches receiving less emphasis in the intended curriculum, while incorporating the experiences of different ethnic/cultural groups was emphasized least in the fourth-grade science curriculum.

Are the TIMSS Science Topics Included In the Intended Curriculum?

The ability of policymakers to make sound judgments about relative strengths and weaknesses of science education in their systems depends on achievement measures being based, as closely as possible, on what students in their systems have actually been taught. *The TIMSS Assessment Frameworks and Specifications: 2003* served as the basis for the TIMSS 2003 science assessment.[4] It delineates the science content and skills to be assessed at both the eighth and fourth grades, and represents a consensus among the countries participating in TIMSS 2003 about the science that students at these grades should be expected to have learned. Content and topic areas are elaborated in the frameworks, with each topic area presented as a comprehensive list of objectives specific to the target grades (eighth or fourth grades) covered in a majority of participating countries. However, the frameworks do not consist solely of content and behaviors included in the intended curricula of most participating countries. The aim was to ensure that goals of science education regarded as important in a significant number of countries be included. Hence, not all topics included in the TIMSS 2003 assessment are in all participating countries' intended curriculum, and consequently the curricula of some countries align more closely than others with the TIMSS frameworks.[5]

National Research Coordinators were asked to indicate whether each of the TIMSS 2003 science topics was included in their countries' intended curricula through the target grade (eighth or fourth grade),

4 Mullis, I.V.S., Martin, M.O., Smith, T.A., Garden, R.A., Gregory, K.D., Gonzalez, E.J., Chrostowski, S.J., and O'Connor, K.M. (2003), *TIMSS Assessment Frameworks and Specifications 2003 (2nd ed.),* Chestnut Hill, MA: Boston College.

5 For a full description of the TIMSS 2003 test development effort, please see Smith Neidorf, T.A. and Garden, R. (2004), "Developing the TIMSS 2003 Mathematics and Science Assessment and Scoring Guides" in M.O. Martin, I.V.S. Mullis, and S.J. Chrostowski (eds.), *TIMSS 2003 Technical Report,* Chestnut Hill, MA: Boston College.

and if so, whether the topics were intended to be taught to "all or almost all students" or "only the more able students."

Exhibit 5.7 shows that, for most countries, a great deal of the science content addressed by the TIMSS 2003 assessment was included in their intended curricula. On average, across participants at the eighth grade, 71 percent of the assessment topics were intended for all or almost all students, and a further 4 percent for only the more able students. In only eight countries were less than half of the topics included in the eighth-grade curriculum: Belgium (Flemish), Botswana, Cyprus, Indonesia, Lebanon, Morocco, South Africa, and Tunisia. Coverage of the TIMSS science topics was particularly sparse in South Africa and Tunisia, with just 16 and 7 percent of the topics, respectively, in the intended curriculum for all or almost all students.

It is noteworthy that in most countries, those topics included in the curriculum were intended for all students. Only in Hong Kong SAR, New Zealand, Scotland, South Africa, Sweden, the Basque Country, and Quebec were more than 10 percent of science topics intended only for the more able students.

Each of the five content areas in the TIMSS eighth-grade science assessment – life science, chemistry, physics, earth science, and environmental science – was included in the intended curriculum in about equal proportions (65-75%), on average. In life science, 73 percent of the topics, on average, were included in participants' intended curriculum for all or almost all students. At least 10 of the 12 life science topics were included in the curriculum of about half of the participants (25). Participants with relatively low coverage (no more than half of the 12 topics) included Botswana, Bulgaria, Cyprus, Indonesia, Iran, Lebanon, Morocco, Slovenia, Tunisia, and Quebec.

Chemistry had fewer topics than life science (8 vs. 12) but a proportionally similar level of inclusion in the intended curriculum – 70 percent of topics, on average. Ten participants included all eight chemistry topics in their curricula, and a further 13 participants included seven of the eight topics. None of the chemistry topics were

included in the intended curriculum in Belgium (Flemish), Indonesia, and Tunisia.

Of the physics topics in the TIMSS assessment, three-fourths, on average, were included in the intended curricula of the participating countries and benchmarking entities for all or almost all students. All 10 physics topics were in the curricula of 17 participants, and 9 of the 10 in that of a further 5 participants. Similar to chemistry, none of the physics topics were included in the curricula of Belgium (Flemish) or Tunisia.

Earth science had, by a small margin, the fewest topics in the participants' intended curricula – 66 percent, on average. All 11 earth science topics were included in the curricula of 10 of the participating entities, and a further 8 participants had at least 10 of the 11 topics in their curricula. Fewer than half of the 11 topics were intended to be taught in Belgium (Flemish), Botswana, Chile, Chinese Taipei, Cyprus, Indonesia, Iran, Korea, Malaysia, Morocco, South Africa, and Tunisia.

Environmental science had just three topics in the assessment, and about two of the three, on average, were included in the participants' curricula for most students. About half of the participants included all three topics in their intended curriculum. In contrast, seven participants – Botswana, Chinese Taipei, Cyprus, Iran, Korea, Lebanon, and Tunisia – included no environmental science topics in their intended curricula.

Unlike mathematics, where the relationship between inclusion in the intended curriculum and student achievement was moderately positive,[6] in science this relationship was not as straightforward. The six highest performing countries in science, with the exception of Korea, had relatively high percentages (about 70%) of the science topics in their intended curricula, and there were several examples of lower-performing countries with few topics in their curricula – Botswana, Indonesia, Lebanon, South Africa, and Tunisia. However, although among the top-performing countries only Korea and Hong Kong, SAR had less than 70 percent of the topics in their curricula, there were some low-performing countries (such as Ghana and the Philippines) with many

6 Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., and Chrostowski, S.J., (2004), *TIMSS 2003 International Mathematics Report: Findings from IEA's Trends in International Mathematics and Science Study at the Eighth and Fourth Grades,* Chestnut Hill, MA: Boston College.

topics in their intended curricula. Belgium (Flemish) is unusual in that it had low coverage of the TIMSS science topics in its intended curriculum (just 23%) but still performed above the international mean. It appears that having at least moderate coverage of the science topics is a pre-requisite for high performance, but that high coverage in the intended curriculum does not of itself lead to high student achievement.

At fourth grade, Exhibit 5.7 shows that internationally, on average, 56 percent of the TIMSS 2003 science topics were included in the intended curricula for all or almost all students, and a further 4 percent for only the more able students. More than 70 percent of the science topics were included in the intended curriculum for all or almost all students in Armenia, England, Lithuania, Italy, Moldova, Norway, the United States, and Ontario.

At the fourth grade even more than at the eighth, those topics that were included in the curriculum were intended for all students. Only Armenia, Belgium (Flemish), Cyprus, Morocco, New Zealand, Scotland, and Quebec had any science topics intended only for the more able students.

Life science, with 10 topics, had the highest percentage of topics included in participants' intended curricula at the fourth grade (60% for most students and 7% for the top track only). Eleven participants had 8 or more of the 10 topics included. However, there were also eleven participants with no more than half of the life science topics included in their intended curricula at this grade level.

Physical science, which at the fourth grade incorporates topics from both physics and chemistry, was next in terms of inclusion in the intended curriculum, with 57 percent of its topics, on average, intended for most students and a further 4 percent for the top track only. Almost one-third of the participants included 10 or more of the 13 physical science topics in their intended curricula for most students. About the same proportion, however, included no more than half of the topics, mostly the same participants with low levels of inclusion overall.

Exhibit 5.7: Summary of TIMSS Science Topics in the Intended Curriculum

SCIENCE Grade 8

Countries	Percentage of TIMSS Science Topics Intended to be Taught Up to and Including Eighth Grade*								
	Overall (44 topics)			Life Science (12 topics)			Chemistry (8 topics)		
	Topics for All or Almost All Students	Topics for Only the More Able Students (top track)	Not Included in the Curriculum Through Grade 8	Topics for All or Almost All Students	Topics for Only the More Able Students (top track)	Not Included in the Curriculum Through Grade 8	Topics for All or Almost All Students	Topics for Only the More Able Students (top track)	Not Included in the Curriculum Through Grade 8
Armenia	91	5	5	67	17	17	100	0	0
Australia	55	0	45	58	0	42	50	0	50
Bahrain	91	0	9	100	0	0	88	0	13
Belgium (Flemish)	23	7	70	67	17	17	0	0	100
Botswana	30	0	70	50	0	50	13	0	88
Bulgaria	75	0	25	33	0	67	88	0	13
Chile	64	0	36	92	0	8	75	0	25
Chinese Taipei	70	0	30	100	0	0	88	0	13
Cyprus	23	2	75	8	8	83	38	0	63
Egypt	86	0	14	83	0	17	100	0	0
England	84	0	16	92	0	8	88	0	13
Estonia	100	0	0	100	0	0	100	0	0
Ghana	95	0	5	100	0	0	88	0	13
Hong Kong, SAR	64	16	20	67	17	17	25	38	38
Hungary	91	0	9	100	0	0	100	0	0
Indonesia	48	0	52	50	0	50	0	0	100
Iran, Islamic Rep. of	61	0	39	42	0	58	100	0	0
Israel	77	0	23	67	0	33	75	0	25
Italy	98	0	2	100	0	0	100	0	0
Japan	73	0	27	58	0	42	88	0	13
Jordan	100	0	0	100	0	0	100	0	0
Korea, Rep. of	52	0	48	58	0	42	38	0	63
Latvia	82	0	18	58	0	42	100	0	0
Lebanon	41	0	59	33	0	67	63	0	38
Lithuania	98	0	2	100	0	0	88	0	13
Macedonia, Rep. of	89	0	11	83	0	17	100	0	0
Malaysia	59	0	41	67	0	33	75	0	25
Moldova, Rep. of	98	0	2	100	0	0	88	0	13
Morocco	43	7	50	50	0	50	75	0	25
Netherlands	73	9	18	92	0	8	75	25	0
New Zealand	57	27	16	58	25	17	50	38	13
Norway	80	0	20	92	0	8	63	0	38
Palestinian Nat'l Auth.	86	0	14	92	0	8	75	0	25
Philippines	70	5	25	100	0	0	38	13	50
Romania	82	0	18	92	0	8	100	0	0
Russian Federation	86	0	14	75	0	25	88	0	13
Saudi Arabia	75	0	25	92	0	8	50	0	50
Scotland	75	18	7	83	17	0	88	13	0
Serbia	98	0	2	100	0	0	88	0	13
Singapore	77	0	23	58	0	42	88	0	13
Slovak Republic	82	5	14	67	0	33	75	25	0
Slovenia	77	0	23	50	0	50	88	0	13
South Africa	16	32	52	25	42	33	13	38	50
Sweden	77	11	11	92	0	8	63	38	0
Syrian Arab Republic	57	7	36	67	25	8	38	0	63
Tunisia	7	0	93	25	0	75	0	0	100
United States	95	2	2	100	0	0	75	13	13
International Avg.	71	4	25	73	4	23	70	5	25
Benchmarking Participants									
Basque Country, Spain	48	27	25	50	17	33	38	25	38
Indiana State, US	93	0	7	100	0	0	63	0	38
Ontario Province, Can.	84	0	16	83	0	17	50	0	50
Quebec Province, Can.	50	11	39	42	8	50	50	0	50

Background data provided by National Research Coordinators.

* Percentages may not add to 100 due to rounding.

See Exhibits 5.9 through 5.13 for data on individual topics.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 5.7: Summary of TIMSS Science Topics in the Intended Curriculum

SCIENCE Grade 8

Countries	Percentage of TIMSS Science Topics Intended to be Taught Up to and Including Eighth Grade*								
	Physics (10 topics)			Earth Science (11 topics)			Environmental Science (3 topics)		
	Topics for All or Almost All Students	Topics for Only the More Able Students (top track)	Not Included in the Curriculum Through Grade 8	Topics for All or Almost All Students	Topics for Only the More Able Students (top track)	Not Included in the Curriculum Through Grade 8	Topics for All or Almost All Students	Topics for Only the More Able Students (top track)	Not Included in the Curriculum Through Grade 8
Armenia	100	0	0	100	0	0	100	0	0
Australia	60	0	40	55	0	45	33	0	67
Bahrain	100	0	0	73	0	27	100	0	0
Belgium (Flemish)	0	0	100	0	9	91	67	0	33
Botswana	40	0	60	18	0	82	0	0	100
Bulgaria	100	0	0	91	0	9	67	0	33
Chile	50	0	50	36	0	64	67	0	33
Chinese Taipei	70	0	30	45	0	55	0	0	100
Cyprus	60	0	40	0	0	100	0	0	100
Egypt	100	0	0	64	0	36	100	0	0
England	100	0	0	64	0	36	67	0	33
Estonia	100	0	0	100	0	0	100	0	0
Ghana	90	0	10	100	0	0	100	0	0
Hong Kong, SAR	60	20	20	82	0	18	100	0	0
Hungary	90	0	10	91	0	9	33	0	67
Indonesia	80	0	20	45	0	55	67	0	33
Iran, Islamic Rep. of	100	0	0	36	0	64	0	0	100
Israel	70	0	30	91	0	9	100	0	0
Italy	100	0	0	100	0	0	67	0	33
Japan	80	0	20	82	0	18	33	0	67
Jordan	100	0	0	100	0	0	100	0	0
Korea, Rep. of	100	0	0	27	0	73	0	0	100
Latvia	100	0	0	73	0	27	100	0	0
Lebanon	30	0	70	55	0	45	0	0	100
Lithuania	100	0	0	100	0	0	100	0	0
Macedonia, Rep. of	90	0	10	82	0	18	100	0	0
Malaysia	70	0	30	18	0	82	100	0	0
Moldova, Rep. of	100	0	0	100	0	0	100	0	0
Morocco	70	0	30	0	0	100	0	100	0
Netherlands	70	10	20	45	9	45	100	0	0
New Zealand	60	20	20	73	18	9	0	67	33
Norway	60	0	40	91	0	9	100	0	0
Palestinian Nat'l Auth.	100	0	0	73	0	27	100	0	0
Philippines	30	0	70	91	9	0	100	0	0
Romania	90	0	10	64	0	36	33	0	67
Russian Federation	90	0	10	91	0	9	100	0	0
Saudi Arabia	80	0	20	64	0	36	100	0	0
Scotland	60	30	10	82	9	9	33	33	33
Serbia	100	0	0	100	0	0	100	0	0
Singapore	90	0	10	73	0	27	100	0	0
Slovak Republic	80	0	20	100	0	0	100	0	0
Slovenia	80	0	20	91	0	9	100	0	0
South Africa	20	30	50	0	9	91	33	67	0
Sweden	80	10	10	64	9	27	100	0	0
Syrian Arab Republic	30	0	70	73	0	27	100	0	0
Tunisia	0	0	100	0	0	100	0	0	100
United States	100	0	0	100	0	0	100	0	0
International Avg.	75	3	22	66	2	32	69	6	26
Benchmarking Participants									
Basque Country, Spain	30	40	30	55	36	9	100	0	0
Indiana State, US	100	0	0	100	0	0	100	0	0
Ontario Province, Can.	100	0	0	91	0	9	100	0	0
Quebec Province, Can.	30	20	50	73	18	9	67	0	33

Background data provided by National Research Coordinators.

* Percentages may not add to 100 due to rounding.

See Exhibits 5.9 through 5.13 for data on individual topics.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 5.7: Summary of TIMSS Science Topics in the Intended Curriculum

SCIENCE Grade 4

Countries	Percentage of TIMSS Science Topics Intended to be Taught Up to and Including Fourth Grade*								
	Overall (32 topics)			Life Science (10 topics)			Physical Science (13 topics)		
	Topics for All or Almost All Students	Topics for Only the More Able Students (top track)	Not Included in the Curriculum Through Grade 4	Topics for All or Almost All Students	Topics for Only the More Able Students (top track)	Not Included in the Curriculum Through Grade 4	Topics for All or Almost All Students	Topics for Only the More Able Students (top track)	Not Included in the Curriculum Through Grade 4
Armenia	78	16	6	100	0	0	77	15	8
Australia	63	0	38	80	0	20	77	0	23
Belgium (Flemish)	31	22	47	20	50	30	31	15	54
Chinese Taipei	38	0	63	40	0	60	54	0	46
Cyprus	63	6	31	60	20	20	77	0	23
England	75	0	25	70	0	30	77	0	23
Hong Kong, SAR	53	0	47	40	0	60	62	0	38
Hungary	50	0	50	90	0	10	46	0	54
Iran, Islamic Rep. of	59	0	41	50	0	50	62	0	38
Italy	69	0	31	80	0	20	46	0	54
Japan	50	0	50	40	0	60	69	0	31
Latvia	41	0	59	50	0	50	15	0	85
Lithuania	88	0	13	90	0	10	100	0	0
Moldova, Rep. of	94	0	6	100	0	0	85	0	15
Morocco	3	41	56	10	90	0	0	31	69
Netherlands	69	0	31	100	0	0	46	0	54
New Zealand	59	25	16	70	10	20	54	38	8
Norway	78	0	22	100	0	0	62	0	38
Philippines	59	0	41	50	0	50	62	0	38
Russian Federation	56	0	44	40	0	60	46	0	54
Scotland	50	6	44	50	10	40	62	8	31
Singapore	38	0	63	30	0	70	62	0	38
Slovenia	63	0	38	80	0	20	69	0	31
Tunisia	0	0	100	0	0	100	0	0	100
United States	78	0	22	80	0	20	77	0	23
Yemen	59	0	41	50	0	50	69	0	31
International Avg.	56	4	39	60	7	33	57	4	39
Benchmarking Participants									
Indiana State, US	44	0	56	50	0	50	38	0	62
Ontario Province, Can.	78	0	22	100	0	0	85	0	15
Quebec Province, Can.	41	3	56	30	10	60	54	0	46

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

* Percentages may not add to 100 due to rounding.

See Exhibits 5.14 through 5.16 for data on individual topics.

Exhibit 5.7: Summary of TIMSS Science Topics in the Intended Curriculum

Countries	Percentage of TIMSS Science Topics Intended to be Taught Up to and Including Fourth Grade*		
	Earth Science (9 topics)		
	Topics for All or Almost All Students	Topics for Only the More Able Students (top track)	Not Included in the Curriculum Through Grade 4
Armenia	56	33	11
Australia	22	0	78
Belgium (Flemish)	44	0	56
Chinese Taipei	11	0	89
Cyprus	44	0	56
England	78	0	22
Hong Kong, SAR	56	0	44
Hungary	11	0	89
Iran, Islamic Rep. of	67	0	33
Italy	89	0	11
Japan	33	0	67
Latvia	67	0	33
Lithuania	67	0	33
Moldova, Rep. of	100	0	0
Morocco	0	0	100
Netherlands	67	0	33
New Zealand	56	22	22
Norway	78	0	22
Philippines	67	0	33
Russian Federation	89	0	11
Scotland	33	0	67
Singapore	11	0	89
Slovenia	33	0	67
Tunisia	0	0	100
United States	78	0	22
Yemen	56	0	44
International Avg.	50	2	47
Benchmarking Participants			
Indiana State, US	44	0	56
Ontario Province, Can.	44	0	56
Quebec Province, Can.	33	0	67

Background data provided by National Research Coordinators.

* Percentages may not add to 100 due to rounding.

See Exhibits 5.14 through 5.16 for data on individual topics.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Earth science, with 9 topics, had the lowest level of inclusion in the intended fourth-grade curriculum (50% of topics for most students and 2% for the top track only). Only three countries, Italy, Moldova, and the Russian Federation, had as many as 8 of the 9 topics in their curricula for most students, and 13 participants had fewer than half of the topics included.

At the fourth grade, as at the eighth grade, the relationship between the coverage of the TIMSS science topics in participants' intended curricula and student achievement in science is not straightforward. Among the six top-performing countries, there was a range of topic coverage in the intended curriculum: two countries included about 40 percent of topics (Singapore and Chinese Taipei), two included about 50 percent of topics (Japan and Hong Kong, SAR), and two about 75 percent (England and the United States). Among the three lowest-performing countries, the Philippines included more than half the topics (59%) but Morocco included just one of the 32 science topics, and Tunisia none at all.

Are the TIMSS Science Topics Taught in School?

The previous section described the coverage of the TIMSS science topics in participating countries *intended* curricula at the eighth and fourth grades, with a focus on the percentage of topics that were included in countries' intended curricula for all or almost all students. This section describes the coverage of the TIMSS topics in countries' *implemented* curricula at the eighth and fourth grades, based on teachers' reports of the percentage of students actually taught these topics.

To gather information about science coverage in the implemented curricula of participating countries, the science teachers[7] of the students assessed were asked to indicate whether each of the TIMSS 2003 science topics was "mostly taught before this year," "mostly taught this year," or "not yet taught or just introduced." Exhibit 5.8 presents for eighth and fourth grade the percentage of students whose teachers reported that the students had been taught the TIMSS science topics

7 At fourth grade there was one teacher questionnaire that asked about both mathematics and science, and at eighth grade there were separate questionnaires for mathematics teachers and science teachers.

either prior to or during the year of the assessment. The exhibit shows for each TIMSS participant, averaged across science content areas, the percentage of students whose teachers reported that the students had been taught each topic. The topics were listed in a questionnaire completed by the science teachers of the students who took the TIMSS 2003 test.[8] Although generally, teacher participation was high, sometimes teachers did not complete the questionnaire assigned to them, so most countries had some percentage of students for whom no teacher questionnaire information is available. The exhibits in this chapter have special notations on this point. For a country where teacher responses are available for at least 70 but less than 85 percent of the students, an "r" is included next to its data. Where teacher responses are available for at least 50 but less than 70 percent of the students, an "s" is included. Where teacher responses are available for less than 50 percent, an "x" replaces the data.

Exhibit 5.8 shows that, according to their teachers, on average 67 percent of the eighth-grade students tested in TIMSS 2003 had been taught the TIMSS science topics. In five countries, Armenia, Egypt, Macedonia, Romania, and Serbia, teachers reported that almost all students (90 percent or more) had been taught the topics, as had the majority of students in all participating entities except Belgium (Flemish), Botswana, New Zealand, Norway, South Africa and Tunisia.

Life science and chemistry were the content areas with the greatest coverage in the classroom, with 70 percent of students, on average, having been taught the TIMSS life science and chemistry topics by the eighth grade. Physics had the next greatest coverage (66%), followed by earth science (61%), and environmental science (49%). In life science, chemistry, physics, and earth science, teachers in 6-8 countries reported that almost all students (90 percent or more) had been taught the topics. Environmental science (just three topics) appears to have received proportionally less attention in the classroom than the other science areas.

8 Further results from the teacher questionnaire are presented in Chapters 6 and 7.

Exhibit 5.8: Summary of Students Taught the TIMSS Science Topics

SCIENCE Grade 8

Countries	Average Percentage of Students Taught the TIMSS Science Topics											
	Overall* (44 topics)		Life Science (12 topics)		Chemistry (8 topics)		Physics (10 topics)		Earth Science (11 topics)		Environmental Science (3 topics)	
Armenia	s	90 (0.7)	r	71 (2.1)	s	97 (1.2)	s	89 (1.0)	s	96 (2.5)	–	–
Australia	r	52 (1.3)	r	51 (1.7)	r	58 (1.5)	r	50 (1.6)	r	53 (2.2)	r	37 (3.3)
Bahrain		55 (0.8)		64 (0.9)		70 (1.3)		90 (1.2)		12 (1.4)		12 (1.6)
Belgium (Flemish)	r	48 (1.3)	r	70 (1.5)		– –		25 (1.6)	r	24 (1.7)		– –
Botswana		28 (0.9)		41 (1.6)		15 (1.3)		37 (1.2)		16 (1.2)		23 (2.1)
Bulgaria	r	88 (0.9)	r	81 (1.6)	r	81 (1.8)	r	95 (1.1)	r	94 (0.9)		– –
Chile		79 (1.1)		90 (1.1)		84 (1.8)		66 (2.0)		74 (1.9)		79 (2.6)
Chinese Taipei		78 (1.0)		– –		90 (0.7)		68 (1.4)		– –		– –
Cyprus		56 (0.4)		– –		46 (0.5)		49 (0.4)		77 (0.8)		– –
Egypt		92 (0.9)		92 (0.9)		96 (1.0)		93 (1.1)		89 (1.3)		84 (2.0)
Estonia		73 (0.9)		61 (1.4)		84 (1.3)		54 (1.5)		95 (0.7)		– –
Ghana		48 (1.3)		55 (1.5)		64 (1.6)		44 (1.6)		32 (2.3)		49 (3.5)
Hong Kong, SAR		53 (1.3)		63 (1.8)		59 (2.2)		70 (1.7)		21 (1.6)		51 (3.9)
Hungary		84 (0.7)		83 (1.1)		97 (0.8)		81 (1.0)		71 (2.3)		– –
Indonesia		75 (0.7)		72 (1.1)		– –		79 (0.8)		– –		– –
Iran, Islamic Rep. of		84 (1.0)		80 (1.3)		88 (1.1)		90 (1.3)		80 (1.5)		76 (2.6)
Israel	r	56 (1.5)		49 (2.0)		76 (1.9)		59 (1.4)	s	45 (3.4)	s	39 (4.0)
Italy		77 (1.0)		91 (0.8)		80 (1.7)		68 (1.8)		74 (1.7)		59 (2.9)
Japan		52 (0.7)		39 (1.1)		80 (1.6)		68 (1.1)		46 (1.2)		1 (0.7)
Jordan		75 (1.5)		75 (2.3)		77 (1.9)		87 (1.5)		66 (2.1)		63 (2.9)
Korea, Rep. of	s	54 (1.7)	s	49 (1.7)	s	44 (2.1)	s	68 (2.2)	s	64 (2.5)	s	23 (2.7)
Latvia	s	64 (1.4)	s	65 (2.6)		x x	s	62 (2.2)		– –		– –
Lebanon	r	73 (1.5)	r	74 (2.0)		88 (1.4)		83 (1.5)	r	51 (3.5)	s	60 (3.9)
Lithuania		70 (0.8)		68 (2.1)		67 (1.6)		47 (2.1)		95 (1.0)		– –
Macedonia, Rep. of		98 (0.3)		97 (0.6)		98 (1.3)		98 (0.6)		92 (1.6)		– –
Malaysia		64 (1.1)		78 (0.9)		81 (1.6)		74 (1.3)		25 (2.1)		67 (3.0)
Moldova, Rep. of	s	80 (1.4)	s	68 (3.6)	s	94 (1.4)	s	77 (2.0)	r	79 (3.4)		x x
Morocco		x x	s	55 (2.6)	s	67 (3.0)	s	61 (3.4)	s	31 (2.7)		– –
Netherlands	r	58 (1.5)	r	73 (1.8)	r	33 (2.4)	r	52 (1.9)	r	59 (2.5)		– –
New Zealand		45 (1.5)		46 (2.3)		59 (2.4)		48 (1.7)		36 (2.1)		30 (3.6)
Norway		45 (1.3)		41 (2.0)		39 (2.1)		33 (1.4)		68 (2.0)		32 (3.4)
Palestinian Nat'l Auth.		68 (1.4)		68 (1.6)		73 (1.7)		81 (1.5)		61 (2.1)		42 (3.5)
Philippines	r	63 (1.8)		88 (1.5)	r	38 (3.7)	r	30 (3.2)	r	77 (3.2)	r	89 (2.9)
Romania		96 (0.4)		96 (0.7)		95 (1.0)		96 (1.3)		95 (1.2)		– –
Russian Federation		– –		– –		– –		– –		– –		– –
Saudi Arabia		70 (1.6)		73 (1.9)		63 (2.5)		65 (2.5)		77 (1.8)		68 (3.7)
Scotland	s	61 (1.2)	s	64 (1.5)	s	75 (1.3)	s	70 (1.6)	s	42 (2.4)	s	41 (2.8)
Serbia		96 (0.6)		94 (1.2)		95 (1.5)		95 (1.1)		94 (1.9)		– –
Singapore		58 (1.0)		67 (1.1)		75 (1.6)		77 (1.1)		17 (1.5)		48 (2.4)
Slovak Republic		81 (0.8)		82 (1.8)		75 (1.4)		77 (0.7)		90 (1.7)		– –
Slovenia		67 (0.8)		77 (1.2)		78 (1.5)		44 (1.6)		– –		– –
South Africa	r	49 (2.2)	r	57 (2.4)	r	54 (2.5)	r	46 (2.5)	r	37 (3.3)	r	63 (3.4)
Sweden	r	63 (1.2)	r	66 (1.6)	r	70 (1.4)	r	64 (1.6)		x x	s	35 (3.4)
Syrian Arab Republic		– –		– –		– –		– –		– –		– –
Tunisia	r	32 (1.4)		66 (1.3)	r	14 (2.1)	r	11 (1.8)		27 (1.7)		31 (3.2)
United States	r	79 (1.2)	r	86 (1.7)	r	73 (2.3)	r	70 (1.9)	r	86 (1.5)	r	69 (3.0)
‡ England		x x		x x		x x	s	93 (1.2)		x x		x x
International Avg.		67 (0.2)		70 (0.3)		70 (0.3)		66 (0.3)		61 (0.3)		49 (0.6)
Benchmarking Participants												
Basque Country, Spain		68 (1.5)		66 (1.9)		54 (2.8)		66 (2.8)		82 (2.2)		70 (4.0)
Indiana State, US		84 (1.6)		89 (2.4)		79 (3.3)		78 (3.0)		89 (3.1)		80 (4.6)
Ontario Province, Can.		72 (1.3)		75 (1.9)		60 (2.2)		72 (2.2)		76 (2.6)		74 (3.9)
Quebec Province, Can.	r	52 (1.3)	r	42 (2.3)	r	50 (1.8)	r	34 (1.8)	r	78 (2.1)	r	71 (3.6)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers at the time of testing.

* Overall includes topics in content areas for which data are available.

For countries that teach science as separate subjects at grade 8, data are based on teachers who teach the relevant science subject.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

See Exhibits 5.9-5.13 for data on individual topics.

Exhibit 5.8: Summary of Students Taught the TIMSS Science Topics

Countries	Average Percentage of Students Taught the TIMSS Science Topics							
	Overall* (32 topics)		Life Science (10 topics)		Physical Science (13topics)		Earth Science (9 topics)	
Armenia		x x		x x		x x		x x
Australia	r	58 (2.0)	r	74 (2.0)	r	45 (2.7)	r	57 (2.2)
Belgium (Flemish)		43 (1.2)		59 (1.8)		30 (1.3)		44 (1.5)
Chinese Taipei		63 (1.5)		68 (1.5)		63 (1.9)		56 (1.9)
Cyprus		55 (1.7)		61 (2.2)		54 (1.9)		51 (2.0)
England	r	69 (1.3)	r	71 (2.1)	r	74 (1.7)	r	62 (1.8)
Hong Kong, SAR	r	62 (1.9)	r	62 (2.5)	r	67 (2.6)	r	53 (1.9)
Hungary		71 (1.5)		88 (1.5)		61 (2.1)		68 (2.0)
Iran, Islamic Rep. of		68 (1.9)		69 (2.4)		68 (2.1)		68 (2.2)
Italy		65 (1.1)		72 (1.1)		55 (1.6)		72 (1.7)
Japan		37 (1.2)		35 (1.5)		46 (1.6)		24 (1.4)
Latvia		x x		x x		x x		x x
Lithuania		81 (1.0)		96 (0.8)		67 (1.7)		85 (1.1)
Moldova, Rep. of	r	75 (1.5)	r	83 (1.7)	r	58 (2.3)	r	91 (1.3)
Morocco		x x		x x		x x		x x
Netherlands		47 (1.6)		65 (2.0)		31 (2.1)		49 (2.2)
New Zealand	r	62 (1.6)	r	73 (1.7)	r	54 (1.7)	r	60 (2.3)
Norway		55 (1.6)		63 (1.8)		45 (1.9)		62 (2.0)
Philippines		83 (1.9)		91 (1.6)		79 (2.2)		78 (2.7)
Russian Federation		– –		– –		– –		– –
Scotland	s	49 (1.6)	s	60 (2.3)	s	44 (2.0)	s	45 (2.4)
Singapore		58 (1.3)		65 (1.7)		68 (1.4)		37 (1.5)
Slovenia		56 (1.8)		63 (2.4)		53 (2.0)		52 (1.9)
Tunisia		54 (1.4)		68 (1.9)		54 (1.6)	r	39 (2.0)
United States	r	69 (1.2)		74 (1.6)		60 (1.7)		75 (1.4)
Yemen		– –		– –		– –		– –
International Avg.		61 (0.3)		69 (0.4)		56 (0.4)		58 (0.4)
Benchmarking Participants								
Indiana State, US		69 (2.2)		81 (2.8)		58 (2.9)		74 (3.3)
Ontario Province, Can.		57 (2.0)		64 (3.2)		53 (2.5)		57 (2.6)
Quebec Province, Can.		48 (1.7)		59 (2.3)		35 (1.8)		56 (2.3)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers at the time of testing.

* Overall includes topics in content areas for which data are available.

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

See Exhibits 5.14-5.16 for data on individual topics.

At the fourth grade, Exhibit 5.8 shows that internationally, on average, 61 percent of the students tested in TIMSS 2003 had been taught the TIMSS science topics, with the percentage ranging from 83 percent in Lithuania to 37 percent in Japan. The majority of students in every participating entity except Belgium (Flemish), Japan, the Netherlands, and Quebec had been taught the topics.

Consistent with the data reported on the intended science curriculum at the fourth grade (Exhibit 5.7), life science was the content area with the greatest percentage of students taught the topics, on average (69%). Percentages were greatest in Lithuania (96%) and the Philippines (91%) and least in Japan (35%). For physical science and earth science, the average percentages of fourth-grade students taught the TIMSS science topics were similar, 56 percent and 58 percent, respectively. The percentage of students taught physical science ranged from 79 percent in the Philippines to 30 and 31 percent in Belgium (Flemish) and the Netherlands, respectively. Although earth science topics did not figure prominently in the intended curriculum at the fourth grade, teachers' reports indicated that students have to a considerable extent been taught the topics. According to teachers' reports, the majority of students in 18 of the participating entities have been taught the earth science topics.

Which TIMSS Science Topics Are in the Intended and Implemented Curricula?

For first the eighth grade and then the fourth grade, this section presents information about the coverage of each individual science topic in each country's intended and implemented curricula. For each topic, the exhibits indicate whether the topic was intended to be taught and if so, to all or only the more able students; the grade(s) at which the topic was primarily intended to be taught; and the percentage of students actually taught the topic. Exhibits 5.9 through 5.13 present these data for the science content areas at eighth grade, and Exhibits 5.14 through 5.16 for those at fourth grade.

Exhibit 5.9 presents information on the 12 life science topics at eighth grade. As shown in this exhibit, several of the TIMSS life science topics were included in the intended curriculum of most participants, and were taught to most students. These topics included "classification of organisms" (in the curriculum of 47 participants for most students; taught to 84% of students, on average), "major organ systems in humans and other organisms" (in the curriculaof 44 participants for most students; taught to 82% of students, on average), and "the interaction of living organisms in an ecosystem" (in the curriculum of 42 participants for most students; taught to 69% of students, on average). In addition, there were several topics less widely intended or taught, but in the curriculum of more than 30 participants and taught to at least 70 percent of the students: "how systems function to maintain stable bodily functions," "cell structures and functions," "photosynthesis and respiration," "life cycles of organisms," and "reproduction and heredity." Exhibit 5.9 also shows that there was great variation among participants in the grade(s) at which the life science topics were primarily intended to be taught. Also, while some countries reported that topics were intended to be taught primarily at a single grade, many provided a range of grades in which they were taught.

Exhibit 5.9: Intended and Taught TIMSS Life Science Topics

SCIENCE Grade 8

Life Science	Classification of organisms			The major organ systems in humans and other organisms			How the systems function to maintain stable bodily conditions			Cell structures and functions		
Countries	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic
Armenia	●	--	s 95 (2.1)	●	--	r 99 (1.1)	●	--	s 91 (2.5)	●	--	r 77 (4.2)
Australia	●	--	r 82 (3.0)	●	--	r 57 (4.0)	●	--	r 42 (3.4)	●	--	r 82 (2.8)
Bahrain	●	1-3,5-7	88 (3.2)	●	4,5,8	97 (1.3)	●	5,8	91 (2.3)	●	7	95 (1.2)
Belgium (Flemish)	●	--	r 61 (4.1)	●	--	r 97 (1.0)	●	--	r 95 (1.8)	⦿	--	r 80 (3.6)
Botswana	●	2	84 (3.8)	●	2	69 (4.5)	○	9	38 (4.7)	●	8	98 (1.3)
Bulgaria	○	10	r 88 (2.9)	●	8	r 100 (0.4)	●	8	r 90 (3.4)	○	9	r 93 (2.0)
Chile	●	3-6	98 (1.1)	●	5,7,9,11	98 (1.0)	●	7,11	93 (2.0)	○	9	87 (2.5)
Chinese Taipei	●	7	– –	●	7	– –	●	7	– –	●	7	– –
Cyprus	○	9	– –	○	9	– –	○	--	– –	●	7-9	– –
Egypt	●	4,9	81 (3.7)	●	5	99 (1.0)	●	5	96 (1.7)	●	5,8	100 (0.0)
Estonia	●	2,4,6-8	r 95 (1.9)	●	2,4,7-9,12	35 (5.0)	●	4,7,9,11-12	32 (5.5)	●	4,7,9,11	74 (5.2)
Ghana	●	7	45 (4.8)	●	8	58 (4.2)	●	7	38 (5.0)	●	7	88 (2.8)
Hong Kong, SAR	●	7	85 (3.3)	●	4	72 (3.9)	○	9	35 (3.8)	⦿	10	84 (3.4)
Hungary	●	7	88 (2.7)	●	8	95 (1.7)	●	8	r 78 (3.6)	●	8	90 (1.9)
Indonesia	●	7	97 (1.5)	●	8	100 (0.0)	●	8	91 (2.7)	○	10	98 (1.5)
Iran, Islamic Rep. of	●	5-6	92 (2.0)	●	5-8	98 (1.0)	○	--	87 (2.7)	●	7-8	97 (1.2)
Israel	●	1-6	52 (3.9)	●	--	62 (3.4)	○	--	52 (4.0)	●	7-12	71 (4.1)
Italy	●	4-6	99 (0.8)	●	4-7	100 (0.0)	●	6-7	93 (1.9)	●	6	100 (0.3)
Japan	●	3-12	97 (1.6)	●	6,8,10-12	99 (0.7)	●	8,10-12	70 (3.6)	○	9-12	17 (3.1)
Jordan	●	1,6,8	98 (1.2)	●	4-6,8	93 (2.3)	●	5-6,8	80 (3.0)	●	4,7	83 (2.9)
Korea, Rep. of	●	6	s 38 (3.4)	●	7	78 (3.1)	●	8	s 77 (3.4)	●	7	s 85 (2.2)
Latvia	●	6-9	s 86 (3.2)	○	9	48 (6.3)	○	9	s 62 (5.7)	●	7-8	s 69 (5.9)
Lebanon	○	12	r 81 (3.7)	○	10	r 79 (3.9)	○	12	r 61 (4.4)	○	11	r 70 (4.5)
Lithuania	●	5-8	91 (2.6)	●	5-8	72 (4.4)	●	7-8	63 (4.4)	●	5-8	85 (3.5)
Macedonia, Rep. of	●	5-6	99 (0.8)	●	5-8	99 (0.8)	●	5-8	96 (1.9)	●	5	99 (0.7)
Malaysia	●	4-7	99 (0.9)	●	7-8	96 (1.7)	●	7-8	88 (3.0)	●	7	97 (1.6)
Moldova, Rep. of	●	6	s 71 (9.4)	●	6	92 (5.3)	●	6	s 91 (5.2)	●	6	s 87 (5.7)
Morocco	●	--	s 88 (4.6)	●	--	78 (4.4)	●	--	s 62 (6.5)	○	--	s 47 (7.3)
Netherlands	●	--	r 82 (4.2)	●	--	r 100 (0.0)	●	--	r 97 (1.5)	●	--	r 72 (5.1)
New Zealand	●	2-7	72 (5.2)	●	2-9	39 (5.0)	⦿	9-11	20 (3.6)	○	10-12	69 (4.2)
Norway	●	4-7	34 (3.9)	●	3,5	19 (3.5)	●	2,4,5,9	10 (2.9)	○	--	50 (4.7)
Palestinian Nat'l Auth.	●	7,11	96 (1.6)	●	4,6-8, 11-12	87 (2.9)	●	3,7,11	75 (4.0)	●	8,11-12	98 (1.3)
Philippines	●	8	95 (1.9)	●	8	90 (2.7)	●	8	85 (2.9)	●	8	100 (0.0)
Romania	●	5-6,9	99 (1.1)	●	4-8,10-11	99 (0.7)	●	7,10-11	98 (1.2)	○	9-11	98 (1.3)
Russian Federation	●	7-8	– –	●	6-9	– –	○	9	– –	●	6-8	– –
Saudi Arabia	●	--	95 (1.6)	●	8	100 (0.0)	●	--	97 (1.7)	●	--	96 (1.5)
Scotland	●	7	s 94 (1.8)	●	7	78 (3.0)	●	7	s 47 (3.5)	●	7	s 95 (1.5)
Serbia	●	5-6	89 (2.9)	●	5-6,8	97 (1.5)	●	6,8	96 (1.5)	●	5,8	98 (1.1)
Singapore	●	8	76 (2.4)	○	11	90 (1.5)	○	9	63 (2.3)	●	7	85 (2.2)
Slovak Republic	●	5-9	97 (1.5)	●	6-7	99 (1.3)	○	9	60 (5.3)	●	5-7,9	96 (1.7)
Slovenia	●	8	76 (3.8)	○	9	90 (2.3)	○	9	89 (2.5)	○	9	91 (2.2)
South Africa	●	--	r 69 (3.8)	●	--	r 58 (3.9)	○	--	r 43 (4.7)	○	--	r 44 (3.6)
Sweden	●	7	r 81 (3.3)	●	8	r 79 (3.6)	●	8	r 64 (4.2)	●	8	r 75 (3.4)
Syrian Arab Republic	●	--	– –	●	--	– –	⦿	--	– –	●	--	– –
Tunisia	○	11	100 (0.0)	○	11	75 (3.8)	○	11	38 (4.1)	○	11	89 (2.7)
United States	●	--	r 87 (2.1)	●	--	r 89 (2.1)	●	--	r 88 (2.0)	●	--	r 92 (1.7)
‡ England	●	1,3,5-6	s 96 (3.1)	●	K,4,6,8	x x	●	4,7-8	x x	●	6,8	s 99 (0.4)
International Avg.			84 (0.5)			82 (0.5)			71 (0.6)			84 (0.5)
Benchmarking Participants												
Basque Country, Spain	●	--	84 (3.2)	●	--	83 (4.4)	●	--	63 (4.1)	○	11	70 (4.7)
Indiana State, US	●	--	90 (3.5)	●	--	88 (4.7)	●	--	86 (4.8)	●	--	93 (3.0)
Ontario Province, Can.	●	6	88 (3.2)	●	5	82 (3.6)	●	5,8	75 (3.8)	●	8	81 (4.3)
Quebec Province, Can.	●	--	r 50 (5.4)	○	9	r 10 (3.1)	○	9	r 5 (1.7)	○	9	r 25 (4.7)

● All or almost all students ⦿ Only the more able students ○ Not included in the curriculum through eighth grade

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data on intended curriculum provided by National Research Coordinators, and on implemented curriculum by teachers at the time of testing.

For countries that teach science as separate subjects at grade 8, data are based on biology teachers only.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

Exhibit 5.9: Intended and Taught TIMSS Life Science Topics *(Continued...)*

Life Science	Photosynthesis and respiration			Life cycles of organisms, including humans, plants, birds, insects			Reproduction and heredity, inherited versus acquired/ learned characteristics			The role of variation and adaptation in survival/extinction of species		
Countries	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic
Armenia	●	--	r 70 (5.2)	⦿	--	86 (3.2)	●	8	r 54 (5.5)	○	--	r 34 (5.1)
Australia	○	10	r 70 (3.3)	●	7	r 49 (4.2)	●	7	r 26 (3.3)	○	10	r 40 (4.2)
Bahrain	●	6-8	77 (2.4)	●	2,4,5	43 (3.4)	●	6,8	51 (3.0)	●	3	15 (2.9)
Belgium (Flemish)	●	--	r 90 (2.6)	○	--	r 49 (3.7)	●	--	r 86 (2.7)	○	--	r 21 (3.7)
Botswana	●	8	29 (4.4)	○	9	14 (3.3)	●	8	32 (3.9)	○	9	5 (2.1)
Bulgaria	○	9	r 96 (1.7)	○	9	r 90 (2.4)	○	9-10	r 66 (4.4)	○	9	r 25 (4.3)
Chile	●	6,7,9	95 (1.8)	●	8,10,12	91 (2.2)	●	7,8	85 (2.6)	●	8,11	78 (3.3)
Chinese Taipei	●	7	– –	●	7	– –	●	7	– –	●	7	– –
Cyprus	○	9	– –	⦿	7	– –	○	9	– –	○	9	– –
Egypt	●	4,5,10	98 (1.1)	●	--	81 (3.4)	○	--	98 (1.1)	●	6	80 (3.0)
Estonia	●	4,7,9,11	88 (2.8)	●	2-4,7-8,11	95 (1.8)	●	2,4,9,11	24 (4.6)	●	2,4-5,8-9,12	26 (4.8)
Ghana	●	7	88 (3.0)	●	7-8	42 (4.7)	●	8	69 (4.3)	●	8	10 (3.1)
Hong Kong, SAR	●	8	99 (0.8)	○	10	40 (4.6)	●	7	78 (4.0)	●	6	54 (4.9)
Hungary	●	8	86 (2.3)	●	8	89 (2.5)	●	8	59 (4.1)	●	7	67 (3.9)
Indonesia	●	6-7	100 (0.0)	○	10	87 (3.1)	○	9	16 (3.3)	○	9	48 (4.3)
Iran, Islamic Rep. of	○	9-11	88 (2.5)	○	9-11	82 (3.2)	○	9-11	89 (2.5)	○	9-11	75 (3.9)
Israel	○	9-12	52 (3.8)	●	--	58 (4.3)	○	9-12	77 (3.7)	○	9-12	30 (3.6)
Italy	●	4-7	99 (0.7)	●	4-7	97 (1.1)	●	8	83 (2.8)	●	8	69 (3.5)
Japan	●	6-8,10-12	88 (3.0)	●	3-12	55 (4.5)	●	5,9-12	3 (1.2)	○	9-12	8 (2.2)
Jordan	●	4,6,8	91 (2.7)	●	4,6,7	76 (3.5)	●	7	56 (4.9)	●	4	59 (4.5)
Korea, Rep. of	●	8	s 89 (2.0)	●	3-4	27 (3.9)	○	9	s 44 (3.9)	○	9	s 20 (3.3)
Latvia	●	7-8	s 98 (1.5)	●	7	87 (4.0)	○	9	s 57 (6.0)	●	7-9	s 77 (4.9)
Lebanon	○	10,12	r 94 (1.8)	○	10,12	r 91 (2.1)	●	--	r 58 (5.3)	●	--	r 59 (5.4)
Lithuania	●	5-8	84 (3.8)	●	5-8	86 (3.3)	●	5-8	75 (4.1)	●	5-8	31 (4.2)
Macedonia, Rep. of	●	5-6	99 (1.1)	●	5-8	98 (1.2)	●	5-8	97 (1.5)	○	10	96 (1.3)
Malaysia	●	7	99 (0.7)	○	--	48 (4.4)	○	9	12 (2.6)	●	8	87 (2.7)
Moldova, Rep. of	●	6	s 57 (10.1)	●	6-9	73 (8.1)	●	7	s 49 (11.0)	●	7,9	s 33 (10.6)
Morocco	○	--	s 75 (5.6)	●	--	73 (6.6)	○	--	s 32 (8.1)	○	--	s 27 (4.8)
Netherlands	●	--	r 87 (3.4)	●	--	r 78 (4.6)	●	--	r 83 (4.4)	●	--	r 40 (5.0)
New Zealand	⦿	8-9	74 (4.0)	●	2-3	43 (5.7)	⦿	8-9	28 (5.1)	○	9-11	38 (5.0)
Norway	●	6	56 (4.4)	●	3	39 (4.1)	●	5-6,10	15 (3.1)	●	5,8	73 (3.9)
Palestinian Nat'l Auth.	●	6-8	89 (2.7)	●	4,6,8	50 (3.9)	●	7,8,10,12	59 (4.5)	○	11-12	39 (4.5)
Philippines	●	8	98 (1.3)	●	8	82 (3.5)	●	8	78 (3.4)	●	8	88 (3.2)
Romania	●	5-7, 10-11	98 (1.3)	●	5-7,9-11	98 (1.4)	●	5-7,9-11	83 (3.4)	●	3,5-10, 12	86 (3.0)
Russian Federation	●	7-8	– –	●	7-9	– –	●	7-11	– –	●	6-8	– –
Saudi Arabia	●	--	94 (2.9)	●	--	66 (5.3)	●	--	47 (5.7)	●	--	74 (4.2)
Scotland	⦿	8	s 83 (2.7)	●	7	60 (3.7)	●	7	s 81 (2.6)	●	8	s 53 (3.8)
Serbia	●	5	93 (2.2)	●	5-6,8	93 (2.3)	●	5-8	94 (1.9)	●	7	94 (1.9)
Singapore	●	8	86 (1.8)	●	3-6	51 (2.8)	●	8	81 (1.7)	○	--	50 (2.6)
Slovak Republic	●	5,9	90 (3.0)	●	5-7,9	94 (2.3)	●	7,9	82 (4.1)	○	9	62 (5.1)
Slovenia	●	8	99 (1.0)	●	4	90 (2.4)	○	9	22 (3.4)	○	10	22 (3.7)
South Africa	⦿	--	r 64 (4.1)	⦿	--	r 59 (3.8)	○	--	r 43 (4.1)	○	--	r 53 (4.4)
Sweden	●	8	r 90 (2.6)	●	8	r 74 (3.5)	●	8	r 33 (3.5)	○	9	r 25 (2.8)
Syrian Arab Republic	●	--	– –	●	--	– –	○	--	– –	⦿	--	– –
Tunisia	●	--	93 (2.2)	●	--	92 (2.1)	○	9	25 (3.7)	●	7	46 (4.2)
United States	●	--	r 88 (2.2)	●	--	r 88 (2.1)	●	--	r 82 (2.5)	●	--	r 83 (2.6)
‡ England	●	7-8	s 97 (0.8)	●	4,6-7	x x	●	4,6	x x	●	5-6,8	x x
International Avg.			86 (0.5)			71 (0.6)			57 (0.7)			50 (0.6)
Benchmarking Participants												
Basque Country, Spain	○	12	84 (4.2)	⦿	10	68 (4.4)	●	--	49 (5.5)	⦿	10	56 (5.3)
Indiana State, US	●	--	95 (2.6)	●	--	92 (2.8)	●	--	85 (3.4)	●	--	90 (2.8)
Ontario Province, Can.	○	10	74 (4.7)	●	2	83 (3.8)	○	9	53 (4.6)	●	6	76 (3.1)
Quebec Province, Can.	⦿	--	r 85 (3.1)	●	--	r 69 (4.5)	○	9	r 20 (4.0)	●	--	r 65 (5.0)

● All or almost all students ⦿ Only the more able students ○ Not included in the curriculum through eighth grade

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data on intended curriculum provided by National Research Coordinators, and on implemented curriculum by teachers at the time of testing.

For countries that teach science as separate subjects at grade 8, data are based on biology teachers only.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

Exhibit 5.9: Intended and Taught TIMSS Life Science Topics *(…Continued)*

SCIENCE Grade 8

Life Science	The interaction of living organisms in an ecosystem			Cycling of materials in nature			Common infectious diseases			Preventive medicine methods		
Countries	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic
Armenia	●	--	r 24 (4.2)	●	--	40 (5.2)	○	--	r 96 (2.0)	⦿	--	r 96 (2.1)
Australia	●	--	r 62 (3.7)	○	--	r 47 (4.2)	○	11	r 18 (3.1)	○	--	r 35 (3.7)
Bahrain	●	3,6,8	51 (2.5)	●	2,3,6,8	28 (2.6)	●	3,6,8	85 (1.4)	●	1-3,5,8	51 (2.8)
Belgium (Flemish)	●	--	r 79 (3.1)	●	--	r 41 (4.4)	⦿	--	r 57 (3.7)	●	--	r 88 (2.5)
Botswana	○	9	6 (2.2)	○	10	19 (3.5)	○	9	33 (4.6)	●	2	62 (3.9)
Bulgaria	○	9	r 63 (5.1)	○	9	r 69 (4.9)	●	8	r 96 (1.7)	●	8	r 95 (2.0)
Chile	●	5,6,10, 12	94 (1.7)	●	6,9	89 (2.1)	●	7,12	87 (2.8)	●	7,9-11	87 (2.8)
Chinese Taipei	●	7	– –	●	7	– –	●	7	– –	●	7	– –
Cyprus	○	9	– –	○	9	– –	○	9	– –	○	9	– –
Egypt	●	6,9	95 (1.8)	●	6	90 (2.2)	●	7	100 (0.1)	○	--	90 (2.5)
Estonia	●	3,6,8, 11-12	77 (3.6)	●	2,5-6, 11-12	52 (5.2)	●	2,4,8-9,11-12	71 (5.4)	●	1-2,4-7,9,10, 12	63 (5.8)
Ghana	●	8-9	23 (4.0)	●	8-9	43 (5.1)	●	8	77 (4.2)	●	8-9	79 (4.2)
Hong Kong, SAR	●	8	86 (3.4)	⦿	8	79 (3.4)	●	5	16 (3.0)	●	5	23 (3.8)
Hungary	●	7	91 (2.4)	●	8	95 (1.9)	●	8	72 (3.9)	●	4	86 (3.0)
Indonesia	●	7	98 (1.4)	○	12	87 (2.8)	○	11	23 (3.5)	●	4	17 (3.1)
Iran, Islamic Rep. of	○	9-11	86 (2.9)	○	9-11	81 (3.4)	●	5-6,8	44 (4.0)	●	5-6,8	45 (3.8)
Israel	●	6-12	43 (4.4)	●	6-12	47 (4.1)	●	1-6	24 (3.5)	●	1-9	24 (4.0)
Italy	●	5-8	83 (2.5)	●	4-8	91 (2.0)	●	5-8	89 (2.1)	●	6-7	94 (1.8)
Japan	○	9-12	1 (0.0)	●	6,9-12	12 (2.6)	○	--	13 (2.6)	○	--	8 (2.3)
Jordan	●	6	80 (3.5)	●	7	77 (3.8)	●	6	46 (4.3)	●	1,4-6	59 (4.5)
Korea, Rep. of	●	6	s 20 (3.2)	○	11-12	27 (3.5)	○	11-12	s 30 (3.2)	○	11-12	s 52 (3.6)
Latvia	●	6-7	s 76 (5.4)	●	6-8	51 (5.9)	○	9	s 30 (6.0)	○	9	s 34 (5.4)
Lebanon	●	--	r 85 (3.3)	○	12	r 66 (4.4)	●	--	r 85 (3.7)	○	11	r 60 (4.6)
Lithuania	●	5-8	78 (3.9)	●	5-8	52 (5.3)	●	5-8	47 (4.3)	●	5-8	48 (4.6)
Macedonia, Rep. of	●	5,9	99 (1.0)	●	5	99 (0.9)	●	8	97 (1.5)	○	9	92 (2.5)
Malaysia	●	8	98 (1.3)	●	7-8	89 (2.7)	○	10	37 (4.0)	○	10	92 (2.0)
Moldova, Rep. of	●	6-8	s 31 (8.7)	●	7	47 (10.8)	●	7,9	s 90 (5.6)	●	6-9	s 94 (3.9)
Morocco	●	--	s 76 (5.4)	●	--	24 (6.6)	○	--	s 10 (4.5)	○	--	s 67 (6.6)
Netherlands	●	--	r 37 (5.8)	●	--	r 40 (5.5)	○	--	r 66 (5.5)	●	--	r 93 (2.9)
New Zealand	●	8-9	73 (3.9)	●	8-9	58 (5.3)	●	K-12	11 (3.0)	●	K-12	24 (3.9)
Norway	●	6-7	42 (4.2)	●	6-7	54 (4.0)	●	2,4,8	58 (3.9)	●	2,6,8	44 (4.5)
Palestinian Nat'l Auth.	●	7,10-12	60 (3.8)	●	4,7-12	56 (4.0)	●	6-7,9-12	55 (4.2)	●	7-12	48 (4.3)
Philippines	●	8	97 (1.3)	●	8	88 (2.5)	●	8	78 (4.2)	●	8	71 (4.0)
Romania	●	8,12	99 (0.6)	●	8,12	99 (0.7)	●	4-7,9-11	94 (2.0)	●	4-7,11	97 (1.5)
Russian Federation	●	6-8,10	– –	●	6-8	– –	○	9	– –	○	9	– –
Saudi Arabia	●	--	76 (4.3)	●	--	70 (5.8)	○	10-12	28 (3.7)	●	--	32 (4.9)
Scotland	●	7	s 79 (3.4)	●	7	53 (3.5)	⦿	8	s 21 (3.1)	●	8	s 26 (3.5)
Serbia	●	7	92 (2.6)	●	7	92 (2.4)	●	8	95 (1.9)	●	8	93 (1.9)
Singapore	●	8	73 (2.2)	●	8	69 (2.0)	○	10	48 (2.1)	○	10	35 (2.2)
Slovak Republic	○	9	50 (5.1)	○	9	60 (4.9)	●	7	96 (2.0)	●	7	97 (1.6)
Slovenia	●	8	93 (2.0)	●	8	94 (2.1)	○	10	72 (3.7)	●	5	89 (2.3)
South Africa	●	--	r 79 (3.2)	⦿	--	r 66 (4.1)	⦿	--	r 55 (3.9)	⦿	--	r 50 (4.2)
Sweden	●	8	r 74 (3.8)	●	8	r 82 (2.9)	●	8	r 55 (4.0)	●	8	r 65 (3.7)
Syrian Arab Republic	⦿	--	– –	●	--	– –	●	--	– –	●	--	– –
Tunisia	○	11	94 (2.0)	○	11	26 (3.7)	○	12	65 (4.0)	○	--	47 (4.3)
United States	●	--	r 90 (2.0)	●	--	r 88 (2.3)	●	--	r 77 (2.9)	●	--	r 81 (2.5)
‡ England	●	5-8	x x	○	9	x x	●	7	x x	●	8	x x
International Avg.			69 (0.6)			63 (0.6)			58 (0.6)			63 (0.6)
Benchmarking Participants												
Basque Country, Spain	○	--	62 (5.2)	○	--	63 (4.6)	●	--	45 (5.3)	●	--	67 (5.4)
Indiana State, US	●	--	87 (4.3)	●	--	85 (4.0)	●	--	86 (4.4)	●	--	90 (4.0)
Ontario Province, Can.	●	7	94 (1.9)	●	7	90 (2.9)	●	8	48 (5.2)	●	5-8	61 (4.4)
Quebec Province, Can.	●	--	r 82 (3.8)	●	--	r 74 (4.5)	○	9	r 6 (2.3)	○	9	r 12 (3.1)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

● All or almost all students ⦿ Only the more able students ○ Not included in the curriculum through eighth grade

Background data on intended curriculum provided by National Research Coordinators, and on implemented curriculum by teachers at the time of testing.

For countries that teach science as separate subjects at grade 8, data are based on biology teachers only.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

Chemistry topics were also generally included in participants' eighth-grade intended curricula and widely taught, as shown in Exhibit 5.10. The most frequently reported topic – "classification and composition of matter" – was included for all or almost all students in 43 of the participating entities and taught to 85 percent of students, on average. Of "properties of solutions," "the particulate structure of matter," and "properties and uses of water," each was included in the curricula of at least 35 participants, and each was taught to 78 percent of students. In contrast, "classification of familiar chemical transformations" was included in the intended curriculum of just 17 participants, and was taught to just 47 percent of students, on average. Most participants indicated that this topic would be taught in later grades.

The TIMSS physics topics were widely included in participants' intended curricula at the eighth grade. Of the ten physics topics, three were in the curricula of at least 40 participants ("physical states and changes of matter," "the processes of melting, freezing, evaporation, and condensation," and "basic properties and behavior of light"), and the remaining seven in the curriculum of at least 34 participants (see Exhibit 5.11). Coverage in the classroom varied somewhat, however, from 85 percent of students, on average, having been taught "physical states and changes in matter" to just 51 percent having been taught "properties of permanent magnets and electromagnets." The latter topic also was one of those in the curriculum of fewest participants (34).

As noted earlier, the 11 earth science topics were included in fewer curricula than the other eighth-grade science topics. As shown in Exhibit 5.12, only one topic, "Earth's water cycle," appeared in the curricula of as many as 40 participants. A further seven were included in the curricula of between 30 and 40 participants. The two topics with the least coverage – "geological processes occurring over billions of years" and "the physical features of Earth" – were reported in the curriculum of between 20 and 30 participants. The percentages of students taught the topics in the classroom were rather similar, ranging from

Exhibit 5.10: Intended and Taught TIMSS Chemistry Topics

SCIENCE Grade 8

Chemistry	Classification and composition of matter			Properties of solutions			Particulate structure of matter			Properties and uses of water		
Countries	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic
Armenia	●	--	s 99 (1.1)	●	--	99 (1.1)	●	8,10	s 100 (0.0)	●	--	s 99 (1.1)
Australia	●	--	r 90 (2.7)	●	7	r 84 (2.8)	●	--	r 67 (4.0)	○	11-12	r 72 (3.2)
Bahrain	●	6-8	89 (2.5)	●	6,8	81 (3.0)	●	6,8	100 (0.0)	●	1-4	26 (3.0)
Belgium (Flemish)	○	--	– –	○	--	– –	○	--	– –	○	--	– –
Botswana	○	10	18 (3.5)	○	9	11 (3.0)	○	10	5 (2.1)	●	6	75 (4.4)
Bulgaria	●	6	r 99 (0.9)	●	6-7,10	r 60 (4.2)	●	6-8	r 100 (0.0)	●	6	r 80 (4.0)
Chile	●	6,8	96 (1.7)	○	--	95 (1.5)	●	7,10,12	94 (1.9)	●	8-9	93 (1.8)
Chinese Taipei	●	8	100 (0.0)	●	8	99 (0.7)	●	8	99 (0.7)	●	8	98 (1.1)
Cyprus	○	--	61 (1.0)	○	--	15 (1.0)	○	12	25 (1.3)	●	8	98 (0.6)
Egypt	●	8,11	97 (1.5)	●	5,8	94 (1.9)	●	5,7,8	100 (0.0)	●	6,8	97 (1.4)
Estonia	●	1,5,8-11	99 (1.1)	●	1,5,7-10	77 (4.1)	●	1,8-10	100 (0.0)	●	1,2,5,7-10	93 (2.5)
Ghana	●	7-9	93 (2.4)	●	8-9	90 (3.0)	●	8-9	92 (2.4)	●	8-9	80 (3.8)
Hong Kong, SAR	⦿	9	67 (4.7)	●	7	83 (3.7)	⦿	9	56 (4.7)	⦿	7	86 (3.3)
Hungary	●	7	100 (0.0)	●	7	100 (0.0)	●	7	99 (0.7)	●	7	99 (1.0)
Indonesia	○	10-12	– –	○	10-12	– –	○	10-12	– –	○	10-12	– –
Iran, Islamic Rep. of	●	5,7-8	100 (0.0)	●	6,8	98 (1.0)	●	5-6,8	99 (0.6)	●	6,8	91 (2.4)
Israel	●	7-8	91 (2.6)	○	10-12	80 (3.9)	●	7-8	98 (1.0)	●	1-8	94 (2.4)
Italy	●	6	94 (1.4)	●	6-7	87 (2.1)	●	6-7	95 (1.6)	●	6	93 (1.8)
Japan	●	3-12	98 (1.2)	●	5-7,10-12	97 (1.5)	●	8,10-12	83 (3.5)	●	4,7,10-12	99 (1.0)
Jordan	●	3,5-7	93 (2.1)	●	6-7	79 (2.9)	●	6-8	99 (0.5)	●	1,3,6	81 (3.3)
Korea, Rep. of	●	8	s 89 (2.7)	●	5	90 (2.4)	○	12	s 40 (4.0)	●	7	s 46 (4.2)
Latvia	●	8-9	x x	●	8-9	x x	●	8-9	x x	●	8-9	x x
Lebanon	○	--	99 (0.7)	○	--	98 (1.3)	●	--	95 (2.1)	○	10	74 (5.2)
Lithuania	●	5-8	99 (0.7)	●	5-8	94 (2.3)	●	5-8	98 (1.1)	●	5-8	21 (3.9)
Macedonia, Rep. of	●	7	99 (1.2)	●	7	99 (1.2)	●	7-8	98 (1.3)	●	7	99 (1.2)
Malaysia	●	7	87 (3.1)	●	8	96 (1.8)	●	7	61 (4.1)	●	8	97 (1.2)
Moldova, Rep. of	●	7	s 96 (2.0)	●	7	91 (3.4)	●	7	s 99 (1.0)	●	8	s 94 (2.9)
Morocco	●	--	s 87 (4.8)	●	--	91 (4.1)	●	--	s 61 (8.3)	●	--	s 46 (8.2)
Netherlands	●	--	r 47 (5.8)	●	--	r 35 (4.9)	⦿	--	r 23 (4.1)	●	--	r 71 (5.3)
New Zealand	●	8-9	94 (1.9)	⦿	8-9	76 (4.8)	●	8-9	77 (3.9)	●	8	75 (3.3)
Norway	●	5,7	42 (4.6)	○	--	41 (4.5)	○	9	30 (4.1)	●	3,7	88 (2.8)
Palestinian Nat'l Auth.	●	4,7-8, 10-12	90 (2.5)	○	10-12	87 (2.9)	●	7-8, 11-12	99 (0.7)	●	4,7,11	74 (3.7)
Philippines	●	7	r 40 (4.7)	○	9	r 35 (4.7)	●	7	r 40 (4.6)	○	9	r 41 (4.5)
Romania	●	4,7	99 (0.8)	●	7,9	95 (2.0)	●	7,9	99 (0.8)	●	4,7,9-10	94 (2.0)
Russian Federation	●	8	– –	○	9	– –	●	7-8	– –	●	7-8	– –
Saudi Arabia	●	--	71 (4.1)	●	8	66 (3.8)	○	9	82 (3.4)	○	9	69 (3.6)
Scotland	●	8	s 94 (1.6)	●	7	93 (1.6)	●	7	s 78 (2.7)	⦿	8	s 79 (3.2)
Serbia	●	7	96 (1.6)	●	7	96 (1.6)	●	7	97 (1.2)	●	7	95 (1.6)
Singapore	●	7	87 (1.7)	●	7	85 (1.8)	●	8	88 (2.0)	●	4	71 (2.7)
Slovak Republic	●	8	99 (0.6)	⦿	8	92 (2.8)	●	8	100 (0.3)	⦿	8	99 (0.4)
Slovenia	●	7	100 (0.0)	●	8	59 (4.0)	●	8	100 (0.0)	●	5,8	62 (4.2)
South Africa	●	--	r 76 (3.3)	⦿	--	r 64 (4.1)	⦿	--	r 69 (3.3)	⦿	--	r 62 (4.0)
Sweden	●	7	r 96 (1.5)	●	7	r 87 (2.7)	●	7-9	r 67 (3.4)	●	7	r 94 (2.0)
Syrian Arab Republic	○	12	– –	○	11-12	– –	●	--	– –	●	--	– –
Tunisia	○	10	r 16 (3.5)	○	10	r 16 (3.5)	○	10	r 4 (1.8)	○	10	r 19 (3.8)
United States	●	--	r 85 (2.7)	●	--	r 72 (3.0)	●	--	r 88 (2.4)	●	--	r 84 (2.7)
‡ England	●	K-7	x x	●	5-6	x x	●	7	x x	●	4	x x
International Avg.			85 (0.4)			78 (0.5)			78 (0.4)			78 (0.5)
Benchmarking Participants												
Basque Country, Spain	●	--	80 (4.6)	●	--	56 (5.5)	○	10	82 (4.1)	●	--	83 (3.6)
Indiana State, US	●	--	96 (2.5)	●	--	74 (5.1)	●	--	94 (3.3)	●	--	89 (4.0)
Ontario Province, Can.	●	7	83 (3.5)	●	7	88 (3.3)	○	9	66 (4.6)	●	5,8	84 (3.3)
Quebec Province, Can.	●	--	r 86 (2.8)	●	--	r 91 (2.0)	○	10	r 19 (3.3)	●	--	r 83 (3.4)

● All or almost all students ⦿ Only the more able students ○ Not included in the curriculum through eighth grade

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data on intended curriculum provided by National Research Coordinators, and on implemented curriculum by teachers at the time of testing.

For countries that teach science as separate subjects at grade 8, data are based on chemistry teachers only.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

Exhibit 5.10: Intended and Taught TIMSS Chemistry Topics

SCIENCE Grade 8

Chemistry	The properties and common uses of acids and bases			Chemical change			The need for oxygen in common oxidation reactions			Classification of familiar chemical transformations		
Countries	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic
Armenia	●	--	s 100 (0.0)	●	8,10	99 (1.1)	●	8,10	s 96 (1.7)	●	8,10	s 82 (3.7)
Australia	○	9-10	r 46 (4.2)	●	--	r 67 (3.2)	○	10-11	r 23 (3.1)	○	10	r 19 (2.4)
Bahrain	●	8	94 (2.0)	●	6,8	74 (2.6)	●	6-7	58 (3.3)	○	--	33 (2.9)
Belgium (Flemish)	○	--	– –	○	--	– –	○	--	– –	○	--	– –
Botswana	○	10	3 (1.6)	○	10	4 (2.0)	○	10	2 (1.2)	○	11	3 (1.5)
Bulgaria	●	7-8	r 99 (0.8)	●	6-8	r 84 (4.0)	●	6,8	r 83 (3.9)	○	9-10	r 43 (4.6)
Chile	○	--	70 (3.7)	●	8,10-12	82 (3.1)	●	8,11	67 (3.7)	●	6,11-12	71 (3.4)
Chinese Taipei	○	9	35 (4.2)	●	8	99 (0.9)	●	8	97 (1.4)	●	8	95 (1.9)
Cyprus	●	8	99 (0.4)	●	8	31 (1.0)	○	--	11 (1.0)	○	--	28 (1.1)
Egypt	●	5,8	93 (2.1)	●	4,8	95 (1.8)	●	8	98 (1.3)	●	8	96 (1.5)
Estonia	●	8-11	83 (3.9)	●	7-11	91 (3.5)	●	5,7-11	92 (2.9)	●	7-10	38 (5.0)
Ghana	●	7-9	43 (4.4)	●	7-8	59 (4.4)	●	7-8	28 (4.2)	○	9	26 (4.5)
Hong Kong, SAR	●	8	95 (2.0)	○	10	22 (3.6)	○	10	41 (4.5)	○	10	25 (4.2)
Hungary	●	8	93 (2.1)	●	7	96 (1.6)	●	7	91 (2.3)	●	7	94 (2.1)
Indonesia	○	10-12	– –	○	10-12	– –	○	10-12	– –	○	10-12	– –
Iran, Islamic Rep. of	●	7-8	81 (3.0)	●	5,7-8	92 (2.2)	●	5,7-8	89 (2.6)	●	8	57 (4.2)
Israel	●	7-8	49 (4.9)	●	7-8	82 (3.2)	●	7-8	81 (3.1)	○	10-12	32 (4.3)
Italy	●	6-8	63 (3.5)	●	6-8	62 (3.6)	●	6-7	82 (2.8)	●	6-8	61 (3.5)
Japan	●	6,7, 10-12	65 (4.0)	●	5-12	91 (2.5)	●	6,8-12	75 (3.7)	○	9-12	30 (4.2)
Jordan	●	6	64 (4.2)	●	6	76 (3.6)	●	8	91 (2.6)	●	8	37 (4.6)
Korea, Rep. of	○	10	s 16 (3.0)	○	9	28 (3.3)	○	11	s 22 (3.6)	○	12	s 21 (2.5)
Latvia	●	8-9	x x	●	8-9	x x	●	8-9	x x	●	8-9	x x
Lebanon	●	--	69 (4.6)	●	--	r 94 (2.9)	●	--	88 (3.3)	●	--	83 (3.6)
Lithuania	●	--	5 (2.3)	●	7-8	84 (3.1)	●	7-8	70 (4.1)	○	9-10	63 (4.4)
Macedonia, Rep. of	●	8	99 (1.2)	●	7	96 (1.9)	●	7-8	97 (1.5)	●	7-8	90 (2.9)
Malaysia	●	8	97 (1.6)	○	10	55 (4.7)	●	7	83 (3.2)	○	10	72 (4.1)
Moldova, Rep. of	●	8	s 96 (2.0)	●	8	96 (2.2)	●	8	s 93 (2.2)	○	9	s 88 (2.7)
Morocco	○	--	s 23 (6.5)	●	--	83 (5.4)	●	--	s 96 (3.0)	○	--	s 38 (7.1)
Netherlands	●	--	r 20 (4.3)	●	--	r 11 (3.3)	●	--	r 47 (5.2)	⦿	--	r 11 (3.9)
New Zealand	●	8-9	32 (5.1)	⦿	8-9	64 (4.5)	⦿	8-9	28 (4.8)	○	10	22 (4.4)
Norway	●	8,10	– –	●	3,5,9	19 (3.3)	●	8-9	36 (4.7)	○	--	15 (2.5)
Palestinian Nat'l Auth.	●	8-9	90 (2.5)	●	8-12	60 (4.6)	●	3,8, 10-12	64 (4.4)	○	11-12	17 (3.2)
Philippines	○	9	r 40 (4.6)	●	7	r 36 (4.7)	○	9	r 33 (4.6)	⦿	9	r 34 (4.3)
Romania	●	8-10	98 (1.3)	●	7-10	98 (1.3)	●	7-8,10	95 (2.0)	●	7,10	84 (3.2)
Russian Federation	●	8	– –	●	8	– –	●	8	– –	●	8	– –
Saudi Arabia	○	9	41 (3.7)	●	--	66 (4.3)	●	--	87 (2.7)	○	10-12	21 (5.3)
Scotland	●	8	s 90 (2.0)	●	7	71 (3.2)	●	7	s 59 (3.3)	●	7	s 38 (3.5)
Serbia	●	7	96 (1.6)	●	7	95 (1.8)	●	7	97 (1.4)	○	--	85 (3.2)
Singapore	●	7	81 (2.3)	●	8	77 (2.5)	●	8	55 (2.8)	○	10	53 (2.7)
Slovak Republic	●	8-9	75 (4.5)	●	8-9	79 (4.1)	●	8	45 (4.8)	●	8	11 (2.3)
Slovenia	○	9	43 (4.2)	●	8	89 (2.8)	●	8	78 (3.9)	●	8	95 (1.7)
South Africa	○	--	r 40 (4.3)	○	--	r 43 (4.0)	○	--	r 43 (4.0)	○	--	r 40 (3.5)
Sweden	●	8	r 83 (2.9)	⦿	7-9	r 50 (3.7)	⦿	8-9	r 61 (3.5)	⦿	8-9	r 18 (2.5)
Syrian Arab Republic	○	9	– –	○	12	– –	●	--	– –	○	11-12	– –
Tunisia	○	11	r 19 (3.6)	○	10	r 11 (3.1)	○	10	r 13 (3.1)	○	10	r 9 (2.7)
United States	●	--	r 66 (3.3)	●	--	r 73 (3.0)	⦿	--	r 58 (3.4)	○	--	r 60 (3.1)
‡ England	●	6	x x	●	6,8	x x	●	8	x x	○	--	x x
International Avg.			65 (0.5)			68 (0.5)			65 (0.5)			47 (0.6)
Benchmarking Participants												
Basque Country, Spain	○	10	15 (4.1)	⦿	11	44 (5.8)	○	12	43 (5.2)	⦿	10	26 (4.6)
Indiana State, US	●	--	61 (5.7)	○	9-12	87 (4.7)	○	9-12	67 (5.8)	○	9-12	66 (6.1)
Ontario Province, Can.	○	10	38 (4.3)	●	5	42 (4.5)	○	10	32 (4.3)	○	10	50 (4.5)
Quebec Province, Can.	○	10	r 16 (3.9)	●	--	r 13 (2.7)	○	11	r 50 (5.2)	○	11	r 42 (4.9)

● All or almost all students ⦿ Only the more able students ○ Not included in the curriculum through eighth grade

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data on intended curriculum provided by National Research Coordinators, and on implemented curriculum by teachers at the time of testing.

For countries that teach science as separate subjects at grade 8, data are based on chemistry teachers only.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

Exhibit 5.11: Intended and Taught TIMSS Physics Topics

SCIENCE Grade 8

Physics	Physical states and changes in matter			The processes of melting, freezing, evaporation, and condensation			Energy types, sources, and conversions, including heat transfer			Thermal expansion and changes in volume and/or pressure		
Countries	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic
Armenia	●	5	s 100 (0.4)	●	5	97 (1.3)	●	5	s 96 (1.7)	●	4	s 64 (4.7)
Australia	●	--	r 85 (2.5)	○	11	r 91 (2.0)	○	11	r 65 (4.2)	○	--	r 43 (3.8)
Bahrain	●	3,5-7	86 (2.2)	●	2,5,7	95 (1.5)	●	5,7	93 (1.6)	●	5	83 (2.3)
Belgium (Flemish)	○	--	43 (4.8)	○	--	60 (4.9)	○	--	32 (5.2)	○	--	25 (5.3)
Botswana	●	6	92 (2.5)	●	7	89 (3.2)	●	6	65 (4.4)	○	11	16 (3.5)
Bulgaria	●	6	r 96 (1.9)	●	8	r 99 (0.9)	●	8	r 99 (0.7)	●	8	r 96 (1.7)
Chile	●	7	93 (2.0)	●	8	96 (1.4)	●	6,10	93 (2.0)	○	10	77 (3.4)
Chinese Taipei	●	8	99 (0.7)	●	8	99 (0.8)	○	9	60 (4.1)	●	8	75 (3.5)
Cyprus	●	7-9	95 (1.6)	●	7-10	100 (0.0)	●	7-9	84 (2.7)	●	7-9	100 (0.0)
Egypt	●	5	97 (1.5)	●	5,8	99 (0.6)	●	5,8	99 (0.9)	●	8	95 (1.8)
Estonia	●	1,7-8,10	82 (3.2)	●	1,2,5,9-10	39 (4.5)	●	5,7-9	50 (5.0)	●	7,9-10	45 (4.9)
Ghana	●	7	89 (2.6)	●	7-8	83 (3.2)	●	8-9	73 (4.2)	●	8	28 (4.5)
Hong Kong, SAR	●	7	85 (3.6)	●	7	85 (3.2)	●	7	87 (3.4)	●	7	73 (3.8)
Hungary	●	7	98 (1.1)	●	7	91 (2.0)	●	7	94 (1.5)	●	7	93 (2.2)
Indonesia	●	7	97 (1.8)	●	6	97 (1.7)	●	6	100 (0.5)	●	8	96 (1.9)
Iran, Islamic Rep. of	●	5-8	96 (1.5)	●	5-6,8	99 (0.7)	●	6-8	96 (1.6)	●	6-8	93 (2.0)
Israel	●	7-8	98 (1.3)	●	7-8	98 (1.0)	○	9	40 (3.6)	●	7-9	92 (1.7)
Italy	●	6-7	95 (1.5)	●	6	94 (1.7)	●	5-8	80 (3.0)	●	6-7	85 (2.6)
Japan	○	10-12	53 (4.0)	●	7,10-12	91 (2.5)	○	9-12	9 (2.2)	●	4,7,10-12	50 (4.3)
Jordan	●	3,5,7	91 (2.7)	●	3,6-7	87 (2.7)	●	2,5,6,8	84 (3.1)	●	7	65 (4.1)
Korea, Rep. of	●	7	s 78 (3.3)	●	7	88 (2.7)	●	5,9-10	s 46 (3.9)	●	4	s 64 (4.0)
Latvia	●	8-9	s 100 (0.0)	●	8-9	62 (6.8)	●	8-9	s 60 (6.7)	●	8-9	s 70 (6.1)
Lebanon	○	--	97 (1.3)	○	9	97 (1.4)	●	8,12	91 (4.5)	○	11	90 (2.7)
Lithuania	●	5-8	83 (3.5)	●	7-8	12 (3.0)	●	5-8	51 (4.8)	●	7-8	24 (4.1)
Macedonia, Rep. of	●	7	99 (0.6)	●	7	99 (0.6)	●	7	99 (0.6)	●	7	99 (0.6)
Malaysia	●	7	94 (2.2)	●	7	97 (1.6)	●	7	95 (2.1)	●	7	74 (3.8)
Moldova, Rep. of	●	6	s 91 (2.9)	●	6-7	89 (3.9)	●	7	s 91 (3.5)	●	8	s 88 (2.8)
Morocco	●	--	s 74 (6.9)	●	--	86 (5.6)	○	--	s 21 (6.6)	●	--	s 94 (3.5)
Netherlands	●	--	r 68 (5.5)	●	--	84 (3.7)	●	--	r 76 (5.0)	○	10	r 18 (4.0)
New Zealand	●	8-9	86 (3.8)	●	8-9	92 (3.5)	⦿	8-9	76 (4.4)	○	11-12	38 (5.5)
Norway	●	8	86 (3.1)	○	10	81 (3.3)	○	9-10	25 (3.6)	○	10	46 (4.4)
Palestinian Nat'l Auth.	●	7,11-12	91 (2.4)	●	7,9-12	92 (2.3)	●	3-6, 9-12	85 (2.8)	●	7,10	78 (3.3)
Philippines	●	7	r 37 (4.4)	●	7-9	r 34 (4.3)	●	7,9-10	r 40 (4.3)	○	9-10	r 22 (4.2)
Romania	●	3,6,11	95 (2.0)	●	4,7-8,11	98 (1.2)	●	6,7,9,11	92 (2.6)	●	6,11	97 (1.8)
Russian Federation	●	7	– –	●	7-8	– –	●	7-8	– –	●	7-8	– –
Saudi Arabia	●	--	87 (3.1)	●	--	82 (3.6)	○	9	31 (6.3)	○	10	50 (5.4)
Scotland	●	7	s 89 (2.2)	●	7	90 (2.4)	●	8	s 97 (1.0)	⦿	8	s 68 (3.9)
Serbia	●	6	95 (1.9)	●	7	94 (1.7)	●	7-8	93 (1.9)	●	7	91 (2.3)
Singapore	●	8	89 (1.8)	○	9	76 (2.2)	●	7	82 (2.1)	●	7	73 (2.8)
Slovak Republic	●	6	99 (1.0)	●	8	98 (0.5)	●	8	89 (3.3)	●	8	94 (1.7)
Slovenia	●	7	81 (3.3)	●	8	31 (4.3)	●	8	75 (4.0)	●	8	50 (4.7)
South Africa	⦿	--	r 66 (4.1)	⦿	--	r 65 (3.9)	●	--	r 70 (3.6)	○	--	r 28 (4.1)
Sweden	●	8	r 82 (3.3)	●	8	r 88 (2.6)	○	9	r 46 (4.0)	●	8	r 48 (3.5)
Syrian Arab Republic	○	--	– –	○	9	– –	○	9	– –	○	9	– –
Tunisia	○	10	r 5 (2.1)	○	10	r 17 (3.5)	○	10	r 17 (3.7)	○	10	r 11 (2.8)
United States	●	--	r 86 (2.1)	●	--	r 84 (2.2)	●	--	r 76 (2.6)	●	--	r 66 (3.1)
‡ England	●	K,1,6	s 97 (1.0)	●	4,6	x x	●	6-8	s 96 (1.8)	●	7	s 82 (4.0)
International Avg.			85 (0.4)			82 (0.4)			72 (0.5)			66 (0.5)
Benchmarking Participants												
Basque Country, Spain	⦿	10	93 (1.9)	●	--	89 (3.5)	●	--	75 (3.8)	●	--	71 (4.4)
Indiana State, US	●	--	97 (1.6)	●	--	93 (3.0)	●	--	80 (5.2)	●	--	80 (5.0)
Ontario Province, Can.	●	5-8	88 (3.0)	●	5-8	93 (2.6)	●	7	84 (3.6)	●	7	79 (4.1)
Quebec Province, Can.	●	--	r 64 (5.1)	●	--	r 78 (4.2)	●	--	r 68 (4.5)	⦿	10	r 63 (5.4)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

● All or almost all students ⦿ Only the more able students ○ Not included in the curriculum through eighth grade

Background data on intended curriculum provided by National Research Coordinators, and on implemented curriculum by teachers at the time of testing.

For countries that teach science as separate subjects at grade 8, data are based on physics teachers only.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

Exhibit 5.11: Intended and Taught TIMSS Physics Topics *(Continued...)*

Physics	Basic properties/behavior of light			Properties of sound			Electric circuits and relationships between voltage and current			Properties of permanent magnets and electromagnets		
Countries	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic
Armenia	●	8	s 92 (2.0)	●	8	68 (3.8)	●	7	s 98 (1.1)	●	8	s 94 (2.0)
Australia	●	--	r 19 (3.5)	●	--	r 28 (3.4)	●	--	r 43 (4.4)	●	--	r 58 (4.1)
Bahrain	●	2,5,8	96 (1.6)	●	2,7	91 (2.4)	●	3,5-7	91 (2.3)	●	3,5,8	97 (1.5)
Belgium (Flemish)	○	--	20 (3.6)	○	--	0 (0.0)	○	--	34 (3.7)	○	--	3 (1.2)
Botswana	○	9	3 (1.4)	●	8	78 (3.7)	○	10	2 (1.3)	○	11	2 (1.1)
Bulgaria	●	7	r 95 (2.8)	●	7	r 86 (4.1)	●	7	r 96 (2.5)	●	7	r 90 (2.6)
Chile	○	9	36 (4.0)	○	9	27 (3.2)	●	6,9	55 (4.2)	○	9	41 (3.7)
Chinese Taipei	●	8	95 (1.9)	●	8	95 (1.8)	●	8	41 (3.9)	○	9	15 (2.9)
Cyprus	●	8-9	80 (2.2)	○	--	6 (0.6)	○	--	1 (0.2)	●	--	4 (0.2)
Egypt	●	8	95 (1.8)	●	5,8	99 (0.9)	●	8	100 (0.0)	●	5	82 (3.3)
Estonia	●	8	97 (2.2)	●	8,11	31 (4.3)	●	3,9,11	6 (2.1)	●	3,9	5 (1.9)
Ghana	●	8-9	24 (4.1)	●	8-9	10 (2.8)	●	8-9	15 (3.0)	○	9	24 (3.9)
Hong Kong, SAR	○	9	12 (2.3)	⦿	8	64 (4.3)	●	8	98 (1.3)	⦿	8	61 (4.1)
Hungary	●	8	33 (3.7)	○	11	32 (3.8)	●	8	98 (0.7)	●	8	93 (1.6)
Indonesia	●	6,8	97 (1.5)	●	7	100 (0.0)	○	9	10 (2.9)	○	9	13 (3.2)
Iran, Islamic Rep. of	●	5,7-8	97 (1.3)	●	7-8	86 (2.9)	●	8	80 (3.4)	●	8	90 (2.5)
Israel	●	6-12	23 (3.3)	●	6-12	16 (3.4)	●	5-8	84 (3.0)	●	5-8	r 61 (4.6)
Italy	●	6-8	38 (3.5)	●	8	37 (3.6)	●	8	54 (3.8)	●	8	44 (3.7)
Japan	●	3,7,10-12	99 (1.0)	●	3,7,10-12	99 (1.0)	●	3,4,8, 10-12	100 (0.0)	●	3,6,8, 10-12	89 (2.7)
Jordan	●	2,4,8	95 (1.9)	●	4,8	97 (1.5)	●	4,6-7	97 (1.3)	●	1,4	92 (2.3)
Korea, Rep. of	●	7	s 67 (3.4)	●	7	57 (3.7)	●	8	s 87 (2.8)	●	6	s 26 (3.8)
Latvia	●	8-9	s 100 (0.0)	●	8-9	96 (2.1)	●	8-9	s 11 (3.7)	●	8-9	s 9 (3.5)
Lebanon	●	8	56 (4.5)	●	8	68 (4.8)	○	9-10,12	90 (2.6)	○	11-12	74 (4.7)
Lithuania	●	5-8	58 (4.3)	●	5-8	51 (4.6)	●	5-8	10 (2.2)	●	5-8	6 (2.3)
Macedonia, Rep. of	●	8	97 (1.5)	○	10	93 (2.3)	●	8	99 (0.9)	●	8	97 (1.5)
Malaysia	●	8	97 (1.5)	●	8	95 (1.9)	○	9	8 (2.3)	○	9	12 (2.8)
Moldova, Rep. of	●	6,8	s 58 (4.4)	●	7	29 (4.3)	●	8	s 65 (4.6)	●	8	s 70 (4.3)
Morocco	●	--	s 48 (8.1)	○	--	10 (4.3)	●	--	s 94 (3.6)	●	--	s 83 (6.4)
Netherlands	●	--	r 76 (4.8)	●	--	r 57 (5.2)	●	--	r 65 (5.0)	●	--	r 20 (4.4)
New Zealand	●	6-9	71 (5.0)	●	6-7	26 (4.1)	⦿	8-9	16 (3.6)	●	6-9	14 (3.1)
Norway	●	1,6	3 (1.5)	●	2,7	5 (1.9)	●	7,9	8 (2.6)	●	5,7	4 (1.5)
Palestinian Nat'l Auth.	●	3,8, 11-12	96 (1.7)	●	3,8, 11-12	98 (1.0)	●	3-12	59 (4.0)	●	3,7,12	88 (2.8)
Philippines	○	10	r 29 (4.2)	○	10	r 21 (3.9)	○	10	r 22 (3.7)	○	10	r 19 (3.5)
Romania	●	6-7,11-12	99 (1.1)	●	7,11	94 (2.3)	●	6-8,10	99 (1.1)	●	6,8,10	98 (1.3)
Russian Federation	●	8	– –	○	9	– –	●	8	– –	●	8	– –
Saudi Arabia	●	--	93 (2.4)	●	--	94 (2.1)	●	--	28 (4.6)	●	--	49 (5.4)
Scotland	●	7	s 56 (4.4)	●	7-8	58 (4.7)	●	8	s 90 (2.5)	⦿	8	s 53 (4.7)
Serbia	●	8	95 (1.1)	●	7	96 (1.4)	●	8	99 (0.7)	●	8	98 (0.8)
Singapore	●	8	90 (2.0)	●	8	85 (1.4)	●	8	95 (1.0)	●	3-9	52 (2.2)
Slovak Republic	○	9	6 (1.3)	○	9	2 (1.0)	●	8	97 (1.7)	●	8	91 (2.1)
Slovenia	●	7	17 (3.0)	●	7	10 (2.0)	○	9	6 (2.0)	○	9	8 (2.5)
South Africa	○	--	r 20 (3.0)	○	--	r 20 (2.8)	●	--	r 70 (3.8)	○	--	r 38 (4.8)
Sweden	●	8-9	r 49 (3.7)	●	8-9	r 51 (3.2)	●	7	r 84 (3.0)	●	8	r 65 (3.4)
Syrian Arab Republic	○	9,11-12	– –	○	9	– –	●	--	– –	○	12	– –
Tunisia	○	10	r 6 (2.2)	○	--	r 3 (1.6)	○	10	r 22 (3.8)	○	12	r 7 (2.4)
United States	●	--	r 63 (2.6)	●	--	r 58 (2.9)	●	--	r 55 (3.0)	●	--	r 57 (3.0)
‡ England	●	K,2,5-6	s 97 (1.1)	●	K,4,6	94 (2.2)	●	1,3,5,6, 8	x x	●	2,5,7	s 96 (1.3)
International Avg.			62 (0.5)			56 (0.5)			59 (0.4)			51 (0.5)
Benchmarking Participants												
Basque Country, Spain	⦿	10	52 (5.6)	○	12	47 (5.8)	⦿	10	61 (5.6)	○	11	49 (5.7)
Indiana State, US	●	--	64 (5.4)	●	--	57 (6.5)	●	--	67 (6.7)	●	--	64 (5.6)
Ontario Province, Can.	●	8	62 (5.2)	●	4	46 (5.1)	●	6	65 (4.3)	●	6	71 (4.6)
Quebec Province, Can.	○	11	r 12 (2.8)	○	11	r 8 (1.9)	○	10	r 3 (1.6)	○	10	r 5 (2.2)

● All or almost all students ⦿ Only the more able students ○ Not included in the curriculum through eighth grade

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data on intended curriculum provided by National Research Coordinators, and on implemented curriculum by teachers at the time of testing.

For countries that teach science as separate subjects at grade 8, data are based on physics teachers only.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

Exhibit 5.11: **Intended and Taught TIMSS Physics Topics** *(…Continued)*

SCIENCE Grade 8

Physics	Forces and motion, uses of distance/time graphs				Effects of density and pressure			
Countries	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught		Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught		Percent of students taught the topic
Armenia	●	7	s	87 (3.0)	●	5		95 (1.9)
Australia	●	--	r	48 (3.8)	○	11	r	22 (3.1)
Bahrain	●	1-2,7		85 (2.3)	●	2,4,6-7		82 (2.2)
Belgium (Flemish)	○	--		27 (4.1)	○	--		12 (2.7)
Botswana	○	11		5 (2.1)	○	11		19 (4.2)
Bulgaria	●	8	r	99 (0.6)	●	6	r	88 (2.6)
Chile	●	5,10		72 (4.0)	○	--		68 (3.7)
Chinese Taipei	○	9		25 (3.6)	●	8		75 (3.2)
Cyprus	○	9		2 (0.2)	○	9		12 (2.2)
Egypt	●	5,8		78 (3.9)	●	6		87 (2.9)
Estonia	●	2,7-8,10		96 (2.4)	●	8		95 (2.4)
Ghana	●	7-9		45 (4.2)	●	7-9		43 (3.6)
Hong Kong, SAR	○	10		77 (3.4)	●	7		55 (4.6)
Hungary	●	7		97 (1.3)	●	7		76 (3.8)
Indonesia	●	7		93 (2.1)	●	7		89 (2.6)
Iran, Islamic Rep. of	●	6,8		84 (2.9)	●	8		82 (3.0)
Israel	○	--		20 (3.7)	○	--		59 (4.3)
Italy	●	6-7		87 (2.4)	●	8		61 (3.3)
Japan	●	5,7,9-12		5 (1.7)	●	4,7,10-12		85 (3.3)
Jordan	●	3,5,7-8		91 (2.4)	●	7		72 (3.9)
Korea, Rep. of	●	8	s	90 (2.3)	●	7		77 (3.6)
Latvia	●	8-9	s	46 (6.9)	●	8-9		62 (6.2)
Lebanon	○	9-12		91 (2.3)	○	10-11		79 (4.0)
Lithuania	●	5-8		93 (2.7)	●	7-8		85 (3.6)
Macedonia, Rep. of	●	7		99 (0.6)	●	7-8		95 (1.8)
Malaysia	○	10		90 (2.9)	●	7		79 (3.6)
Moldova, Rep. of	●	7	s	89 (2.6)	●	7		92 (3.0)
Morocco	●	--	s	69 (7.2)	○	--		23 (7.1)
Netherlands	⦿	--	r	41 (4.7)	○	9	r	18 (3.6)
New Zealand	●	6-9		40 (5.0)	○	9		21 (4.2)
Norway	○	--		39 (4.2)	●	8		31 (3.8)
Palestinian Nat'l Auth.	●	3,6, 10-12		47 (4.2)	●	7,10-12		74 (3.4)
Philippines	○	10	r	42 (4.2)	○	9-10	r	31 (4.1)
Romania	●	6-7,9		98 (1.4)	○	11		92 (2.4)
Russian Federation	●	7		– –	●	7		– –
Saudi Arabia	●	--		79 (4.0)	●	--		56 (5.6)
Scotland	○	9-10	s	63 (3.9)	⦿	8		36 (3.5)
Serbia	●	7		95 (1.6)	●	6-7		95 (1.5)
Singapore	●	7		62 (2.5)	●	7		61 (2.8)
Slovak Republic	●	7		100 (0.0)	●	7		95 (1.8)
Slovenia	●	8		65 (4.3)	●	8		97 (1.5)
South Africa	⦿	--	r	51 (3.7)	○	--	r	41 (4.3)
Sweden	⦿	7	r	71 (3.8)	●	7-8	r	57 (3.9)
Syrian Arab Republic	●	--		– –	●	--		– –
Tunisia	○	12	r	12 (2.9)	○	11	r	4 (1.9)
United States	●	--	r	77 (3.0)	●	--	r	77 (2.7)
‡ England	●	K,1,3,5-6,8	s	94 (2.2)	●	8		85 (3.4)
International Avg.				66 (0.5)				63 (0.5)
Benchmarking Participants								
Basque Country, Spain	⦿	10		66 (5.2)	○	10		57 (4.8)
Indiana State, US	●	--		84 (5.1)	●	--		92 (3.2)
Ontario Province, Can.	●	5,7-8		57 (4.7)	●	8		79 (3.3)
Quebec Province, Can.	○	11	r	9 (2.1)	⦿	10	r	34 (4.3)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

● All or almost all students ⦿ Only the more able students ○ Not included in the curriculum through eighth grade

Background data on intended curriculum provided by National Research Coordinators, and on implemented curriculum by teachers at the time of testing.

For countries that teach science as separate subjects at grade 8, data are based on physics teachers only.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

68 percent for the "Earth's water cycle" to 54 percent for "weather data and maps, and changes in weather patterns."

Environmental science had just three topics in the TIMSS eighth-grade science assessment; and, as noted earlier, did not receive as much emphasis as topics in other areas either in the intended or the implemented curriculum. As shown in detail in Exhibit 5.13, the three topics were included for most students in the intended curricula of between 30 and 39 participants. "Changes in environments" and "use and conservation of natural resources" were included in the curricula of 39 and 38 participants, respectively, and had the greatest percentages of students who were taught them – 53 percent and 56 percent, respectively. "Trends in human population and its effects on the environment" was included in 30 participants' curricula and was taught to just 38 percent of students, on average.

At the fourth grade, 10 of the 32 TIMSS science topics were in life science. As shown in Exhibit 5.14, three of the topics – "types, characteristics, and classification of living things," "major body structures and their function in humans and other organisms," and "the general steps in the life cycle of familiar organisms" – were included in two-thirds or more of participants' intended curricula and were generally well-covered in the classroom. On average, 82 percent, 77 percent, and 78 percent of students, respectively, were taught these topics. The remaining life science topics were included in fewer participants' curricula, from a maximum of 17 to a minimum of 13. The average percentage of students taught these topics ranged from 80 percent for "ways of maintaining good health, including diet and exercise" to 53 percent for "plant and animal reproduction."

As shown in Exhibit 5.15, the 13 TIMSS physical science topics vary considerably, both in terms of inclusion in the intended curriculum and in being taught in the classroom. Just three of the topics were included in the curricula of 20 or more participants – "classification of objects and materials based on physical properties," "properties and uses of water," and "changes in state of water by heating and

Exhibit 5.12: Intended and Taught TIMSS Earth Science Topics

SCIENCE Grade 8

Earth Science	Earth's structure and physical features			Water on the Earth			The Earth's atmosphere			Earth's water cycle		
Countries	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic
Armenia	●	5	s 98 (2.5)	●	5	98 (2.5)	●	5	s 98 (2.5)	●	5	s 98 (2.5)
Australia	●	--	r 63 (3.9)	○	--	r 43 (4.2)	○	--	r 57 (3.9)	○	--	r 57 (3.5)
Bahrain	●	8	5 (1.4)	●	6-7	7 (1.5)	●	6-7	8 (2.1)	●	3-4,7	19 (2.6)
Belgium (Flemish)	○	--	r 38 (4.0)	○	--	r 16 (2.6)	○	--	r 12 (2.4)	○	--	r 34 (4.0)
Botswana	○	10	2 (1.4)	○	11	14 (3.2)	○	11	r 6 (2.3)	●	8	64 (3.8)
Bulgaria	●	8	r 98 (1.4)	●	8	r 100 (0.0)	●	8	r 100 (0.0)	●	8	r 100 (0.5)
Chile	○	--	77 (2.9)	○	9	84 (3.2)	○	9	92 (2.2)	○	9	89 (2.2)
Chinese Taipei	○	9	– –	○	9	– –	○	9	– –	●	8	– –
Cyprus	○	10	88 (0.6)	○	--	63 (2.0)	○	10	43 (1.9)	○	--	58 (1.8)
Egypt	○	--	94 (1.9)	●	6	70 (4.1)	●	7	96 (1.5)	●	6	91 (2.5)
Estonia	●	3-4,7-8,11	100 (0.0)	●	2,5,7,11	99 (1.4)	●	2,5,7-8,11	100 (0.0)	●	2,5,7-8,11	98 (1.2)
Ghana	●	7-8	25 (4.1)	●	7-8	33 (4.2)	●	7-8	29 (4.2)	●	7-8	34 (4.9)
Hong Kong, SAR	●	8	8 (2.3)	●	8	21 (3.3)	●	8	46 (4.9)	●	8	58 (4.3)
Hungary	●	6	65 (4.3)	●	6	78 (4.1)	●	6,8	64 (4.1)	●	8	83 (3.6)
Indonesia	●	8	– –	○	10	– –	○	11	– –	●	6	– –
Iran, Islamic Rep. of	●	7-8	97 (1.0)	○	--	78 (3.6)	●	6,8	73 (3.6)	●	6,8	85 (2.8)
Israel	●	7-12	s 53 (4.8)	●	5-8	64 (4.8)	●	5-8	s 64 (5.2)	●	5-8	s 59 (5.2)
Italy	●	8	81 (2.8)	●	6-7	86 (2.4)	●	4,6-7	85 (2.5)	●	3-6	90 (2.4)
Japan	●	7,10-12	69 (3.3)	●	5,6,10-12	33 (3.7)	●	7,10-12	61 (4.0)	●	8,10-12	33 (3.8)
Jordan	●	1-5	86 (2.9)	●	1,6	57 (4.2)	●	1-2,6	40 (4.2)	●	3,6,8	81 (3.5)
Korea, Rep. of	●	7	s 76 (3.3)	●	7	65 (3.8)	●	7	s 71 (3.5)	○	9	s 51 (4.0)
Latvia	●	6	– –	●	6-7	– –	●	6	– –	●	7	– –
Lebanon	●	--	r 57 (4.5)	●	--	r 45 (5.9)	●	--	r 44 (6.1)	●	--	r 57 (5.5)
Lithuania	●	5-8	98 (1.1)	●	7-8	r 96 (1.7)	●	5-8	98 (1.5)	●	5-8	98 (1.1)
Macedonia, Rep. of	●	5	94 (2.2)	●	5	94 (2.0)	●	5	94 (1.8)	●	5	94 (2.3)
Malaysia	○	9	15 (3.0)	○	10	35 (4.3)	●	7	24 (3.9)	●	8	79 (3.5)
Moldova, Rep. of	●	5	r 81 (3.9)	●	5	r 83 (3.9)	●	5	r 79 (4.7)	●	5	r 81 (4.4)
Morocco	○	--	s 43 (5.6)	○	--	15 (5.1)	○	--	s 9 (4.1)	○	--	s 13 (4.9)
Netherlands	●	--	r 89 (2.8)	○	10	r 73 (4.5)	○	10	r 67 (5.4)	●	--	r 74 (4.1)
New Zealand	●	8-9	23 (3.2)	●	4-5	18 (3.8)	●	8-9	35 (5.0)	●	4-5	53 (6.3)
Norway	●	8	85 (2.8)	●	8	58 (4.3)	●	8	78 (3.6)	●	7-8	57 (4.8)
Palestinian Nat'l Auth.	●	3,8	70 (3.6)	○	--	36 (4.5)	●	4,8	47 (4.3)	●	4,8	69 (4.0)
Philippines	●	7	r 81 (3.3)	●	7	r 75 (3.9)	●	7	r 78 (3.7)	⦿	8	r 81 (3.4)
Romania	○	9	99 (1.0)	●	5,9	97 (1.6)	●	5,9	98 (1.3)	●	4-5,9	94 (2.1)
Russian Federation	●	6-8	– –	●	6-8	– –	●	7	– –	●	7	– –
Saudi Arabia	●	--	95 (1.8)	●	--	72 (4.5)	●	--	96 (1.7)	●	--	84 (3.9)
Scotland	●	6	s 44 (4.3)	⦿	8	32 (3.3)	●	6	s 64 (3.9)	●	8	s 70 (4.2)
Serbia	●	5	95 (2.0)	●	5	95 (2.0)	●	5	95 (1.9)	●	5	95 (2.0)
Singapore	●	7	13 (2.1)	●	7	14 (2.3)	●	7	23 (2.2)	●	7	35 (2.8)
Slovak Republic	●	5-6	99 (0.5)	●	5-6	94 (2.2)	●	5	90 (3.2)	●	5-6	97 (1.4)
Slovenia	●	6	– –	●	7	– –	●	6	– –	●	7	– –
South Africa	○	--	r 39 (4.1)	○	--	r 41 (4.4)	○	--	r 38 (4.5)	⦿	--	r 50 (4.6)
Sweden	●	6	x x	●	5	x x	●	7-8	x x	●	8	s 62 (4.8)
Syrian Arab Republic	○	9,11	– –	●	--	– –	○	9	– –	●	--	– –
Tunisia	○	11	31 (4.2)	○	11	12 (2.7)	○	11	7 (2.2)	○	11	17 (3.1)
United States	●	--	r 90 (1.9)	●	--	r 88 (2.1)	●	--	r 86 (1.8)	●	--	r 90 (2.0)
‡ England	○	--	x x	●	6-7	x x	○	--	x x	●	4	x x
International Avg.			66 (0.5)			59 (0.6)			61 (0.6)			68 (0.6)
Benchmarking Participants												
Basque Country, Spain	●	--	87 (3.5)	●	--	90 (3.0)	●	--	95 (2.3)	●	--	85 (3.5)
Indiana State, US	●	--	92 (3.4)	●	--	89 (3.7)	●	--	86 (5.0)	●	--	91 (3.7)
Ontario Province, Can.	●	7	87 (3.2)	●	8	69 (4.7)	○	9-10	67 (4.3)	●	8	71 (4.9)
Quebec Province, Can.	●	--	r 81 (3.8)	●	--	r 84 (3.3)	●	--	r 90 (2.3)	●	--	r 93 (1.9)

● All or almost all students ⦿ Only the more able students ○ Not included in the curriculum through eighth grade

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data on intended curriculum provided by National Research Coordinators, and on implemented curriculum by teachers at the time of testing.

For countries that teach science as separate subjects at grade 8, data are based on earth science teachers only.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

Exhibit 5.12: **Intended and Taught TIMSS Earth Science Topics** *(Continued...)*

SCIENCE Grade 8

Earth Science	Processes in the rock cycle and the formation of rocks				Weather data/maps, and changes in weather patterns				Geological processes occurring over billions of years				Formation of fossils and fossil fuels			
Countries	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught		Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught		Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught		Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught		Percent of students taught the topic
Armenia	●	5	s	96 (2.8)	●	5		98 (2.5)	●	5	s	95 (3.0)	●	5	s	96 (2.8)
Australia	●	--	r	56 (3.5)	●	--	r	25 (3.8)	●	--	r	43 (3.9)	○	10	r	45 (3.9)
Bahrain	○	--		5 (1.6)	●	3,6		12 (2.6)	○	--		5 (1.2)	○	--		4 (1.6)
Belgium (Flemish)	○	--	r	28 (3.3)	⦿	--	r	70 (3.7)	○	--	r	22 (3.5)	○	--	r	17 (3.1)
Botswana	○	10		2 (1.2)	○	10		2 (1.3)	○	11		4 (1.9)	●	8		73 (3.8)
Bulgaria	●	8	r	96 (1.9)	●	8	r	99 (1.4)	●	8	r	93 (2.5)	○	--	r	79 (3.6)
Chile	○	--		39 (4.1)	○	--		55 (3.8)	○	10		63 (3.9)	●	7,9		63 (3.8)
Chinese Taipei	○	9		– –	○	9		– –	○	9		– –	○	9		– –
Cyprus	○	--		69 (1.5)	○	10		95 (1.3)	○	--		91 (0.8)	○	--		60 (2.6)
Egypt	●	7		99 (0.7)	○	--		78 (3.4)	○	--		94 (1.9)	○	--		62 (4.3)
Estonia	●	4,7,11		100 (0.0)	●	1-2,6-8,11		100 (0.5)	●	4,7,11		99 (0.9)	●	4,5,7,9,11		89 (3.1)
Ghana	●	8-9		41 (4.8)	●	8-9		30 (4.4)	●	7-8		32 (4.0)	●	7-8		15 (3.2)
Hong Kong, SAR	○	11		2 (1.4)	●	8		6 (2.2)	●	8		3 (1.7)	●	7		41 (4.8)
Hungary	●	5		91 (2.6)	●	6,8		94 (2.1)	●	5		96 (1.8)	●	6		82 (3.5)
Indonesia	●	5		– –	○	10		– –	○	10		– –	○	9		– –
Iran, Islamic Rep. of	●	7-8		98 (1.2)	○	9-11		36 (3.6)	○	9-11		88 (2.5)	○	9-11		87 (3.0)
Israel	●	7-8	s	36 (4.9)	●	7-8		35 (5.4)	○	--	s	38 (5.2)	●	5-8	s	32 (5.5)
Italy	●	8		59 (3.6)	●	6-8		61 (3.7)	●	8		77 (2.8)	●	8		65 (3.3)
Japan	●	7,10-12		92 (2.0)	●	5,8,10-12		58 (4.5)	●	7,10-12		89 (2.2)	●	6,7,10-12		48 (4.5)
Jordan	●	3-4		74 (3.7)	●	5		42 (4.4)	●	5		58 (3.8)	●	6,8		93 (2.0)
Korea, Rep. of	●	7	s	76 (3.2)	○	9		30 (3.6)	●	8	s	89 (2.5)	●	8	s	80 (3.2)
Latvia	●	7		– –	●	7		– –	●	7		– –	●	6		– –
Lebanon	●	--	r	75 (4.0)	●	--	r	30 (5.7)	○	--	r	65 (5.2)	○	--	r	66 (5.0)
Lithuania	●	7-8		98 (1.1)	●	5-8	r	99 (0.9)	●	7-8	r	99 (0.9)	●	5-8	r	81 (3.6)
Macedonia, Rep. of	●	5		94 (2.3)	●	5		94 (2.1)	●	5		92 (2.4)	●	5-8	r	77 (3.8)
Malaysia	○	9		9 (2.5)	○	10		16 (3.2)	○	10		13 (2.7)	○	9		37 (4.2)
Moldova, Rep. of	●	5	r	80 (4.3)	●	5	r	89 (3.3)	●	5	r	84 (3.6)	●	5	r	75 (5.1)
Morocco	○	--	s	63 (6.1)	○	--		14 (5.2)	○	--	s	52 (6.1)	○	--	s	93 (3.8)
Netherlands	⦿	--	r	37 (5.3)	●	--	r	81 (4.2)	●	--	r	82 (3.8)	○	--	r	30 (5.1)
New Zealand	○	10		16 (3.8)	●	6-7		26 (4.3)	⦿	8-9		12 (3.1)	●	6-7		11 (3.2)
Norway	○	--		48 (4.4)	●	4,7		46 (4.7)	●	8		66 (4.1)	●	8		59 (4.2)
Palestinian Nat'l Auth.	●	8,11-12		77 (3.4)	●	8-9		34 (4.2)	○	--		42 (4.1)	○	--		76 (3.7)
Philippines	●	7	r	78 (3.6)	●	7	r	74 (4.1)	●	7	r	74 (4.0)	●	7	r	79 (3.8)
Romania	○	9		93 (2.0)	●	5,9		97 (1.3)	○	9		96 (1.7)	○	--		78 (3.4)
Russian Federation	●	6-8		– –	●	7		– –	●	7-8		– –	●	7-8		– –
Saudi Arabia	●	--		91 (2.8)	○	--		38 (6.7)	○	11-12		55 (4.4)	○	11-12		46 (5.6)
Scotland	●	6	s	45 (4.1)	○	--		11 (2.2)	●	--	s	24 (3.8)	●	6	s	63 (4.2)
Serbia	●	5		95 (2.0)	●	5		94 (2.1)	●	5		96 (1.8)	●	5		86 (2.9)
Singapore	●	7		8 (1.9)	●	7		10 (1.9)	●	7		11 (2.0)	○	--		32 (2.9)
Slovak Republic	●	5,8		79 (4.1)	●	5,8		90 (3.2)	●	5,8		91 (2.9)	●	7		67 (5.2)
Slovenia	●	6		– –	●	5-6		– –	○	10		– –	●	8-9		– –
South Africa	○	--	r	26 (4.0)	○	--	r	37 (4.6)	○	--	r	39 (4.3)	○	--	r	35 (3.7)
Sweden	○	9		x x	●	7-8		x x	○	9		x x	●	8-9	s	44 (5.3)
Syrian Arab Republic	●	--		– –	○	10		– –	●	--		– –	●	--		– –
Tunisia	○	11		88 (2.6)	○	10		29 (4.5)	○	11		42 (3.9)	○	11		58 (3.9)
United States	●	--	r	84 (2.1)	●	--	r	80 (2.4)	●	--	r	86 (2.1)	●	--	r	82 (2.5)
‡ England	●	7		x x	●	7		x x	○	--		x x	○	--		x x
International Avg.				63 (0.5)				54 (0.6)				62 (0.5)				60 (0.6)
Benchmarking Participants																
Basque Country, Spain	⦿	10		83 (3.7)	⦿	10		69 (5.3)	○	10		66 (4.9)	⦿	9		62 (5.0)
Indiana State, US	●	--		86 (4.7)	●	--		86 (5.0)	●	--		90 (3.8)	●	--		89 (4.4)
Ontario Province, Can.	●	7		86 (3.1)	●	5		76 (4.2)	●	7	r	81 (4.2)	●	7		78 (4.2)
Quebec Province, Can.	●	--	r	58 (5.2)	●	--	r	83 (3.1)	●	--		x x	⦿	--	r	70 (4.2)

● All or almost all students ⦿ Only the more able students ○ Not included in the curriculum through eighth grade

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data on intended curriculum provided by National Research Coordinators, and on implemented curriculum by teachers at the time of testing.

For countries that teach science as separate subjects at grade 8, data are based on earth science teachers only.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

Exhibit 5.12: **Intended and Taught TIMSS Earth Science Topics** *(...Continued)*

SCIENCE Grade 8

Earth Science	Explanation of phenomena on Earth			The physical features of Earth			The sun as a star		
Countries	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic
Armenia	●	5	s 96 (2.9)	●	5	93 (3.3)	●	5	91 (3.7)
Australia	●	--	r 69 (3.5)	●	--	r 66 (3.8)	○	--	r 63 (3.4)
Bahrain	●	2,6-8	30 (2.5)	●	7-8	13 (2.4)	●	2,6-7	19 (2.7)
Belgium (Flemish)	○	--	r 17 (3.2)	○	--	r 8 (2.1)	○	--	r 4 (1.7)
Botswana	○	10	3 (1.5)	○	10	1 (1.0)	○	10	3 (1.7)
Bulgaria	●	8	r 99 (0.9)	●	8	r 91 (2.8)	●	8	r 84 (3.3)
Chile	●	5,10	81 (3.5)	●	4,10	82 (3.4)	●	4,10	82 (3.4)
Chinese Taipei	○	10	– –	○	10	– –	●	8	– –
Cyprus	○	--	96 (0.6)	○	--	89 (1.6)	○	--	88 (0.9)
Egypt	●	6	98 (1.1)	●	6	97 (1.5)	●	6	100 (0.0)
Estonia	●	4,7	99 (0.6)	●	7	85 (3.2)	●	4,7	76 (3.5)
Ghana	●	8-9	37 (4.5)	●	8-9	42 (4.8)	●	8-9	39 (4.6)
Hong Kong, SAR	●	6	10 (2.9)	○	--	14 (3.3)	●	6	20 (3.7)
Hungary	●	6	42 (4.0)	○	9	44 (4.4)	●	8	41 (4.4)
Indonesia	●	6	– –	○	11	– –	●	6	– –
Iran, Islamic Rep. of	○	9-11	86 (2.6)	○	9-11	70 (3.6)	○	9-11	79 (2.8)
Israel	●	5-8	s 47 (5.3)	●	5-8	45 (5.1)	●	5-8	36 (5.2)
Italy	●	8	71 (3.1)	●	8	67 (3.3)	●	8	67 (3.3)
Japan	●	4,9-12	6 (1.5)	○	9-12	8 (1.7)	○	9-12	8 (2.0)
Jordan	●	3-7	71 (4.2)	●	3-4,7	49 (5.1)	●	4,7	74 (4.1)
Korea, Rep. of	○	9-10	s 45 (4.0)	○	9	56 (3.8)	○	9	66 (3.7)
Latvia	○	--	– –	○	--	– –	○	--	– –
Lebanon	○	--	r 49 (5.2)	○	--	r 41 (5.3)	○	--	33 (5.1)
Lithuania	●	5-8	r 95 (2.0)	●	5-8	r 88 (2.8)	●	5-8	r 91 (2.7)
Macedonia, Rep. of	○	9	94 (1.9)	○	12	95 (1.9)	●	5	r 94 (2.0)
Malaysia	○	9	19 (3.3)	○	9	12 (2.5)	○	9	15 (2.7)
Moldova, Rep. of	●	6	r 75 (4.4)	●	6	r 73 (4.5)	●	6	r 70 (4.5)
Morocco	○	--	s 15 (4.0)	○	--	9 (2.3)	○	--	x x
Netherlands	●	--	r 57 (5.4)	○	10	r 32 (5.3)	○	10	r 28 (4.9)
New Zealand	●	1-9	67 (4.1)	◉	8-9	67 (4.9)	●	8-9	74 (4.5)
Norway	●	4,8	87 (2.9)	●	8	82 (3.3)	●	8	81 (3.5)
Palestinian Nat'l Auth.	●	4-8	84 (3.1)	●	7-8	57 (4.5)	●	4,8	78 (3.7)
Philippines	●	7	r 79 (3.5)	●	7	r 76 (3.7)	●	7	r 76 (3.9)
Romania	●	5,9	98 (1.2)	●	5,9	98 (1.4)	●	5,9	96 (1.7)
Russian Federation	●	5,11	– –	○	11	– –	●	5,11	– –
Saudi Arabia	●	--	84 (3.1)	○	--	84 (4.5)	●	--	96 (1.6)
Scotland	●	7	s 38 (4.1)	●	6	36 (4.0)	●	2	39 (4.2)
Serbia	●	5	95 (1.9)	●	5	93 (2.2)	●	5	94 (2.2)
Singapore	○	--	15 (2.1)	○	--	9 (1.7)	●	3	11 (1.8)
Slovak Republic	●	5-9	99 (0.7)	●	5	88 (3.3)	●	5	92 (2.7)
Slovenia	●	6,9	– –	●	6	– –	●	6	– –
South Africa	○	--	r 36 (3.9)	○	--	r 37 (4.2)	○	--	r 32 (4.6)
Sweden	●	5-9	s 62 (5.3)	◉	7-9	45 (5.1)	○	9	39 (5.2)
Syrian Arab Republic	●	--	– –	●	--	– –	●	--	– –
Tunisia	○	10	10 (2.6)	○	10	7 (2.3)	○	--	3 (1.5)
United States	●	--	r 87 (2.1)	●	--	r 86 (2.1)	●	--	r 87 (2.2)
‡ England	●	4,6,8	x x	●	--	x x	●	--	x x
International Avg.			61 (0.5)			56 (0.6)			58 (0.5)
Benchmarking Participants									
Basque Country, Spain	●	--	92 (3.2)	◉	10	87 (3.8)	●	--	84 (4.0)
Indiana State, US	●	--	90 (3.9)	●	--	90 (3.0)	●	--	91 (3.4)
Ontario Province, Can.	●	6	73 (3.8)	●	6	67 (4.2)	●	6	75 (4.1)
Quebec Province, Can.	●	--	r 80 (3.3)	○	11	r 72 (4.2)	◉	--	r 68 (4.1)

● All or almost all students ◉ Only the more able students ○ Not included in the curriculum through eighth grade

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data on intended curriculum provided by National Research Coordinators, and on implemented curriculum by teachers at the time of testing.

For countries that teach science as separate subjects at grade 8, data are based on earth science teachers only.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

Exhibit 5.13: Intended and Taught TIMSS Environmental Science Topics

Environmental Science	Trends in human population and its effects on the environment				Use and conservation of natural resources				Changes in environments			
Countries	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught		Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught		Percent of students taught the topic	Student population intended to be taught topic through 8th grade	Grade(s) topic is intended to be taught		Percent of students taught the topic
Armenia	●	8,10		– –	●	8,10		– –	●	K-8		– –
Australia	○	--	r	25 (3.2)	○	--	r	46 (3.9)	●	--	r	40 (4.1)
Bahrain	●	4-6		7 (2.1)	●	4-7		17 (2.4)	●	1,4,6-7		13 (2.0)
Belgium (Flemish)	○	--		– –	●	--		– –	●	--		– –
Botswana	○	11		8 (2.5)	○	10		53 (4.5)	○	10		7 (2.2)
Bulgaria	●	8		– –	○	9		– –	●	8-9		– –
Chile	○	--		64 (4.0)	●	5,8		88 (2.7)	●	6,8		84 (2.9)
Chinese Taipei	○	9		– –	○	9		– –	○	9		– –
Cyprus	○	--		– –	○	--		– –	○	--		– –
Egypt	●	6,10		67 (3.7)	●	6		97 (1.2)	●	6,9		87 (2.8)
Estonia	●	2,8-9		– –	●	5-7		– –	●	6-11		– –
Ghana	●	8-9		40 (4.5)	●	7-9		47 (4.6)	●	7-9		60 (4.6)
Hong Kong, SAR	●	6		28 (4.6)	●	6		60 (5.0)	●	6		65 (5.0)
Hungary	○	10		– –	○	10		– –	●	8		– –
Indonesia	○	9		– –	●	5		– –	●	7		– –
Iran, Islamic Rep. of	○	9-11		74 (3.4)	○	9-11		78 (3.3)	○	9-11		78 (3.5)
Israel	●	5-8	s	36 (4.1)	●	5-8		38 (4.4)	●	5-8	s	44 (4.7)
Italy	○	--		40 (3.8)	●	8		68 (3.8)	●	8		68 (3.9)
Japan	○	--		0 (0.0)	●	6,9-12		2 (1.2)	○	9-12		2 (1.2)
Jordan	●	6		49 (4.0)	●	4-6,8		81 (3.4)	●	6		60 (4.4)
Korea, Rep. of	○	11	s	20 (3.0)	○	11		22 (3.0)	○	10	s	27 (3.3)
Latvia	●	--		– –	●	--		– –	●	--		– –
Lebanon	○	--	s	48 (4.8)	○	--		72 (5.2)	○	12	s	60 (5.5)
Lithuania	●	7-8		– –	●	5-8		– –	●	5-8		– –
Macedonia, Rep. of	●	5-8		– –	●	5-8		– –	●	5-8		– –
Malaysia	●	8		53 (4.2)	●	8		71 (3.9)	●	8		76 (3.6)
Moldova, Rep. of	●	8-9		x x	●	8-9		x x	●	8-9		x x
Morocco	◉	--		– –	◉	--		– –	◉	--		– –
Netherlands	●	--		– –	●	--		– –	●	--		– –
New Zealand	○	--		18 (3.4)	◉	8-9		42 (5.8)	◉	8-9		31 (4.4)
Norway	●	4,8,10		21 (4.0)	●	8-10		33 (4.4)	●	8-10		40 (4.6)
Palestinian Nat'l Auth.	●	6-12		28 (4.0)	●	6,8-10		60 (4.3)	●	7-10		38 (4.3)
Philippines	●	7	r	82 (4.2)	●	7	r	91 (2.8)	●	7	r	91 (3.0)
Romania	○	10-11		– –	○	10-11		– –	●	5,10-11		– –
Russian Federation	●	7-8		– –	●	7-8		– –	●	7-8		– –
Saudi Arabia	●	--		63 (5.1)	●	--		65 (5.8)	●	--		75 (3.6)
Scotland	○	--	s	23 (3.0)	●	8		60 (3.4)	◉	8	s	41 (3.6)
Serbia	●	6		– –	●	6-7		– –	●	5-7		– –
Singapore	●	8-10		27 (2.9)	●	8-10		57 (2.8)	●	8-10		60 (2.6)
Slovak Republic	●	7,9		– –	●	7,9		– –	●	7,9		– –
Slovenia	●	8		– –	●	7		– –	●	8		– –
South Africa	◉	--	r	52 (4.0)	●	--	r	70 (4.2)	◉	--	r	65 (3.5)
Sweden	●	8	s	24 (4.1)	●	7-9		43 (4.3)	●	7-9	s	37 (4.2)
Syrian Arab Republic	●	--		– –	●	--		– –	●	--		– –
Tunisia	○	11		18 (3.6)	○	11		29 (4.2)	○	11		47 (3.8)
United States	●	--	r	62 (3.4)	●	--	r	73 (3.0)	●	--	r	71 (3.3)
‡ England	○	--		x x	●	7-8		x x	●	7-8		x x
International Avg.				38 (0.7)				56 (0.8)				53 (0.7)
Benchmarking Participants												
Basque Country, Spain	●	--		61 (5.3)	●	--		73 (4.4)	●	--		76 (4.6)
Indiana State, US	●	--		77 (5.2)	●	--		83 (5.0)	●	--		81 (5.6)
Ontario Province, Can.	●	7		65 (4.7)	●	5-8		77 (4.4)	●	7		79 (4.5)
Quebec Province, Can.	○	9	r	61 (4.5)	●	--	r	78 (3.8)	●	--	r	75 (3.8)

● All or almost all students ◉ Only the more able students ○ Not included in the curriculum through eighth grade

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data on intended curriculum provided by National Research Coordinators, and on implemented curriculum by teachers at the time of testing.

Data for percent of students taught the topic are not available for countries that teach science as separate subjects at grade 8.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

Exhibit 5.14: Intended and Taught TIMSS Life Science Topics

SCIENCE Grade 4

Life Science	Types, characteristics, and classification of living things			Major body structures and their function in humans and other organisms			Bodily actions in response to outside conditions and exercise			The general steps in the life cycle of familiar organisms		
Countries	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic
Armenia	●	--	x x	●	--	x x	●	--	x x	●	--	x x
Australia	●	--	r 85 (3.0)	●	--	r 70 (4.2)	●	--	r 76 (3.2)	●	--	r 90 (2.9)
Belgium (Flemish)	●	--	49 (3.9)	⦿	5	40 (4.0)	⦿	5	58 (4.2)	○	6	70 (3.4)
Chinese Taipei	●	3	91 (2.2)	●	3-4	92 (2.3)	●	3-4	69 (3.8)	●	3-4	76 (3.3)
Cyprus	●	4-5	96 (1.6)	●	1-6	77 (3.5)	○	--	50 (4.3)	●	1-3	68 (3.7)
England	●	1,3	r 84 (3.5)	●	K,4	r 85 (3.5)	●	3-4	r 82 (3.7)	●	4	r 85 (3.6)
Hong Kong, SAR	●	2	r 74 (4.6)	●	4	r 87 (3.4)	○	6	r 87 (3.3)	●	2	r 62 (4.6)
Hungary	●	2	95 (1.9)	●	2	89 (2.6)	○	7	86 (2.7)	●	4	89 (2.9)
Iran, Islamic Rep. of	●	1-4	91 (2.6)	●	2-4	94 (1.8)	●	1-4	71 (3.9)	○	5,6,8	76 (4.1)
Italy	●	4-6	97 (1.2)	●	4-7	71 (3.1)	●	4-6	50 (3.3)	●	4-7	93 (1.7)
Japan	●	3-12	53 (4.0)	●	3-12	30 (3.8)	●	4,6,8-12	24 (3.5)	●	3-12	85 (2.8)
Latvia	●	--	x x	●	--	x x	○	--	x x	○	6-9	x x
Lithuania	●	1-4	93 (1.8)	●	3-4	98 (1.2)	○	5-6	98 (0.8)	●	1-4	99 (0.8)
Moldova, Rep. of	●	--	r 81 (3.6)	●	--	r 95 (1.8)	●	--	r 87 (3.4)	●	--	r 85 (2.5)
Morocco	⦿	--	x x	⦿	--	x x	●	--	x x	⦿	--	x x
Netherlands	●	--	71 (4.6)	●	--	72 (4.0)	●	--	72 (4.0)	●	--	72 (4.1)
New Zealand	●	1-4	r 87 (2.4)	●	2-3	r 77 (3.4)	●	2-3	r 63 (3.7)	●	2-3	r 88 (2.0)
Norway	●	1,4-5,8	60 (4.0)	●	3-10	70 (3.6)	●	2-10	63 (4.4)	●	3-5	67 (4.2)
Philippines	○	5,8	98 (1.4)	●	3-4,8	96 (2.4)	○	5,8	91 (3.2)	●	4	98 (1.7)
Russian Federation	●	3-4	– –	○	6-9	– –	○	6-9	– –	○	6-9	– –
Scotland	●	--	s 83 (3.6)	○	--	s 73 (4.0)	○	--	s 69 (4.4)	●	--	s 74 (4.6)
Singapore	●	3	97 (1.4)	●	3-5	98 (1.3)	○	6	83 (3.3)	●	3	80 (3.5)
Slovenia	●	4	65 (4.5)	●	4	75 (4.1)	○	10	77 (4.0)	●	4	39 (4.5)
Tunisia	○	9	r 93 (2.4)	○	6	65 (4.1)	○	5	59 (4.0)	○	7	r 59 (4.6)
United States	●	--	r 83 (2.4)	●	--	71 (2.8)	○	--	r 69 (2.7)	●	--	80 (2.4)
Yemen	○	--	– –	●	--	– –	●	4	– –	○	--	– –
International Avg.			82 (0.7)			77 (0.7)			71 (0.8)			78 (0.7)
Benchmarking Participants												
Indiana State, US	●	--	84 (4.1)	○	5	77 (5.9)	●	--	80 (4.9)	○	5,6	81 (4.0)
Ontario Province, Can.	●	1-2	72 (4.8)	●	1-2	49 (4.9)	●	3-4	60 (5.1)	●	2	72 (4.6)
Quebec Province, Can.	●	3-4	73 (3.7)	●	--	61 (4.0)	○	5-7	60 (4.9)	○	5-7	64 (4.3)

● All or almost all students ⦿ Only the more able students ○ Not included in the curriculum through fourth grade

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data on intended curriculum provided by National Research Coordinators, and on implemented curriculum by teachers at the time of testing.

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

Exhibit 5.14: **Intended and Taught TIMSS Life Science Topics** *(Continued...)*

Life Science	Plant and animal reproduction			Physical features, behavior, and survival of plants and animals			Relationships in a living community			Changes in environments		
Countries	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic
Armenia	●	K-4	x x	●	--	x x	●	--	x x	●	4,10	x x
Australia	●	--	r 44 (4.9)	●	--	r 73 (4.1)	●	--	r 80 (3.9)	●	--	r 79 (2.8)
Belgium (Flemish)	○	6	40 (4.0)	○	6	58 (3.7)	⦿	5	68 (3.8)	●	--	69 (3.7)
Chinese Taipei	○	5	43 (3.7)	○	6	77 (3.3)	○	5	41 (3.9)	○	6	82 (3.1)
Cyprus	●	2-3	50 (5.0)	⦿	4	59 (4.5)	●	2-3	88 (3.2)	●	3-5	57 (4.5)
England	●	4	r 67 (4.8)	●	3	r 65 (4.7)	○	--	r 60 (4.6)	○	--	r 45 (4.4)
Hong Kong, SAR	○	5	r 34 (4.8)	○	6	r 39 (5.3)	○	6	r 28 (4.9)	○	5	r 56 (4.5)
Hungary	●	4,8	74 (3.7)	●	4	81 (3.5)	●	4	89 (2.6)	●	4	92 (2.2)
Iran, Islamic Rep. of	○	5,6,8	45 (4.9)	●	1-4	50 (4.9)	○	5,8	53 (4.5)	○	5,8	79 (3.8)
Italy	●	4-7	71 (3.6)	●	4-7	85 (2.6)	●	3-8	95 (1.5)	●	3-8	80 (2.8)
Japan	○	5,9-12	24 (3.5)	○	9-12	55 (3.9)	○	9-12	10 (2.7)	○	9-12	8 (2.3)
Latvia	○	6-9	x x	●	--	x x	●	--	x x	●	--	x x
Lithuania	●	3-4	95 (1.5)	●	1-4	94 (1.9)	●	3-4	98 (0.8)	●	1-4	96 (1.4)
Moldova, Rep. of	●	--	r 62 (4.4)	●	--	r 78 (3.6)	●	--	r 83 (3.3)	●	--	r 88 (2.5)
Morocco	⦿	--	x x	⦿	--	x x	⦿	--	x x	⦿	--	x x
Netherlands	●	--	48 (4.8)	●	--	64 (4.8)	●	--	66 (5.0)	●	--	66 (4.7)
New Zealand	○	6-11	r 44 (3.5)	●	4-5	r 75 (3.0)	○	6-9	r 80 (2.8)	⦿	4-5	r 70 (3.0)
Norway	●	3	31 (4.4)	●	3-4	38 (4.0)	●	3-4	74 (4.0)	●	1,4	72 (3.6)
Philippines	●	4-5,8	99 (0.9)	●	4-6,8	84 (3.7)	○	6,8	68 (4.2)	○	5-7	95 (2.3)
Russian Federation	○	6-9	– –	○	6-8	– –	○	6-8	– –	●	3-4	– –
Scotland	○	--	s 32 (4.7)	⦿	--	s 49 (5.3)	●	--	s 52 (5.4)	○	--	s 45 (4.7)
Singapore	○	5	63 (4.2)	○	6	52 (3.8)	○	6	39 (4.4)	○	6	69 (4.2)
Slovenia	●	3-4	37 (3.8)	●	4	35 (4.4)	●	3-5	37 (4.7)	○	5	93 (2.5)
Tunisia	○	7	r 67 (3.5)	○	7	r 46 (4.4)	○	11	r 35 (4.2)	○	11	r 80 (3.8)
United States	●	--	r 53 (3.0)	●	--	82 (2.4)	●	--	87 (2.3)	●	--	r 78 (2.5)
Yemen	●	4,9, 11-12	– –	●	4,11-12	– –	●	4,11	– –	○	7,12	– –
International Avg.			53 (0.9)			64 (0.9)			64 (0.8)			71 (0.7)
Benchmarking Participants												
Indiana State, US	○	5,6	53 (6.0)	○	6	78 (5.1)	●	--	90 (4.1)	○	6	88 (3.5)
Ontario Province, Can.	●	4	46 (4.6)	●	2-3	73 (5.0)	●	4	73 (5.0)	●	4	73 (5.0)
Quebec Province, Can.	○	5-7	51 (4.4)	○	5-7	50 (4.6)	●	3-4	61 (4.5)	⦿	6	57 (4.2)

● All or almost all students ⦿ Only the more able students ○ Not included in the curriculum through fourth grade

Background data on intended curriculum provided by National Research Coordinators, and on implemented curriculum by teachers at the time of testing.

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

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 5.14: **Intended and Taught TIMSS Life Science Topics** *(...Continued)*

Life Science	Ways that common communicable diseases are transmitted			Ways of maintaining good health, including diet and exercise		
Countries	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic
Armenia	●	4,8	x x	●	4,10	x x
Australia	○	--	r 46 (4.3)	○	--	r 92 (2.3)
Belgium (Flemish)	⦿	6	55 (3.6)	⦿	6	85 (2.7)
Chinese Taipei	○	7	42 (4.0)	○	7	67 (3.6)
Cyprus	○	--	24 (3.9)	⦿	4	43 (4.2)
England	○	--	r 39 (4.6)	●	4	r 92 (2.4)
Hong Kong, SAR	○	5	r 60 (5.0)	●	4	r 95 (2.3)
Hungary	●	3	85 (2.5)	●	4	97 (1.5)
Iran, Islamic Rep. of	○	5,6	50 (4.8)	●	1-4	79 (3.4)
Italy	○	5-8	27 (2.6)	○	--	49 (3.4)
Japan	○	--	22 (3.5)	○	--	40 (4.1)
Latvia	○	5	x x	○	5	x x
Lithuania	●	3-4	93 (1.8)	●	1-4	95 (1.7)
Moldova, Rep. of	●	--	r 79 (3.4)	●	--	r 90 (2.6)
Morocco	⦿	--	x x	⦿	--	x x
Netherlands	●	--	35 (4.8)	●	--	85 (3.6)
New Zealand	●	K-12	r 52 (3.8)	●	K-12	r 97 (0.8)
Norway	●	2	72 (3.6)	●	2	82 (3.1)
Philippines	○	5	88 (3.3)	●	3-6	93 (2.8)
Russian Federation	●	3-4	– –	●	3-4	– –
Scotland	●	--	s 36 (4.6)	●	--	s 87 (4.0)
Singapore	○	--	15 (3.0)	○	--	51 (3.9)
Slovenia	●	3	76 (3.9)	●	2	91 (2.7)
Tunisia	○	--	90 (2.5)	○	--	85 (2.9)
United States	●	--	55 (3.3)	○	--	79 (2.8)
Yemen	○	6-8,10	– –	○	6,8-10	– –
International Avg.			54 (0.8)			80 (0.7)
Benchmarking Participants						
Indiana State, US	●	--	85 (4.7)	●	--	92 (3.4)
Ontario Province, Can.	●	2-4	40 (4.9)	●	4	81 (3.6)
Quebec Province, Can.	○	--	38 (4.4)	○	--	71 (3.7)

● All or almost all students ⦿ Only the more able students ○ Not included in the curriculum through fourth grade

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data on intended curriculum provided by National Research Coordinators, and on implemented curriculum by teachers at the time of testing.

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

cooling." These were taught, respectively, to 61 percent, 80 percent, and 83 percent of students, on average. The remaining topics were in the intended curricula of between 13 and 19 participants, with the percentage of students taught the topics ranging from 35 to 69 percent, on average. The topics taught to the least percentages of students were "properties and uses of metals" (38%) and "forming and separating mixtures" (35%).

As described before, earth science topics did not figure prominently in the intended fourth-grade science curricula of the participating countries, and they were taught to fewer students than the other science content areas. As shown in Exhibit 5.16, "water on Earth" was the topic included in the curriculum of most participants (18). Other topics included in the curricula of about half the participants were: "rocks, minerals, sand, and soil," "air," "common features of the Earth's landscape," "Earth's water cycle," and "weather conditions from day to day or over the seasons." The percentage of students taught these topics, on average, ranged from 41 percent (rocks, minerals, sand, and soil) to 81 percent (Earth's water cycle). "Fossils of animals and plants" was included in the curriculum of the fewest participants and had the lowest percentage of students taught the topic (27%).

Exhibit 5.15: Intended and Taught TIMSS Physical Science Topics

SCIENCE Grade 4

Physical Science	Classification of objects and materials based on physical properties			Properties and uses of metals			Forming and separating mixtures			Properties and uses of water		
Countries	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic
Armenia	●	4,6	x x	●	4,6	x x	●	--	x x	●	4	x x
Australia	●	--	r 55 (4.4)	○	--	r 21 (3.9)	●	--	r 26 (4.3)	○	--	r 69 (4.7)
Belgium (Flemish)	⦿	5	17 (2.8)	○	7	3 (1.3)	○	7	3 (1.2)	●	--	70 (4.1)
Chinese Taipei	●	3-4	49 (4.1)	●	4	30 (4.0)	○	8	28 (3.4)	●	3-4	90 (2.5)
Cyprus	●	1-5	76 (3.7)	○	--	24 (3.8)	●	3	57 (4.0)	●	4-5	68 (4.2)
England	●	K-4	r 95 (2.2)	○	--	r 78 (3.7)	●	3	r 70 (4.7)	●	4	r 80 (4.1)
Hong Kong, SAR	●	1	r 58 (5.4)	○	9	r 59 (5.3)	○	7	r 24 (4.7)	●	3	r 85 (3.9)
Hungary	●	2	86 (2.7)	●	2	49 (4.5)	○	7	28 (4.1)	●	2	93 (1.7)
Iran, Islamic Rep. of	●	1-2,4	55 (4.6)	○	9	43 (4.2)	●	2-4	93 (1.9)	●	1,3-4	70 (4.6)
Italy	●	3,6-8	76 (3.3)	○	6-8	43 (3.6)	●	3,6-8	64 (3.3)	●	3,6-8	95 (1.7)
Japan	●	3-12	26 (3.7)	●	3,4,6-12	48 (4.1)	○	5-7,10-12	5 (1.8)	●	4,7,10-12	65 (3.9)
Latvia	○	8-9	x x	○	8-9	x x	○	8-9	x x	○	8-9	x x
Lithuania	●	1-4	68 (3.4)	●	3-4	51 (3.6)	●	3-4	21 (2.8)	●	3-4	98 (0.9)
Moldova, Rep. of	●	--	r 70 (3.9)	●	--	r 35 (4.5)	●	--	r 36 (4.5)	●	--	r 94 (1.9)
Morocco	○	--	x x	○	--	x x	○	--	x x	⦿	--	x x
Netherlands	○	--	24 (4.3)	○	--	14 (3.4)	○	--	6 (2.3)	○	--	65 (4.6)
New Zealand	●	2-5	r 74 (3.1)	⦿	4-5	r 30 (3.3)	●	2-5	r 46 (3.4)	●	4-5	r 68 (3.2)
Norway	●	1	20 (3.3)	●	1-3	11 (2.6)	○	5	7 (2.3)	●	3	83 (2.9)
Philippines	●	3-4,7,9	89 (3.0)	○	9	58 (4.7)	●	4,9	89 (3.4)	●	3,7,9	93 (2.0)
Russian Federation	●	3-4	– –	○	8	– –	○	8	– –	●	3-4	– –
Scotland	●	--	s 57 (4.9)	●	--	s 19 (3.9)	⦿	--	s 29 (4.2)	●	--	s 73 (4.3)
Singapore	●	3-4,6	99 (0.5)	●	3,6	63 (3.8)	○	--	21 (3.3)	●	4	90 (2.5)
Slovenia	●	1	62 (4.4)	●	4	25 (4.3)	●	4	29 (3.8)	●	2,5	94 (1.9)
Tunisia	○	10	r 61 (4.5)	○	10	48 (4.6)	○	10	16 (3.3)	○	10	70 (3.6)
United States	●	--	74 (2.9)	○	--	35 (2.6)	●	--	31 (2.5)	●	--	r 71 (2.7)
Yemen	●	--	– –	○	5,10	– –	○	7	– –	●	--	– –
International Avg.			61 (0.8)			38 (0.8)			35 (0.8)			80 (0.7)
Benchmarking Participants												
Indiana State, US	●	--	72 (6.0)	○	5-8	33 (4.4)	○	6	32 (5.4)	○	5,6	74 (6.1)
Ontario Province, Can.	●	1	66 (4.5)	●	1	47 (4.9)	○	7	16 (4.2)	●	2	r 59 (5.3)
Quebec Province, Can.	●	--	49 (4.3)	○	--	24 (3.9)	●	--	21 (3.5)	●	--	70 (4.0)

● All or almost all students ⦿ Only the more able students ○ Not included in the curriculum through fourth grade

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data on intended curriculum provided by National Research Coordinators, and on implemented curriculum by teachers at the time of testing.

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

A dash (–) indicates data are not available.

An "r" indicates 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 the students.

Exhibit 5.15: **Intended and Taught TIMSS Physical Science Topics** *(Continued...)*

SCIENCE Grade 4

Physical Science	Chemical and physical changes			States of matter and differences in their physical properties			Changes in state of water by heating and cooling			Common energy sources/forms and their practical uses		
Countries	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic
Armenia	●	4	x x	●	4	x x	●	4	x x	●	4	x x
Australia	○	5	r 33 (4.4)	●	--	r 39 (4.2)	●	--	r 72 (4.0)	●	--	r 70 (3.7)
Belgium (Flemish)	○	7	16 (2.4)	○	6	28 (2.8)	●	--	69 (3.8)	●	--	52 (3.5)
Chinese Taipei	○	5	42 (4.0)	○	6	67 (4.0)	●	3-4	75 (4.0)	○	6	89 (2.2)
Cyprus	○	--	18 (3.5)	●	2-4	76 (4.6)	●	2,4	90 (2.4)	○	6	38 (4.3)
England	○	--	r 48 (5.0)	●	4	r 94 (1.9)	●	4	r 95 (2.0)	○	--	r 43 (5.1)
Hong Kong, SAR	●	4	r 77 (4.7)	○	7	r 85 (3.8)	●	3	r 90 (3.3)	○	5	r 64 (5.5)
Hungary	○	7	41 (4.3)	●	3	89 (2.4)	●	3	95 (1.4)	○	7	67 (4.8)
Iran, Islamic Rep. of	○	5	25 (4.4)	●	2-4	80 (3.7)	●	2-4	61 (4.3)	●	1-4	68 (4.3)
Italy	●	4-8	65 (3.7)	●	3,6-7	89 (2.4)	●	3,6	94 (1.8)	○	5,8	48 (3.4)
Japan	●	4-12	6 (2.0)	●	4,7,10-12	61 (4.1)	●	4,7.10-12	65 (4.1)	○	9-12	37 (4.5)
Latvia	○	8-9	x x	○	8-9	x x	○	8-9	x x	●	--	x x
Lithuania	●	3-4	73 (3.3)	●	3-4	55 (3.5)	●	3-4	87 (2.2)	●	1-4	97 (1.4)
Moldova, Rep. of	●	--	r 53 (5.0)	●	--	r 93 (1.9)	●	--	r 96 (1.6)	●	--	r 65 (4.2)
Morocco	○	--	x x	○	--	x x	⦿	--	x x	○	--	x x
Netherlands	●	--	28 (4.5)	○	--	22 (4.2)	○	--	65 (4.7)	●	--	64 (4.4)
New Zealand	⦿	4-5	r 43 (3.5)	⦿	2-5	r 53 (3.6)	●	2-3	r 79 (2.7)	○	6-7	r 56 (3.5)
Norway	●	1	48 (4.4)	●	3	42 (4.6)	●	3	88 (2.3)	○	10	70 (3.8)
Philippines	○	5	93 (2.9)	●	3	95 (1.6)	○	5	94 (2.4)	●	3,5,7,10	91 (3.1)
Russian Federation	○	6-7	– –	●	3-4	– –	●	3-4	– –	○	6-7	– –
Scotland	○	--	s 13 (3.3)	○	--	s 48 (5.3)	○	--	s 76 (4.4)	●	--	s 51 (4.6)
Singapore	○	6	26 (3.5)	●	4	96 (1.6)	●	4	98 (1.1)	○	6	83 (3.2)
Slovenia	○	7	25 (4.3)	●	4	69 (4.0)	○	5	86 (3.4)	○	6	80 (3.7)
Tunisia	○	10	r 73 (3.5)	○	10	r 90 (2.9)	○	10	r 87 (3.3)	○	9	87 (3.0)
United States	○	--	r 56 (3.3)	●	--	r 74 (2.9)	●	--	r 80 (2.6)	●	--	r 68 (3.2)
Yemen	○	6	– –	○	7,10	– –	●	4,6	– –	●	4,6,9-11	– –
International Avg.			43 (0.8)			69 (0.8)			83 (0.7)			66 (0.9)
Benchmarking Participants												
Indiana State, US	○	8	61 (5.9)	○	5	76 (5.3)	○	5	81 (4.9)	●	--	67 (5.5)
Ontario Province, Can.	●	3-4	36 (4.8)	●	2	49 (5.3)	●	2	61 (4.4)	●	1	64 (4.6)
Quebec Province, Can.	○	6	17 (3.4)	●	--	54 (4.6)	○	7	75 (3.8)	●	--	38 (4.4)

● All or almost all students ⦿ Only the more able students ○ Not included in the curriculum through fourth grade

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Exhibit 5.15: Intended and Taught TIMSS Physical Science Topics *(...Continued)*

SCIENCE Grade 4

Physical Science	Heat flow and temperature			Common sources of light and related phenomena			Common uses of electricity and electrical circuits			Magnets		
Countries	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic
Armenia	●	4,6	x x	⦿	6	x x	○	8	x x	●	--	x x
Australia	●	--	r 33 (4.6)	●	--	r 30 (4.4)	●	--	r 32 (4.7)	●	--	r 53 (5.3)
Belgium (Flemish)	●	--	73 (3.4)	⦿	5	22 (3.1)	○	7	9 (1.8)	○	7	16 (2.7)
Chinese Taipei	●	4	77 (3.7)	○	8	76 (3.5)	●	3-4	67 (4.3)	●	2	74 (3.8)
Cyprus	●	3	44 (4.3)	●	2-3	30 (4.1)	●	4	75 (4.0)	●	2-3	66 (4.4)
England	●	3	r 45 (4.7)	●	K,2	r 69 (5.3)	●	1,3	r 85 (3.6)	●	2	r 83 (4.0)
Hong Kong, SAR	●	2	r 66 (5.1)	●	3	r 70 (4.6)	●	4	r 93 (2.4)	●	1	r 72 (5.5)
Hungary	○	5	73 (4.2)	○	5	49 (4.1)	○	8	21 (3.5)	●	3	74 (4.0)
Iran, Islamic Rep. of	○	7	61 (4.8)	○	5	76 (4.1)	●	4	96 (1.6)	●	1,4	98 (1.1)
Italy	○	6-8	49 (3.8)	○	6-8	34 (3.4)	○	6-8	11 (2.1)	○	6-8	14 (2.1)
Japan	○	5,9-12	77 (3.6)	●	3,7,10-12	33 (4.0)	●	3,4,8,10-12	81 (3.3)	●	3	91 (2.6)
Latvia	●	--	x x	○	8-9	x x	○	8-9	x x	○	8-9	x x
Lithuania	●	1-4	92 (2.0)	●	3-4	73 (3.6)	●	1-4	77 (3.2)	●	3-4	51 (4.0)
Moldova, Rep. of	●	--	r 62 (4.5)	●	--	r 50 (4.7)	●	--	r 33 (4.1)	○	--	r 37 (4.5)
Morocco	⦿	--	x x	○	--	x x	⦿	--	x x	○	--	x x
Netherlands	●	--	41 (4.5)	●	--	23 (4.2)	○	--	12 (2.4)	●	--	26 (4.2)
New Zealand	⦿	4-5	r 40 (3.3)	●	2-5	r 50 (3.5)	●	2-5	r 56 (3.7)	●	2-3	r 55 (3.7)
Norway	●	3,5,8	61 (4.8)	○	6	58 (4.4)	○	7,9	11 (2.6)	○	5	30 (4.0)
Philippines	●	4,7,10	82 (4.2)	●	3,10	63 (4.7)	○	5,10	56 (5.0)	○	5,10	49 (5.2)
Russian Federation	●	3-4	– –	○	8-9	– –	●	3-4	– –	○	8	– –
Scotland	○	--	s 27 (5.1)	●	--	s 49 (4.8)	●	--	s 42 (5.2)	●	--	s 38 (4.9)
Singapore	●	4	95 (1.4)	●	4	81 (2.9)	○	5	31 (4.1)	●	3	83 (3.0)
Slovenia	○	5	34 (4.6)	●	3	21 (3.9)	●	4	83 (3.4)	●	4	55 (3.9)
Tunisia	○	10	91 (2.4)	○	10	11 (2.9)	○	7	r 10 (2.6)	○	8	4 (1.6)
United States	●	--	r 53 (3.1)	●	--	r 40 (2.9)	○	--	61 (3.1)	●	--	67 (2.7)
Yemen	●	--	– –	●	4,10,12	– –	●	4,12	– –	●	4,9-10,12	– –
International Avg.			61 (0.9)			48 (0.9)			50 (0.8)			54 (0.8)
Benchmarking Participants												
Indiana State, US	○	5	42 (4.9)	●	--	28 (4.7)	○	6	63 (5.3)	●	--	61 (4.6)
Ontario Province, Can.	○	7	34 (4.6)	●	4	84 (3.6)	●	1	26 (4.7)	●	3	78 (4.0)
Quebec Province, Can.	●	--	33 (4.5)	○	5-7	25 (4.1)	●	--	12 (3.1)	○	6	16 (3.0)

● All or almost all students ⦿ Only the more able students ○ Not included in the curriculum through fourth grade

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Exhibit 5.15: Intended and Taught TIMSS Physical Science Topics

Physical Science	Forces that cause objects to move.		
Countries	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic
Armenia	◉	--	x x
Australia	●	--	r 58 (5.0)
Belgium (Flemish)	○	6	13 (2.2)
Chinese Taipei	○	6	56 (4.1)
Cyprus	●	3	41 (4.6)
England	●	K,1,3	r 77 (4.4)
Hong Kong, SAR	○	6	r 27 (4.7)
Hungary	○	7	26 (3.8)
Iran, Islamic Rep. of	○	6	52 (4.8)
Italy	○	6-8	30 (3.3)
Japan	○	5,7,9-12	5 (1.8)
Latvia	○	8-9	x x
Lithuania	●	1-4	29 (3.2)
Moldova, Rep. of	○	--	r 34 (4.3)
Morocco	○	--	x x
Netherlands	●	--	20 (3.9)
New Zealand	◉	2-3	r 51 (3.4)
Norway	●	4	58 (4.5)
Philippines	●	3,6-7,10	77 (4.5)
Russian Federation	○	7	– –
Scotland	●	--	s 51 (5.1)
Singapore	○	6	18 (3.4)
Slovenia	●	3	22 (3.7)
Tunisia	○	10	r 60 (3.4)
United States	●	--	68 (3.0)
Yemen	●	4,6	– –
International Avg.			42 (0.9)
Benchmarking Participants			
Indiana State, US	●	--	60 (4.7)
Ontario Province, Can.	●	3	65 (4.6)
Quebec Province, Can.	○	6	20 (3.8)

● All or almost all students ◉ Only the more able students ○ Not included in the curriculum through fourth grade

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data on intended curriculum provided by National Research Coordinators, and on implemented curriculum by teachers at the time of testing.

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

A dash (–) indicates data are not available.

An "r" indicates 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 the students.

Exhibit 5.16: Intended and Taught TIMSS Earth Science Topics

SCIENCE Grade 4

Earth Science	Rocks, minerals, sand, and soil			Water on Earth			Air			Common features of the Earth's landscape and relationship to human use		
Countries	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic
Armenia	⦿	--	x x	●	--	x x	●	--	x x	⦿	--	x x
Australia	●	--	r 36 (5.0)	○	--	r 57 (4.3)	○	--	r 43 (4.2)	●	--	r 66 (4.4)
Belgium (Flemish)	○	6	8 (1.7)	●	--	59 (3.6)	●	--	30 (3.2)	○	6	39 (3.6)
Chinese Taipei	○	7	27 (3.5)	○	9	71 (3.6)	●	3	71 (3.8)	○	9	43 (4.2)
Cyprus	●	4	46 (4.4)	○	--	37 (4.4)	●	4	91 (2.1)	○	--	51 (4.6)
England	●	2	r 68 (4.4)	●	4	r 64 (4.1)	●	4	r 65 (4.6)	●	1-4	r 42 (4.5)
Hong Kong, SAR	○	--	r 29 (4.2)	●	3	r 38 (4.5)	●	4	r 98 (1.2)	●	4	67 (4.6)
Hungary	○	5	53 (4.6)	○	5	78 (3.6)	○	5	65 (4.3)	○	5	92 (2.4)
Iran, Islamic Rep. of	●	1,4	95 (1.8)	●	1,3	64 (4.7)	●	2-4	57 (4.4)	○	5-8	78 (4.3)
Italy	●	3-8	68 (3.8)	●	3-7	85 (2.8)	●	4,6-7	87 (2.3)	●	3-8	76 (3.0)
Japan	○	6,7,10-12	5 (1.8)	○	5,8,10-12	34 (4.0)	●	4,7,10-12	27 (3.6)	●	4,7,10-12	15 (3.0)
Latvia	●	3-4	x x	●	3-4	x x	○	--	x x	●	--	x x
Lithuania	○	7-8	66 (3.4)	●	3-4	96 (1.1)	○	5-6	87 (2.8)	●	3-4	90 (2.4)
Moldova, Rep. of	●	--	r 86 (3.1)	●	--	r 96 (1.8)	●	--	r 99 (0.9)	●	--	r 94 (2.2)
Morocco	○	--	x x	○	--	x x	○	--	x x	○	--	x x
Netherlands	●	--	31 (4.6)	●	--	59 (5.0)	○	--	47 (4.6)	●	--	71 (4.4)
New Zealand	⦿	2-5	r 43 (3.6)	●	4-5	r 65 (3.6)	●	3-9	r 41 (3.8)	⦿	2-3	r 64 (3.7)
Norway	●	2	16 (3.0)	●	4	62 (4.5)	○	8	56 (4.2)	●	3-4	62 (4.3)
Philippines	●	3,5,7	72 (4.6)	●	3-4,7	74 (4.4)	●	3-4,7	73 (4.2)	●	3,7	83 (3.7)
Russian Federation	●	2-4	– –	●	2-4	– –	○	6	– –	●	3-4	– –
Scotland	○	--	s 15 (3.5)	●	--	s 54 (5.4)	○	--	s 33 (4.2)	○	--	s 51 (4.6)
Singapore	○	--	5 (1.6)	○	--	45 (3.9)	○	--	84 (2.7)	○	--	7 (1.8)
Slovenia	●	2	11 (2.6)	○	5	77 (4.0)	○	5	62 (4.4)	●	3	66 (4.4)
Tunisia	○	11	r 15 (3.0)	○	11	r 27 (4.0)	○	10	r 87 (2.5)	○	10	r 46 (4.4)
United States	●	--	76 (2.8)	●	--	82 (2.2)	○	--	62 (2.9)	●	--	86 (2.0)
Yemen	●	4,10-12	– –	○	5,10,12	– –	●	--	– –	●	--	– –
International Avg.			41 (0.8)			63 (0.9)			65 (0.8)			61 (0.8)
Benchmarking Participants												
Indiana State, US	●	--	72 (5.1)	●	--	80 (5.7)	●	--	63 (6.5)	○	6,7	86 (4.3)
Ontario Province, Can.	●	4	62 (5.0)	●	2	54 (4.8)	○	6	48 (4.5)	●	4	79 (4.0)
Quebec Province, Can.	○	6	50 (5.0)	○	6	44 (4.4)	●	--	47 (4.5)	○	6	71 (4.4)

● All or almost all students ⦿ Only the more able students ○ Not included in the curriculum through fourth grade

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data on intended curriculum provided by National Research Coordinators, and on implented curriculum by teachers at the time of testing.

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

Exhibit 5.16: **Intended and Taught TIMSS Earth Science Topics** *(Continued...)*

Earth Science	Use and conservation of Earth's natural resources			Earth's water cycle			Weather conditions from day to day or over the seasons			Fossils of animals and plants		
Countries	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic
Armenia	○	9	x x	●	--	x x	●	K-4	x x	●	--	x x
Australia	○	--	r 65 (4.0)	○	--	r 70 (4.8)	○	5	r 78 (4.1)	○	--	r 30 (3.4)
Belgium (Flemish)	○	6	30 (3.8)	●	--	88 (2.4)	●	--	93 (1.5)	○	6	13 (2.8)
Chinese Taipei	○	7	79 (2.9)	○	7	77 (3.6)	○	7	81 (3.4)	○	8	11 (2.5)
Cyprus	○	6	31 (4.8)	●	2	92 (2.3)	●	2	76 (3.7)	○	--	16 (3.3)
England	○	--	r 37 (4.5)	●	4	r 86 (3.1)	●	2	r 79 (3.8)	○	--	r 30 (4.8)
Hong Kong, SAR	○	5	r 56 (4.3)	●	3	r 80 (3.8)	●	2	84 (3.5)	○	7	r 7 (2.9)
Hungary	○	8	54 (4.3)	○	5	94 (2.1)	●	1	91 (2.4)	○	8	17 (3.3)
Iran, Islamic Rep. of	●	4	75 (4.1)	●	3-4	70 (4.6)	○	6	50 (4.1)	○	5,8	18 (3.4)
Italy	●	4,6-8	63 (3.4)	●	3,6	95 (1.5)	●	3,6	84 (2.5)	●	4,8	62 (3.4)
Japan	○	9-12	5 (1.7)	○	5,8,10-12	41 (4.0)	○	5,8,10-12	29 (3.8)	○	6,7,10-12	1 (1.0)
Latvia	●	--	x x	○	--	x x	●	3-4	x x	○	--	x x
Lithuania	●	3-4	77 (3.1)	●	3-4	96 (1.4)	●	1-4	98 (1.1)	○	5-6	64 (3.7)
Moldova, Rep. of	●	--	r 92 (2.7)	●	--	r 96 (1.7)	●	--	r 97 (1.5)	●	--	r 62 (4.7)
Morocco	○	--	x x	○	--	x x	○	--	x x	○	--	x x
Netherlands	●	--	34 (4.8)	○	--	79 (4.0)	●	--	72 (4.4)	○	--	26 (3.9)
New Zealand	○	8-9	r 61 (3.9)	●	4-5	r 70 (3.3)	○	6-7	r 75 (3.0)	●	2-3	r 41 (3.5)
Norway	●	3-4	57 (4.5)	●	3-4	79 (3.1)	●	3	96 (1.6)	○	8	30 (3.7)
Philippines	●	3-5,7	84 (3.6)	○	5,7	89 (3.2)	●	3-5,7	92 (2.6)	○	--	54 (5.2)
Russian Federation	●	3-4	– –	●	3-4	– –	●	2-3	– –	●	3-4	– –
Scotland	○	--	s 35 (4.4)	●	--	s 73 (4.5)	●	--	s 76 (4.5)	○	--	s 10 (2.8)
Singapore	○	6	43 (4.2)	●	4	87 (2.3)	○	--	28 (3.7)	○	--	4 (1.8)
Slovenia	○	5	51 (4.5)	○	5	88 (2.7)	○	5	71 (3.8)	○	8	4 (1.9)
Tunisia	○	--	r 40 (3.9)	○	10	r 62 (4.6)	○	10	r 61 (4.5)	○	11	r 5 (1.8)
United States	○	--	80 (2.3)	●	--	80 (2.3)	●	--	80 (2.5)	●	--	r 58 (2.9)
Yemen	○	5	– –	●	4,11	– –	○	5	– –	○	10,12	– –
International Avg.			55 (0.8)			81 (0.7)			76 (0.7)			27 (0.7)
Benchmarking Participants												
Indiana State, US	○	6	85 (3.8)	○	6	75 (5.4)	●	4	79 (4.7)	○	7	63 (5.4)
Ontario Province, Can.	○	5	68 (4.3)	○	5	63 (5.1)	○	5	61 (5.0)	●	4	55 (5.1)
Quebec Province, Can.	○	6	62 (3.8)	●	--	81 (3.1)	○	6	77 (3.7)	●	--	32 (4.2)

● All or almost all students ⦿ Only the more able students ○ Not included in the curriculum through fourth grade

Background data on intended curriculum provided by National Research Coordinators, and on implented curriculum by teachers at the time of testing.

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

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 5.16: **Intended and Taught TIMSS Earth Science Topics** *(...Continued)*

Earth Science	Earth's solar system		
Countries	Student population intended to be taught topic through 4th grade	Grade(s) topic is intended to be taught	Percent of students taught the topic
Armenia	◉	8	x x
Australia	○	5	r 69 (4.1)
Belgium (Flemish)	○	6	39 (4.0)
Chinese Taipei	○	7	46 (3.8)
Cyprus	○	--	13 (2.7)
England	●	4	r 83 (4.1)
Hong Kong, SAR	○	6	r 19 (3.7)
Hungary	○	6	67 (4.0)
Iran, Islamic Rep. of	●	4	99 (0.8)
Italy	○	5,8	27 (3.2)
Japan	●	4,9-12	60 (3.9)
Latvia	●	2-4	x x
Lithuania	●	1-4	92 (2.4)
Moldova, Rep. of	●	--	r 92 (2.5)
Morocco	○	--	x x
Netherlands	●	--	18 (3.6)
New Zealand	●	1-5	r 80 (2.6)
Norway	●	4,8	97 (1.2)
Philippines	○	5,7	80 (4.3)
Russian Federation	●	3-4	– –
Scotland	○	--	s 59 (4.9)
Singapore	○	5	26 (3.6)
Slovenia	●	3,6	32 (4.6)
Tunisia	○	11	r 12 (3.0)
United States	●	--	74 (2.6)
Yemen	●	4,7	– –
International Avg.			56 (0.8)
Benchmarking Participants			
Indiana State, US	○	5,6	58 (4.7)
Ontario Province, Can.	○	6	23 (4.5)
Quebec Province, Can.	○	6	42 (4.4)

● All or almost all students ◉ Only the more able students ○ Not included in the curriculum through fourth grade

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data on intended curriculum provided by National Research Coordinators, and on implented curriculum by teachers at the time of testing.

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

6

Chapter 6

Teachers of Science

Since the teacher is central in creating a classroom environment that supports learning science, Chapter 6 presents information about the preparation and background of science teachers in the participating countries. The chapter begins with information about the licensing and/or certification requirements for teaching science at the eighth and fourth grades in the TIMSS countries. The National Research Coordinators were responsible for providing this information as part of completing the Curriculum Questionnaire.

The remaining sections of the chapter include information about the demographic characteristics of the teaching force and about teachers' educational background and preparation, including opportunities for professional development. To collect information from teachers, TIMSS administered a two-part questionnaire in which teachers were asked to provide information about their background and training and their instructional practices. Chapter 6 essentially presents teachers' responses to the first part of the questionnaire, while Chapter 7 presents information from the second part about classroom instruction.

Because the sampling for the teacher questionnaires was based on participating students, teachers' responses do not necessarily represent all eighth-grade or all fourth-grade science teachers in each country. Rather, they represent teachers of the representative samples

of students assessed. It is important to note that when information from the teacher questionnaire is being reported, the student is always the unit of analysis. That is, the data shown are the percentages of students whose teachers reported on various characteristics or instructional strategies. Using the student as the unit of analysis makes it possible to describe the instruction received by representative samples of students and the characteristics of the teachers delivering that instruction. Although this perspective may differ from that obtained by simply collecting information from teachers, it is consistent with the TIMSS goals of providing information about the educational contexts and performance of students.

The teachers who completed the questionnaires were the science teachers of the students who took the TIMSS 2003 test. At the eighth grade, the general sampling procedure was to sample a mathematics class from each participating school, administer the test to those students, and ask both their mathematics and science teachers to complete the questionnaire. In countries where science is taught as separate subjects, all science subject teachers of the students in the sampled mathematics classes were asked to complete a questionnaire. At the fourth grade, students often only have one teacher for all subjects, so this teacher is their science teacher and the one who completed the questionnaire. In either grade, the information about teachers' characteristics and instruction is tied directly to the students tested. Sometimes, however, teachers did not complete the questionnaire assigned to them, so most countries had some percentage of students for whom no teacher questionnaire information is available. The exhibits in this chapter have special notations on this point. For a country where teacher responses are available for at least 70 but less than 85 percent of the students, an "r" is included next to its data. Where teacher responses are available for at least 50 but less than 70 percent of the students, an "s" is included. Where teacher responses are available for less than 50 percent, an "x" replaces the data.

What Are the Requirements for Being a Science Teacher?

Exhibit 6.1 presents the country-level responses about the requirements for being certified or licensed to teach science at the eighth and fourth grades. Countries were asked about five requirements, including supervised practical experience (practicum), passing an examination, obtaining a university degree, completion of a probationary period, and completion of an induction program. At the eighth grade, 72 percent of the TIMSS countries (34 out of 47) and three benchmarking entities required a university degree (or equivalent) and just as many participants required fulfillment of some type of practicum for certification as a science teacher. In more than half of the countries (30 out of 47) and three of the benchmarking participants, certification required passing an examination. A probationary period was required in 28 countries and one benchmarking entity. Of the TIMSS countries, nine required completion of an induction program as did one of the benchmarking entities. For the United States and Canada, it should be noted that requirements for certification vary across states and provinces.

At the fourth grade, most of the TIMSS countries (19 out of 26) and two of the benchmarking participants required some type of practicum for certification. Seventeen of the countries participating at the fourth grade and two of the three benchmarking participants required two or more of the following for certification – passing an examination, a university degree, or completion of a probationary a period. Similar to the eighth grade, the fewest number of fourth grade participants required completion of an induction program.

Exhibit 6.2 contains participants' reports about the organization or authority responsible for granting certification for science teachers. Across participants at the eighth grade, universities or colleges were most likely to be responsible for granting certification (70% of the countries and Quebec province). The next most prevalent procedure was for the ministry of education to grant certification. A handful of participants reported using licensing boards and three (New Zealand, Scotland, and Syria) reported granting certification through a teacher

Exhibit 6.1: Current Requirements for Being a Science Teacher

Countries	Pre-practicum and Supervised Practicum	Passing an Examination	University Degree or Equivalent	Completion of a Probationary Teaching Period	Completion of an Induction Program
Armenia	●	●	○	●	○
Australia	●	○	●	●	○
Bahrain	●	●	●	●	○
Belgium (Flemish)	●	●	●	○	○
Botswana	●	●	○	●	○
Bulgaria	●	●	●	○	○
Chile	○	○	●	○	○
Chinese Taipei	●	○	●	●	○
Cyprus	○	○	●	●	○
Egypt	○	○	●	○	○
England	●	●	●	●	●
Estonia	●	○	●	○	○
Ghana	●	●	○	○	○
Hong Kong, SAR	○	○	○	○	○
Hungary	●	●	●	○	○
Indonesia	●	●	●	○	○
Iran, Islamic Rep. of	●	○	○	●	●
Israel	●	●	●	●	○
Italy	○	●	●	●	○
Japan	●	●	●	●	●
Jordan	○	○	●	○	○
Korea, Rep. of	●	●	●	○	○
Latvia	○	○	●	○	○
Lebanon	○	●	○	○	●
Lithuania	●	●	○	●	○
Macedonia, Rep. of	○	○	●	●	○
Malaysia	●	●	○	●	●
Moldova, Rep. of	○	○	○	○	○
Morocco	○	●	○	●	○
Netherlands	●	●	○	●	○
New Zealand	●	○	●	●	○
Norway	●	●	○	●	○
Palestinian Nat'l Auth.	○	○	●	○	○
Philippines	●	●	●	●	○
Romania	●	●	●	●	●
Russian Federation	●	●	●	○	○
Saudi Arabia	●	●	●	●	●
Scotland	●	●	●	●	○
Serbia	●	●	●	●	●
Singapore	●	●	●	●	●
Slovak Republic	○	○	●	○	○
Slovenia	●	○	●	●	●
South Africa	●	●	○	●	○
Sweden	●	●	●	○	○
Syrian Arab Republic	●	●	●	○	○
Tunisia	●	●	●	●	○
United States	●	○	●	●	○
Benchmarking Participants					
Basque Country, Spain	○	●	●	○	○
Indiana State, US	●	●	○	●	●
Ontario Province, Can.	●	●	●	○	○
Quebec Province, Can.	○	○	●	○	○

● Country reported Yes for the particular option

○ Country reported No for the particular option

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

Exhibit 6.1: Current Requirements for Being a Science Teacher

Countries	Pre-practicum and Supervised Practicum	Passing an Examination	University Degree or Equivalent	Completion of a Probationary Teaching Period	Completion of an Induction Program
Armenia	○	○	●	○	○
Australia	●	○	●	●	○
Belgium (Flemish)	●	●	●	○	○
Chinese Taipei	●	○	●	●	○
Cyprus	○	○	●	○	●
England	●	●	●	●	●
Hong Kong, SAR	○	○	○	○	○
Hungary	●	●	●	○	○
Iran, Islamic Rep. of	●	○	○	●	●
Italy	○	●	○	●	○
Japan	●	●	○	●	●
Latvia	○	○	●	○	○
Lithuania	●	●	○	●	○
Moldova, Rep. of	○	○	○	○	○
Morocco	●	●	○	○	--
Netherlands	●	●	○	●	○
New Zealand	●	○	●	●	○
Norway	●	●	○	●	○
Philippines	●	●	●	○	○
Russian Federation	●	●	●	○	○
Scotland	●	●	●	●	○
Singapore	●	●	○	●	●
Slovenia	●	○	●	●	●
Tunisia	●	●	●	●	○
United States	○	○	●	○	○
Yemen	●	○	○	●	○
Benchmarking Participants					
Indiana State, US	●	●	○	●	●
Ontario Province, Can.	●	●	●	○	○
Quebec Province, Can.	○	○	●	○	○

● Country reported Yes for the particular option

○ Country reported No for the particular option

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

A dash (–) indicates comparable data are not available.

Exhibit 6.2: Licensing/Certification Authority for Science Teachers

Countries	Minister/ Ministry of Education	National/State Licensing Board	Universities/ Colleges	Teacher Organization
Armenia	○	○	○	○
Australia	●	○	○	○
Bahrain	○	○	○	○
Belgium (Flemish)	○	○	●	○
Botswana	○	○	●	○
Bulgaria	○	○	●	○
Chile	○	○	○	○
Chinese Taipei	○	●	●	○
Cyprus	○	○	○	○
Egypt	○	○	○	○
England	●	○	○	○
Estonia	○	○	●	○
Ghana	○	○	●	○
Hong Kong, SAR	●	○	○	○
Hungary	○	○	●	○
Indonesia	○	○	●	○
Iran, Islamic Rep. of	●	○	●	○
Israel	●	○	●	○
Italy	●	○	○	○
Japan	○	●	○	○
Jordan	●	○	●	○
Korea, Rep. of	●	○	○	○
Latvia	○	○	○	○
Lebanon	●	○	●	○
Lithuania	○	○	●	○
Macedonia, Rep. of	○	○	○	○
Malaysia	○	○	●	○
Moldova, Rep. of	○	○	○	○
Morocco	●	○	○	○
Netherlands	○	○	●	○
New Zealand	○	○	○	●
Norway	●	●	●	○
Palestinian Nat'l Auth.	●	○	●	○
Philippines	○	●	○	○
Romania	●	○	●	○
Russian Federation	○	○	●	○
Saudi Arabia	○	○	●	○
Scotland	○	○	○	●
Serbia	○	○	●	○
Singapore	○	○	●	○
Slovak Republic	○	○	●	○
Slovenia	●	○	●	○
South Africa	○	○	●	○
Sweden	○	○	○	○
Syrian Arab Republic	●	●	●	●
Tunisia	●	○	○	○
United States	○	●	○	○
Benchmarking Participants				
Basque Country, Spain	●	○	○	○
Indiana State, US	○	●	○	○
Ontario Province, Can.	○	●	○	○
Quebec Province, Can.	●	○	●	○

● Country reported Yes for the particular option

○ Country reported No for the particular option

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

Exhibit 6.2: Licensing/Certification Authority for Science Teachers

Countries	Minister/ Ministry of Education	National/State Licensing Board	Universities/ Colleges	Teacher Organization
Armenia	○	○	○	○
Australia	●	○	○	○
Belgium (Flemish)	○	○	●	○
Chinese Taipei	○	●	●	○
Cyprus	○	○	○	○
England	●	○	○	○
Hong Kong, SAR	●	○	○	○
Hungary	○	○	●	○
Iran, Islamic Rep. of	●	○	●	○
Italy	●	○	○	○
Japan	○	●	○	○
Latvia	○	○	○	○
Lithuania	○	○	●	○
Moldova, Rep. of	○	○	○	○
Morocco	●	○	○	○
Netherlands	○	○	●	○
New Zealand	○	○	○	●
Norway	●	●	○	○
Philippines	○	●	○	○
Russian Federation	○	○	●	○
Scotland	○	○	○	●
Singapore	○	○	●	○
Slovenia	●	○	●	○
Tunisia	●	○	○	○
United States	○	●	○	○
Yemen	○	○	○	○
Benchmarking Participants				
Indiana State, US	○	●	○	○
Ontario Province, Can.	○	●	○	○
Quebec Province, Can.	●	○	●	○

● Country reported Yes for the particular option

○ Country reported No for the particular option

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators.

organization. The responses at the fourth grade were similar, with ministries of education and universities/colleges being the organizations most often responsible for granting certification.

What Are the Background Characteristics of Science teachers?

Exhibit 6.3 presents a considerable amount of information about the background characteristics of science teachers at the eighth and fourth grades, including their gender, age, certification status, and number of years of teaching experience. Typically, larger percentages of students were taught science by female teachers than male teachers, particularly at the fourth grade. At the eighth grade, on average, internationally, 60 percent of the students were taught science by females and 40 percent by males, and similar percentages were found in a number of countries. However, at least 80 percent of students had female teachers in Armenia, Bulgaria, Italy, Latvia, Lithuania, the Philippines, the Russian Federation, and Slovenia. By contrast, only in Ghana and Japan were as many as 80 percent of the students taught science by male teachers. At the fourth grade, on average, internationally, almost four-fifths (79%) of the science teaching force was female. Across the participants, in each country with the exception of Tunisia, at least 50 percent, and often a much higher percentage, of the students were taught by female teachers.

Looking to the last column of Exhibit 6.3, it can be seen that, in general, the science teaching force around the world is quite experienced. Eighth-grade science teachers reported 15 years of teaching experience, on average, internationally, and fourth-grade teachers reported 16 years.

Given their years of teaching experience, it follows that the majority of the eighth-grade and the fourth-grade students were taught science by teachers in their 30s and 40s. If there was a steady replenishing of the teaching force, one might expect approximately equivalent percentages of students taught by teachers in their 20s, 30s, 40s, and 50s. Few countries, however, had a comparatively younger teach-

ing force at either the eighth or fourth grades. At the eighth grade, on average, internationally, only 20 percent of students were taught by teachers younger than age 30. The four countries with the most students (more than 40 percent) taught by younger teachers were Botswana, Ghana, Lebanon, and Saudi Arabia. The pattern was very similar at the fourth grade. On average, internationally, 20 percent of the students were taught by teachers younger than 30 years old, and with the exception of Cyprus (48%) and Singapore (45%), this percentage was usually well under 40 percent.

At the other end of the age distribution, 22 percent of the eighth-grade students and 21 percent of the fourth-grade students internationally were taught by teachers age 50 or older. At the eighth grade, interestingly, the teaching force was relatively older in some countries. For example, at least half of the students in Italy and Macedonia had teachers at least 50 years of age.

Finally, from Exhibit 6.3, it can be seen that teachers at both the eighth and fourth grades, reported having full certification rather than provisional or emergency credentials. Given the potential problem of teacher shortages for a variety of reasons, it is interesting to note that, on average, internationally, 87 percent of the eighth-grade students and 84 percent of the fourth-grade students were taught science by certified teachers. Of course, the situation varied dramatically across the TIMSS countries. For example, in Lebanon, only 45 percent of the eighth-grade students and in Tunisia only 21 percent of the fourth-grade students were taught science by a fully certified teacher.

Exhibit 6.3: Science Teachers' Gender, Age, Certification, and Number of Years of Teaching

SCIENCE Grade 8

Countries	Percentage of Students by Teacher Characteristics							Number of Years of Teaching
	Gender		Age				Have Full Certificate*	
	Female	Male	29 Years or Under	30-39 Years	40-49 Years	50 Years or Older		
Armenia	r 86 (1.7)	14 (1.7)	r 10 (1.4)	27 (2.0)	36 (2.3)	28 (1.7)	r 95 (1.1)	r 19 (0.5)
Australia	r 46 (3.6)	54 (3.6)	r 23 (3.3)	23 (2.5)	33 (3.8)	21 (3.2)	r 90 (2.7)	r 15 (0.8)
Bahrain	52 (0.4)	48 (0.4)	27 (2.3)	58 (2.6)	14 (2.4)	1 (0.2)	94 (1.5)	9 (0.5)
Belgium (Flemish)	71 (2.9)	29 (2.9)	31 (3.1)	23 (2.4)	28 (2.4)	18 (2.6)	– –	15 (0.8)
Botswana	39 (4.2)	61 (4.2)	56 (4.4)	35 (4.5)	6 (2.2)	3 (1.6)	r 91 (2.9)	r 6 (0.5)
Bulgaria	r 81 (2.0)	19 (2.0)	r 8 (1.6)	25 (2.5)	34 (1.7)	33 (2.2)	r 99 (0.4)	r 19 (0.6)
Chile	75 (2.8)	25 (2.8)	5 (1.7)	20 (3.2)	39 (4.3)	36 (3.3)	87 (2.2)	21 (0.6)
Chinese Taipei	41 (4.1)	59 (4.1)	18 (3.3)	38 (3.9)	25 (3.3)	19 (3.1)	93 (2.3)	13 (0.8)
Cyprus	64 (1.1)	36 (1.1)	10 (0.7)	21 (1.0)	47 (0.9)	22 (1.4)	– –	9 (0.3)
Egypt	62 (4.2)	38 (4.2)	16 (3.4)	59 (3.7)	23 (3.0)	1 (0.9)	100 (0.2)	13 (0.5)
Estonia	79 (1.9)	21 (1.9)	11 (1.8)	16 (1.7)	35 (2.8)	38 (2.9)	91 (1.4)	20 (0.6)
Ghana	11 (2.4)	89 (2.4)	50 (4.5)	30 (4.1)	13 (3.2)	7 (2.3)	r 83 (3.5)	8 (0.6)
Hong Kong, SAR	41 (4.6)	59 (4.6)	30 (4.4)	42 (3.4)	19 (3.5)	9 (2.6)	83 (3.2)	12 (0.9)
Hungary	74 (1.9)	26 (1.9)	9 (1.5)	20 (1.7)	40 (2.6)	31 (2.3)	– –	21 (0.5)
Indonesia	56 (3.1)	44 (3.1)	16 (2.2)	50 (3.2)	26 (2.8)	7 (1.6)	90 (2.1)	12 (0.5)
Iran, Islamic Rep. of	39 (4.2)	61 (4.2)	17 (2.6)	42 (4.0)	36 (3.7)	5 (1.8)	57 (3.8)	14 (0.6)
Israel	79 (2.5)	21 (2.5)	14 (2.8)	35 (3.2)	30 (3.0)	21 (3.2)	96 (1.6)	16 (0.8)
Italy	80 (3.0)	20 (3.0)	3 (1.0)	7 (2.1)	31 (3.1)	59 (3.1)	95 (1.6)	23 (0.6)
Japan	20 (3.1)	80 (3.1)	14 (2.8)	30 (3.6)	38 (3.9)	18 (3.4)	97 (1.6)	18 (0.8)
Jordan	48 (1.9)	52 (1.9)	33 (4.0)	45 (4.5)	15 (3.2)	7 (2.4)	70 (3.7)	11 (0.7)
Korea, Rep. of	r 66 (3.4)	34 (3.4)	r 15 (2.6)	41 (3.0)	40 (3.6)	4 (1.7)	s 99 (0.2)	r 13 (0.5)
Latvia	83 (1.9)	17 (1.9)	9 (1.6)	24 (2.6)	33 (2.8)	34 (2.8)	– –	20 (0.7)
Lebanon	71 (3.1)	29 (3.1)	45 (2.9)	27 (2.6)	20 (2.7)	8 (1.7)	r 45 (3.9)	11 (0.5)
Lithuania	82 (1.7)	18 (1.7)	11 (1.4)	26 (2.3)	34 (2.2)	30 (2.4)	100 (0.0)	20 (0.7)
Macedonia, Rep. of	58 (2.3)	42 (2.3)	4 (0.8)	17 (1.8)	29 (2.0)	50 (2.2)	x x	22 (0.6)
Malaysia	76 (3.5)	24 (3.5)	26 (3.5)	39 (4.2)	31 (3.9)	4 (1.7)	77 (3.8)	11 (0.7)
Moldova, Rep. of	71 (2.1)	29 (2.1)	18 (2.0)	15 (1.7)	25 (2.6)	42 (2.4)	r 92 (1.6)	r 22 (0.7)
Morocco	34 (4.9)	66 (4.9)	17 (3.8)	29 (4.1)	46 (5.4)	7 (2.7)	88 (3.0)	15 (1.1)
Netherlands	27 (2.0)	73 (2.0)	18 (2.5)	20 (2.4)	31 (3.1)	31 (3.0)	– –	r 16 (0.7)
New Zealand	50 (5.8)	50 (5.8)	15 (3.4)	34 (5.0)	31 (5.1)	21 (3.3)	76 (4.4)	12 (0.8)
Norway	40 (4.0)	60 (4.0)	18 (3.3)	25 (3.4)	22 (3.3)	36 (4.4)	96 (2.0)	16 (1.0)
Palestinian Nat'l Auth.	52 (3.0)	48 (3.0)	35 (3.9)	36 (4.1)	21 (3.7)	8 (2.2)	r 83 (3.6)	9 (0.7)
Philippines	88 (3.1)	12 (3.1)	24 (4.1)	32 (4.2)	24 (3.5)	20 (3.7)	93 (2.2)	13 (0.8)
Romania	77 (2.1)	23 (2.1)	20 (2.0)	20 (2.1)	22 (1.7)	38 (2.0)	89 (1.8)	19 (0.6)
Russian Federation	88 (1.3)	12 (1.3)	16 (2.1)	23 (1.5)	29 (1.8)	32 (2.2)	92 (1.5)	19 (0.6)
Saudi Arabia	43 (2.5)	57 (2.5)	45 (5.7)	37 (5.0)	16 (3.7)	2 (1.2)	95 (1.9)	9 (0.7)
Scotland	s 45 (3.3)	55 (3.3)	s 13 (2.1)	13 (2.1)	34 (3.1)	40 (3.3)	– –	s 18 (0.7)
Serbia	69 (2.0)	31 (2.0)	8 (1.1)	22 (1.8)	26 (2.0)	45 (2.1)	90 (1.3)	20 (0.5)
Singapore	64 (2.6)	36 (2.6)	34 (2.6)	27 (2.6)	19 (1.8)	21 (2.3)	96 (1.0)	12 (0.6)
Slovak Republic	78 (1.9)	22 (1.9)	16 (2.0)	20 (2.1)	25 (2.1)	39 (2.7)	87 (1.9)	20 (0.7)
Slovenia	84 (2.0)	16 (2.0)	8 (1.5)	31 (2.7)	42 (2.5)	19 (2.1)	87 (2.1)	18 (0.6)
South Africa	49 (4.1)	51 (4.1)	24 (3.2)	51 (3.4)	20 (2.8)	4 (1.2)	r 53 (4.4)	10 (0.5)
Sweden	45 (3.6)	55 (3.6)	15 (2.5)	29 (2.8)	22 (2.7)	34 (2.7)	r 86 (2.5)	13 (0.7)
Tunisia	70 (3.3)	30 (3.3)	24 (3.2)	45 (4.3)	19 (3.5)	12 (2.6)	96 (1.7)	r 11 (0.8)
United States	54 (3.1)	46 (3.1)	15 (2.3)	23 (2.4)	31 (3.1)	30 (2.9)	r 88 (2.2)	14 (0.7)
‡ England	s 55 (4.5)	45 (4.5)	s 23 (3.3)	27 (4.0)	28 (3.9)	23 (3.7)	– –	s 13 (1.1)
International Avg.	60 (0.5)	40 (0.5)	20 (0.4)	30 (0.5)	28 (0.5)	22 (0.4)	87 (0.4)	15 (0.1)
Benchmarking Participants								
Basque Country, Spain	70 (4.8)	30 (4.8)	9 (2.9)	29 (4.1)	49 (4.4)	13 (2.9)	– –	17 (1.0)
Indiana State, US	45 (6.1)	55 (6.1)	17 (5.1)	15 (4.4)	32 (5.5)	36 (5.9)	99 (0.0)	– –
Ontario Province, Can.	50 (4.9)	50 (4.9)	26 (4.1)	31 (4.6)	23 (4.0)	19 (3.8)	97 (1.5)	12 (0.9)
Quebec Province, Can.	53 (5.0)	47 (5.0)	28 (4.2)	33 (4.0)	23 (4.4)	16 (2.9)	r 88 (3.4)	12 (0.7)

Background data provided by teachers.

*Does not include provisional or emergency certificate.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 6.3: Science Teachers' Gender, Age, Certification, and Number of Years of Teaching

Countries	Percentage of Students by Teacher Characteristics								Number of Years of Teaching
	Gender		Age				Have Full Certificate*		
	Female	Male	29 Years or Under	30-39 Years	40-49 Years	50 Years or Older			
Armenia	s 90 (3.0)	10 (3.0)	s 15 (4.6)	33 (5.5)	30 (5.2)	21 (4.5)	s 93 (3.0)	s	15 (1.2)
Australia	75 (4.2)	25 (4.2)	21 (3.5)	14 (2.4)	46 (4.4)	19 (3.0)	r 91 (2.4)		17 (0.9)
Belgium (Flemish)	77 (2.7)	23 (2.7)	22 (2.8)	39 (3.5)	26 (3.0)	13 (2.2)	100 (0.0)		16 (0.7)
Chinese Taipei	59 (4.0)	41 (4.0)	21 (3.5)	35 (4.0)	28 (4.1)	15 (3.2)	81 (3.6)		14 (1.0)
Cyprus	76 (3.8)	24 (3.8)	48 (4.2)	42 (4.1)	4 (1.6)	6 (2.0)	– –		9 (0.6)
England	r 73 (4.2)	27 (4.2)	r 30 (4.7)	24 (4.4)	25 (3.8)	21 (3.5)	– –	r	12 (1.0)
Hong Kong, SAR	73 (4.0)	27 (4.0)	38 (4.8)	26 (3.9)	11 (2.7)	25 (4.7)	87 (2.9)		14 (1.0)
Hungary	94 (1.8)	6 (1.8)	8 (2.1)	33 (3.7)	40 (3.7)	19 (3.2)	– –		19 (0.8)
Iran, Islamic Rep. of	51 (4.8)	49 (4.8)	14 (3.4)	39 (4.2)	39 (4.4)	8 (2.6)	33 (4.2)		16 (0.7)
Italy	96 (1.2)	4 (1.2)	3 (1.4)	18 (2.4)	39 (3.6)	39 (3.3)	97 (1.3)		21 (0.6)
Japan	57 (3.9)	43 (3.9)	10 (2.6)	19 (3.3)	44 (4.3)	27 (3.6)	99 (1.0)		20 (0.8)
Latvia	99 (0.6)	1 (0.6)	6 (2.0)	40 (4.1)	31 (3.8)	22 (3.7)	– –		19 (0.9)
Lithuania	99 (0.6)	1 (0.6)	12 (2.2)	37 (3.1)	32 (3.1)	19 (2.6)	100 (0.0)		19 (0.7)
Moldova, Rep. of	98 (1.2)	2 (1.2)	15 (2.8)	30 (4.0)	35 (4.2)	20 (3.5)	64 (4.6)		21 (0.9)
Morocco	s 52 (4.6)	48 (4.6)	s 23 (4.4)	21 (4.3)	46 (5.1)	10 (2.0)	s 91 (2.8)	s	15 (0.9)
Netherlands	64 (4.6)	36 (4.6)	30 (4.4)	18 (3.7)	24 (4.3)	28 (3.9)	– –		16 (1.1)
New Zealand	81 (2.5)	19 (2.5)	26 (2.9)	26 (2.9)	29 (2.9)	19 (2.5)	r 85 (2.5)	r	12 (0.6)
Norway	81 (2.4)	19 (2.4)	13 (2.7)	24 (3.3)	31 (4.1)	31 (3.4)	97 (1.3)		16 (0.9)
Philippines	87 (2.9)	13 (2.9)	14 (3.1)	39 (5.1)	24 (4.2)	22 (4.0)	89 (2.9)		13 (0.9)
Russian Federation	99 (0.8)	1 (0.8)	11 (2.6)	36 (3.4)	28 (3.5)	25 (3.7)	98 (0.9)		21 (0.7)
Scotland	r 93 (2.2)	7 (2.2)	r 22 (3.8)	27 (3.6)	22 (3.9)	29 (4.3)	– –	r	16 (0.9)
Singapore	84 (2.9)	16 (2.9)	45 (3.9)	35 (3.9)	5 (1.6)	15 (2.7)	95 (1.7)		10 (0.8)
Slovenia	97 (1.6)	3 (1.6)	11 (3.0)	32 (4.3)	36 (4.6)	21 (3.7)	r 89 (3.1)		19 (0.8)
Tunisia	46 (4.3)	54 (4.3)	11 (2.5)	46 (4.6)	24 (3.6)	19 (3.3)	r 21 (3.5)	r	18 (0.8)
United States	86 (2.1)	14 (2.1)	21 (1.9)	28 (2.1)	22 (2.2)	29 (2.5)	91 (1.6)		13 (0.6)
International Avg.	79 (0.6)	21 (0.6)	20 (0.7)	31 (0.8)	29 (0.8)	21 (0.7)	84 (0.6)		16 (0.2)
Benchmarking Participants									
Indiana State, US	88 (3.6)	12 (3.6)	17 (3.8)	24 (4.9)	24 (5.5)	36 (5.4)	100 (0.0)		– –
Ontario Province, Can.	75 (3.8)	25 (3.8)	23 (4.1)	23 (3.9)	26 (4.5)	28 (4.5)	92 (3.1)		13 (0.9)
Quebec Province, Can.	93 (2.0)	7 (2.0)	17 (3.6)	30 (4.2)	21 (3.6)	32 (4.4)	83 (3.6)		17 (1.0)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

*Does not include provisional or emergency certificate.

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

What Preparation Do Teachers Have for Teaching Science?

Exhibits 6.4 through 6.9 present teachers' reports about their preparation to teach science, including educational experiences before actually teaching and opportunities for developing their expertise after entering the profession (often referred to as pre-service and in-service training).

Exhibit 6.4 presents teachers' highest level of education. Even though the percentages were somewhat higher at the eighth grade than the fourth grade, approximately two-thirds of the eighth- and fourth-grade students were taught science by teachers having at least a university degree or equivalent. At the eighth grade, 57 percent of the students were taught by teachers with a university degree and another 22 percent by teachers who had coursework beyond the initial university degree. At the fourth grade, 52 percent of the students were taught by teachers with a university degree and another 13 percent by teachers with coursework beyond that degree.

Despite a relatively well-educated teaching force, on average, the situation varied dramatically among countries. At the eighth grade, for example, at least half the students were taught by teachers with work beyond the initial university degree in Armenia, Australia, Bulgaria, Lithuania, New Zealand, the Russian Federation, Tunisia, the United States, and the Basque Country, Spain. In contrast, 44 percent of the eighth-grade students in Morocco and 25 percent in Malaysia were taught by teachers only having completed secondary school.

According to the results of the Curriculum Questionnaire, almost all of the students participating in TIMSS 2003 were supposed to be learning science according to a national (for most countries) or regional curriculum. To gather some information about coherence between the intended curriculum and teacher preparation, the Curriculum Questionnaire also asked about specific teacher training in how to teach this curriculum – as part of either teachers' pre-service or in-service education. Exhibit 6.5 has the results. The majority of countries

and benchmarking participants reported preparation in how to teach the intended curriculum as part of both pre- and in-service training, and most reported coverage in at least one of these places. Countries reporting no specific training in how to teach the intended curriculum included Chile, Korea, Moldova, Norway, and Sweden.

Teachers' reports about their major area or areas of study during their postsecondary education also can be found in Exhibit 6.5. At the eighth grade, on average, internationally, most students (82%) had teachers who studied a science subject – biology, physics, chemistry, or earth science. Science education was also a popular option, with 37 percent of students, on average, taught by teachers with science education as a major. Less common majors for science teachers were general education (taken by teachers of 25 percent of students) and mathematics (taken by teachers of 20 percent of students). Teachers often reported that their study was focused in more than one area. For example, it was not uncommon for teachers in some countries to report pedagogy as a major area of study and a science subject as another major area. As might be considered, the situation was different at the fourth grade. Here teachers typically studied primary or elementary education (approximately 80 percent, on average, of fourth-grade students had such teachers). On average, for the primary education majors, about one-fourth (23%) of students were taught by teachers who specialized in science, 7 percent in mathematics, and half (50%) not having any particular specialization. In Latvia and the Russian Federation, more than half the fourth-grade students were being taught by science specialists.

To provide more information about the branches of science that science teachers studied during their postsecondary education, Exhibit 6.6 presents the percentage of eighth-grade students whose teachers reported majoring in biology, physics, chemistry, or earth science. Teachers could major in more than one of these subjects, and the percentages in the exhibit reflect this. Biology was the most popular science major, followed by chemistry, physics, and earth science. On

Exhibit 6.4: Highest Educational Level of Science Teachers*

Countries		Percentage of Students by Their Teachers' Educational Level				
		Beyond Initial University Degree**	Finished University or Equivalent	Finished Post Secondary Education but Not University	Finshed Upper Secondary Schooling	Did Not Complete Upper Secondary Schooling
Armenia	r	82 (2.1)	16 (2.0)	1 (0.4)	1 (0.3)	0 (0.0)
Australia	r	56 (3.5)	38 (3.7)	5 (1.5)	0 (0.1)	0 (0.0)
Bahrain		10 (1.8)	88 (2.2)	2 (1.1)	0 (0.0)	1 (0.0)
Belgium (Flemish)		0 (0.0)	0 (0.0)	100 (0.0)	0 (0.0)	0 (0.0)
Botswana		4 (2.0)	34 (4.7)	61 (4.8)	1 (0.6)	0 (0.0)
Bulgaria	r	67 (3.0)	24 (2.5)	9 (1.5)	0 (0.0)	0 (0.0)
Chile		2 (1.1)	91 (2.6)	7 (2.3)	0 (0.0)	0 (0.0)
Chinese Taipei		27 (3.6)	70 (3.7)	2 (1.5)	0 (0.0)	0 (0.0)
Cyprus		21 (1.0)	79 (1.0)	0 (0.0)	0 (0.0)	0 (0.0)
Egypt		8 (2.3)	92 (2.3)	0 (0.0)	0 (0.0)	0 (0.0)
Estonia		23 (2.2)	61 (2.6)	12 (1.6)	3 (1.1)	0 (0.0)
Ghana		0 (0.0)	9 (3.1)	79 (4.4)	12 (3.3)	0 (0.0)
Hong Kong, SAR		17 (3.3)	66 (4.2)	17 (3.2)	0 (0.0)	0 (0.0)
Hungary		28 (2.1)	72 (2.1)	0 (0.2)	0 (0.0)	0 (0.0)
Indonesia		0 (0.0)	57 (3.0)	40 (2.9)	3 (1.3)	0 (0.0)
Iran, Islamic Rep. of		1 (0.5)	42 (4.0)	57 (4.0)	0 (0.0)	0 (0.0)
Israel		27 (3.2)	71 (3.4)	3 (1.0)	0 (0.0)	0 (0.0)
Italy		7 (1.9)	93 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)
Japan		9 (2.6)	90 (2.7)	1 (0.9)	0 (0.0)	0 (0.0)
Jordan		13 (2.9)	78 (3.7)	8 (2.7)	0 (0.0)	1 (0.0)
Korea, Rep. of	r	25 (2.9)	75 (2.9)	0 (0.0)	0 (0.0)	0 (0.0)
Latvia		1 (0.5)	95 (1.1)	0 (0.2)	4 (0.9)	0 (0.0)
Lebanon		– –	– –	– –	– –	– –
Lithuania		62 (2.2)	35 (2.1)	2 (0.7)	1 (0.3)	0 (0.0)
Macedonia, Rep. of		0 (0.0)	21 (2.0)	78 (2.0)	0 (0.2)	0 (0.0)
Malaysia		3 (1.5)	47 (4.0)	25 (3.8)	25 (3.6)	0 (0.0)
Moldova, Rep. of		1 (0.6)	91 (1.5)	1 (0.6)	6 (1.2)	1 (0.4)
Morocco		2 (1.4)	32 (4.5)	16 (3.8)	44 (5.8)	5 (1.9)
Netherlands		30 (3.1)	– –	66 (3.0)	5 (1.5)	0 (0.0)
New Zealand		51 (4.8)	43 (5.2)	6 (3.0)	0 (0.0)	0 (0.0)
Norway		12 (2.6)	72 (4.0)	14 (2.9)	1 (0.8)	1 (1.0)
Palestinian Nat'l Auth.		10 (2.6)	73 (3.9)	16 (3.2)	1 (0.8)	0 (0.0)
Philippines		8 (2.6)	92 (2.6)	0 (0.0)	0 (0.0)	0 (0.0)
Romania		4 (1.0)	81 (2.1)	13 (1.7)	2 (0.9)	0 (0.0)
Russian Federation		89 (1.0)	8 (1.1)	3 (0.5)	1 (0.3)	0 (0.0)
Saudi Arabia		3 (2.6)	85 (3.6)	10 (2.2)	2 (1.2)	0 (0.0)
Scotland	s	24 (2.6)	76 (2.6)	0 (0.0)	0 (0.0)	0 (0.0)
Serbia		1 (0.4)	43 (2.2)	54 (2.2)	2 (0.6)	0 (0.1)
Singapore		8 (1.5)	80 (2.2)	8 (1.3)	4 (1.0)	0 (0.0)
Slovak Republic		13 (1.4)	86 (1.5)	1 (0.5)	1 (0.4)	0 (0.0)
Slovenia		36 (3.0)	61 (3.1)	1 (0.3)	3 (1.0)	0 (0.0)
South Africa	r	7 (2.0)	21 (3.0)	69 (3.5)	2 (1.2)	0 (0.1)
Sweden		30 (3.2)	63 (3.4)	4 (1.2)	4 (1.2)	0 (0.0)
Tunisia		81 (3.6)	17 (3.4)	1 (0.7)	1 (0.0)	0 (0.0)
United States		59 (3.0)	41 (3.0)	0 (0.0)	0 (0.0)	0 (0.0)
‡ England	s	24 (3.7)	76 (3.7)	0 (0.0)	0 (0.0)	0 (0.0)
International Avg.		22 (0.4)	57 (0.4)	18 (0.3)	3 (0.2)	0 (0.0)
Benchmarking Participants						
Basque Country, Spain		50 (5.3)	50 (5.3)	0 (0.0)	0 (0.0)	0 (0.0)
Indiana State, US		– –	– –	– –	– –	– –
Ontario Province, Can.		15 (3.2)	83 (3.4)	2 (1.3)	0 (0.0)	0 (0.0)
Quebec Province, Can.		10 (2.6)	90 (2.6)	0 (0.3)	0 (0.0)	0 (0.0)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

*Based on countries categorizations to UNESCO's International Standard Classification of Education (Operational Manual for ISCED-1997).

**For example, doctorate, master's, postgraduate diploma, and honors bachelor's degree.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

Exhibit 6.4: Highest Educational Level of Science Teachers*

Countries		Percentage of Students by Their Teachers' Educational Level				
		Beyond Initial University Degree**	Finished University or Equivalent	Finished Post Secondary Education but Not University	Finshed Upper Secondary Schooling	Did Not Complete Upper Secondary Schooling
Armenia	s	68 (4.8)	22 (4.4)	8 (2.8)	3 (1.6)	0 (0.0)
Australia		27 (4.1)	49 (4.4)	24 (3.4)	0 (0.0)	0 (0.0)
Belgium (Flemish)		0 (0.0)	0 (0.0)	100 (0.0)	0 (0.0)	0 (0.0)
Chinese Taipei		15 (3.0)	69 (4.3)	11 (2.7)	4 (1.7)	1 (0.0)
Cyprus		15 (3.2)	84 (3.2)	0 (0.3)	0 (0.0)	0 (0.0)
England	r	4 (1.9)	96 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)
Hong Kong, SAR		4 (1.8)	55 (5.1)	41 (5.1)	0 (0.0)	0 (0.0)
Hungary		3 (1.3)	97 (1.3)	0 (0.0)	0 (0.0)	0 (0.0)
Iran, Islamic Rep. of		2 (1.9)	21 (4.2)	34 (4.7)	34 (3.9)	8 (2.2)
Italy		1 (0.5)	13 (2.2)	3 (1.0)	84 (2.3)	0 (0.0)
Japan		3 (1.4)	84 (3.0)	13 (2.8)	0 (0.0)	0 (0.0)
Latvia		0 (0.0)	82 (3.3)	3 (1.4)	15 (3.2)	0 (0.0)
Lithuania		16 (2.4)	75 (3.2)	8 (2.1)	0 (0.0)	1 (0.5)
Moldova, Rep. of		0 (0.0)	65 (4.2)	21 (4.0)	12 (2.9)	2 (1.0)
Morocco	s	0 (0.0)	22 (4.5)	2 (1.3)	56 (5.2)	20 (3.8)
Netherlands		1 (0.5)	– –	98 (1.0)	1 (0.9)	0 (0.0)
New Zealand		12 (2.3)	53 (3.1)	36 (3.1)	0 (0.0)	0 (0.0)
Norway		1 (0.6)	57 (3.9)	38 (3.9)	2 (1.1)	2 (0.8)
Philippines		7 (2.3)	93 (2.3)	0 (0.0)	0 (0.0)	0 (0.0)
Russian Federation		44 (3.8)	26 (3.4)	29 (3.5)	0 (0.0)	0 (0.0)
Scotland	r	12 (3.1)	88 (3.1)	0 (0.0)	0 (0.0)	0 (0.0)
Singapore		0 (0.0)	41 (4.0)	40 (3.9)	18 (3.1)	0 (0.0)
Slovenia		34 (4.4)	56 (4.8)	3 (1.4)	7 (2.3)	0 (0.0)
Tunisia	r	2 (1.2)	7 (2.4)	43 (4.2)	48 (4.0)	1 (0.9)
United States		53 (2.7)	46 (2.7)	0 (0.0)	0 (0.0)	0 (0.0)
International Avg.		13 (0.5)	52 (0.7)	22 (0.5)	11 (0.4)	1 (0.2)
Benchmarking Participants						
Indiana State, US		– –	– –	– –	– –	– –
Ontario Province, Can.		10 (2.8)	84 (3.6)	7 (2.3)	0 (0.0)	0 (0.0)
Quebec Province, Can.		9 (2.6)	88 (2.8)	4 (1.2)	0 (0.0)	0 (0.0)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

*Based on countries categorizations to UNESCO's International Standard Classification of Education (Operational Manual for ISCED-1997).

**For example, doctorate, master's, postgraduate diploma, and honors bachelor's degree.

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

Exhibit 6.5: Preparation to Teach Science

SCIENCE Grade 8

Countries	Teachers Receive Specific Preparation in How to Teach the Intended Science Curriculum		Teachers' Major Area of Study in Their Postsecondary Education[1]					
			Education-Science	Biology, Physics, Chemistry, or Earth Science	Education-Mathematics	Mathematics	Education-General	Other
	As Part of Pre-Service Education	As Part of In-Service Education	Percent of Students	Percent of Students	Percent of Students	Percent of Students	Percent of Students	Percent of Students
Armenia	●	●	r 11 (1.6)	r 92 (1.2)	r 4 (0.9)	r 16 (2.2)	r 13 (2.0)	r 13 (1.9)
Australia	●	●	r 65 (3.4)	r 80 (3.3)	r 23 (3.3)	r 30 (3.3)	r 42 (3.7)	r 39 (4.0)
Bahrain	●	●	45 (3.2)	96 (1.4)	1 (0.9)	9 (2.1)	23 (2.5)	13 (1.9)
Belgium (Flemish)	●	●	– –	77 (2.7)	– –	23 (2.1)	8 (1.4)	35 (3.0)
Botswana	●	●	54 (4.5)	85 (3.4)	13 (3.0)	33 (4.4)	36 (4.7)	r 25 (4.5)
Bulgaria	●	●	r 68 (2.9)	r 99 (0.6)	r 13 (1.3)	r 24 (1.8)	r 59 (3.1)	r 43 (2.9)
Chile	○	○	37 (4.3)	47 (4.1)	3 (1.6)	13 (2.5)	66 (3.6)	r 18 (3.0)
Chinese Taipei	●	●	39 (3.9)	97 (1.4)	8 (1.7)	21 (3.1)	43 (4.4)	13 (2.7)
Cyprus	○	●	9 (0.7)	99 (0.4)	3 (0.4)	12 (0.8)	8 (0.6)	12 (0.8)
Egypt	●	●	61 (4.1)	96 (1.8)	4 (1.8)	29 (4.0)	35 (4.1)	13 (2.8)
Estonia	●	●	33 (2.6)	90 (1.4)	7 (1.3)	17 (1.7)	34 (2.7)	r 21 (2.8)
Ghana	●	●	47 (4.8)	55 (5.3)	35 (5.1)	47 (4.9)	70 (4.7)	r 45 (4.7)
Hong Kong, SAR	●	●	47 (4.9)	71 (4.4)	25 (3.9)	30 (4.4)	34 (4.8)	25 (4.4)
Hungary	●	●	33 (2.1)	84 (1.6)	25 (1.4)	21 (1.4)	5 (1.0)	28 (1.9)
Indonesia	●	●	51 (3.7)	74 (3.0)	10 (2.2)	13 (2.7)	22 (3.0)	20 (3.0)
Iran, Islamic Rep. of	●	●	86 (3.0)	13 (2.8)	1 (0.5)	3 (1.3)	3 (1.3)	13 (3.0)
Israel	●	●	60 (3.3)	94 (1.7)	1 (0.7)	11 (2.1)	34 (3.4)	r 21 (2.8)
Italy	○	●	– –	65 (3.4)	– –	20 (3.4)	0 (0.0)	18 (2.6)
Japan	●	●	42 (4.4)	89 (2.5)	1 (0.7)	3 (1.4)	24 (3.6)	20 (3.3)
Jordan	●	●	30 (3.8)	67 (3.9)	1 (0.7)	1 (0.7)	1 (0.7)	9 (2.6)
Korea, Rep. of	○	○	r 20 (3.1)	r 92 (1.8)	r 0 (0.0)	r 0 (0.1)	r 6 (1.5)	r 7 (2.0)
Latvia	●	●	50 (2.8)	97 (0.8)	19 (1.7)	38 (2.0)	76 (2.5)	r 52 (3.2)
Lebanon	●	●	27 (3.6)	90 (1.7)	11 (2.6)	27 (3.0)	14 (2.7)	19 (2.9)
Lithuania	●	●	23 (2.2)	93 (1.3)	3 (0.8)	10 (1.5)	29 (2.5)	r 28 (2.3)
Macedonia, Rep. of	●	●	2 (0.6)	97 (0.7)	3 (0.6)	7 (0.9)	4 (0.9)	6 (1.1)
Malaysia	●	●	58 (4.2)	36 (4.1)	22 (3.6)	31 (4.0)	14 (3.2)	38 (4.1)
Moldova, Rep. of	○	○	r 14 (2.3)	90 (1.5)	r 7 (1.4)	r 18 (2.1)	r 18 (2.5)	r 19 (2.9)
Morocco	●	●	10 (3.2)	97 (1.6)	0 (0.0)	5 (1.1)	3 (1.4)	7 (2.4)
Netherlands	●	●	r 21 (2.7)	r 74 (2.2)	r 7 (1.7)	– –	r 17 (2.6)	r 24 (2.8)
New Zealand	●	●	33 (4.6)	90 (2.7)	7 (3.1)	32 (5.2)	26 (4.8)	r 31 (5.0)
Norway	○	○	r 8 (2.6)	r 52 (4.9)	r 2 (1.2)	r 34 (4.8)	r 31 (3.7)	r 52 (5.0)
Palestinian Nat'l Auth.	●	●	24 (4.0)	63 (4.3)	1 (0.9)	1 (0.8)	6 (2.4)	13 (3.4)
Philippines	●	●	r 19 (3.7)	r 77 (3.9)	r 3 (1.6)	r 4 (1.8)	r 10 (2.6)	s 22 (4.5)
Romania	●	●	5 (1.0)	89 (1.5)	1 (0.4)	3 (0.9)	10 (1.6)	19 (2.1)
Russian Federation	●	●	– –	98 (0.5)	6 (0.8)	13 (0.8)	– –	– –
Saudi Arabia	●	●	53 (5.2)	92 (2.8)	6 (2.3)	32 (5.8)	40 (5.3)	22 (5.2)
Scotland	●	●	s 43 (3.4)	s 99 (0.4)	s 10 (1.8)	s 33 (2.8)	s 28 (2.7)	s 15 (2.3)
Serbia	●	●	47 (2.5)	99 (0.5)	4 (0.9)	12 (1.4)	42 (2.4)	27 (2.4)
Singapore	○	●	42 (2.7)	92 (1.4)	27 (2.5)	58 (3.0)	35 (2.8)	25 (2.4)
Slovak Republic	●	○	7 (1.4)	76 (1.9)	2 (0.6)	26 (2.5)	8 (1.4)	35 (2.5)
Slovenia	●	●	31 (2.5)	97 (0.9)	9 (1.3)	20 (1.6)	16 (2.2)	22 (2.1)
South Africa	○	●	r 38 (3.8)	76 (3.5)	r 17 (3.1)	36 (4.2)	r 42 (3.6)	r 33 (3.8)
Sweden	○	○	58 (3.1)	86 (2.2)	49 (2.9)	62 (3.0)	36 (3.0)	34 (3.2)
Tunisia	●	●	62 (3.7)	82 (3.2)	0 (0.0)	5 (1.8)	4 (1.7)	10 (2.6)
United States	●	--	43 (3.0)	58 (3.3)	r 6 (1.2)	r 9 (1.9)	– –	r 40 (3.0)
‡ England	●	●	s 45 (4.8)	s 95 (1.6)	s 5 (2.0)	s 18 (2.8)	s 26 (3.5)	s 17 (4.0)
International Avg.			37 (0.5)	82 (0.4)	9 (0.3)	20 (0.4)	25 (0.4)	24 (0.5)
Benchmarking Participants								
Basque Country, Spain	○	●	45 (4.9)	41 (5.5)	25 (4.0)	13 (3.5)	9 (2.9)	10 (2.8)
Indiana State, US	●	○	– –	– –	– –	– –	– –	– –
Ontario Province, Can.	●	○	25 (4.7)	46 (4.6)	13 (3.3)	14 (3.2)	56 (4.8)	72 (4.8)
Quebec Province, Can.	●	○	56 (4.5)	74 (3.9)	15 (3.7)	14 (3.4)	r 23 (3.7)	r 22 (3.1)

Country reported No for the particular option ○

Country reported Yes for the particular option ●

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators and by teachers.

1 Teachers who responded that they majored in more than one area are reflected in all categories that apply.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

Exhibit 6.5: Preparation to Teach Science

Countries		Teachers Receive Specific Preparation in How to Teach the Intended Science Curriculum		Teachers' Major Area of Study in Their Postsecondary Education				
				Primary / Elementary Education with a Major or Specialization in Science	Primary / Elementary Education with a Major or Specialization in Mathematics but Not in Science	Science or Mathematics Major or Specialization without a Major in Primary / Elementary Education	Primary / Elementary Education without a Major or Specialization in Science or Mathematics	Other
		As Part of Pre-Service Education	As Part of In-Service Education	Percent of Students	Percent of Students	Percent of Students	Percent of Students	Percent of Students
Armenia	s	●	●	13 (3.2)	2 (1.4)	77 (4.4)	3 (2.0)	5 (1.8)
Australia		●	●	14 (2.9)	9 (2.6)	1 (0.5)	72 (4.1)	4 (1.4)
Belgium (Flemish)		●	●	25 (3.5)	11 (2.4)	2 (1.2)	59 (3.2)	2 (0.7)
Chinese Taipei		●	●	30 (3.8)	4 (1.6)	17 (3.4)	28 (3.2)	22 (3.6)
Cyprus		●	○	20 (3.5)	12 (2.3)	2 (1.3)	66 (4.2)	0 (0.0)
England	r	●	○	8 (2.6)	7 (3.0)	5 (1.8)	64 (4.3)	16 (2.7)
Hong Kong, SAR		●	●	22 (3.8)	6 (2.7)	8 (2.4)	43 (5.1)	21 (3.9)
Hungary		●	●	x x	x x	x x	x x	x x
Iran, Islamic Rep. of	s	●	●	47 (5.7)	6 (2.5)	5 (2.5)	32 (5.2)	11 (2.8)
Italy	s	○	●	0 (0.0)	0 (0.0)	6 (1.8)	5 (2.1)	88 (2.8)
Japan		●	●	14 (3.0)	6 (2.1)	3 (1.4)	54 (4.1)	23 (3.6)
Latvia		●	●	57 (4.5)	4 (1.6)	5 (1.9)	24 (3.5)	10 (3.1)
Lithuania		●	●	13 (2.4)	2 (1.0)	3 (1.0)	78 (3.2)	4 (1.3)
Moldova, Rep. of		○	○	48 (4.3)	5 (1.8)	5 (1.7)	32 (4.4)	10 (2.5)
Morocco		●	●	x x	x x	x x	x x	x x
Netherlands		●	●	13 (2.8)	9 (2.7)	– –	76 (3.7)	2 (1.7)
New Zealand		●	●	17 (2.6)	13 (2.1)	1 (0.6)	63 (3.2)	5 (1.4)
Norway		○	○	– –	– –	– –	– –	– –
Philippines		●	●	13 (2.7)	18 (3.6)	4 (2.2)	54 (4.3)	11 (2.9)
Russian Federation		●	●	52 (4.0)	7 (2.0)	1 (0.8)	35 (3.7)	5 (1.6)
Scotland	r	●	●	6 (2.0)	7 (2.2)	1 (0.1)	79 (3.6)	7 (2.3)
Singapore		●	●	32 (3.7)	19 (3.1)	15 (2.6)	23 (3.4)	12 (2.8)
Slovenia		●	●	35 (4.4)	2 (1.2)	0 (0.0)	63 (4.4)	0 (0.0)
Tunisia		●	●	14 (2.8)	1 (0.0)	6 (1.8)	67 (4.1)	12 (2.7)
United States		--	--	8 (1.7)	5 (1.5)	3 (1.0)	73 (2.9)	10 (1.8)
International Avg.				23 (0.7)	7 (0.5)	8 (0.4)	50 (0.8)	13 (0.5)
Benchmarking Participants								
Indiana State, US		●	○	– –	– –	– –	– –	– –
Ontario Province, Can.		●	○	8 (2.1)	3 (1.8)	5 (2.1)	63 (5.1)	21 (3.9)
Quebec Province, Can.		●	○	12 (2.8)	4 (1.6)	3 (1.4)	69 (4.1)	12 (2.8)

● Country reported Yes for the particular option

○ Country reported No for the particular option

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators and by teachers.

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

Exhibit 6.6: Teachers' Major Area of Study in Science

Countries	Percentage of Students Taught by Teachers Having Major Area of Study in Sciences in Their Postsecondary Education[1]							
	Biology		Physics		Chemistry		Earth Science	
Armenia	r	31 (1.7)	r	30 (1.6)	r	33 (1.7)	r	20 (1.2)
Australia	r	60 (3.6)	r	24 (3.0)	r	52 (3.8)		– –
Bahrain		52 (3.1)		19 (2.8)		70 (2.9)		3 (1.0)
Belgium (Flemish)		63 (3.2)		37 (3.3)		43 (3.4)		54 (3.4)
Botswana		72 (4.3)		55 (4.9)		71 (4.1)		12 (3.1)
Bulgaria	r	39 (1.6)	r	40 (1.7)	r	55 (2.1)	r	27 (1.4)
Chile		35 (3.8)		18 (2.9)		25 (3.1)		9 (2.1)
Chinese Taipei		25 (3.9)		67 (3.9)		75 (3.7)		22 (3.0)
Cyprus		26 (0.8)		45 (1.1)		46 (0.8)		18 (0.7)
Egypt		65 (3.4)		81 (3.0)		85 (3.0)		36 (4.0)
Estonia		42 (2.2)		31 (1.6)		38 (2.0)		31 (2.4)
Ghana		49 (5.4)		48 (5.3)		46 (5.4)		12 (3.0)
Hong Kong, SAR		37 (4.2)		34 (4.1)		37 (4.8)		2 (1.4)
Hungary		39 (1.7)		20 (1.3)		26 (1.5)		33 (1.4)
Indonesia		51 (2.9)		37 (2.8)		11 (2.3)		4 (1.4)
Iran, Islamic Rep. of		10 (2.5)		7 (1.9)		9 (2.4)		7 (2.0)
Israel		75 (2.8)		30 (3.0)		57 (3.4)		15 (2.6)
Italy		54 (3.5)		6 (1.8)		3 (1.1)		5 (1.6)
Japan		35 (4.3)		33 (3.4)		42 (4.4)		29 (3.6)
Jordan		18 (3.5)		21 (3.6)		27 (3.8)		7 (2.3)
Korea, Rep. of	r	35 (3.3)	r	27 (3.5)	r	25 (2.9)	r	9 (1.7)
Latvia		58 (1.7)		44 (1.7)		62 (1.9)		– –
Lebanon		60 (3.3)		44 (3.0)		51 (3.2)		27 (3.3)
Lithuania		38 (1.5)		30 (1.2)		30 (1.6)		22 (1.4)
Macedonia, Rep. of		38 (1.3)		27 (0.9)		44 (1.7)		25 (0.6)
Malaysia		29 (3.8)		16 (3.3)		19 (3.5)		7 (2.3)
Moldova, Rep. of	r	41 (2.3)	r	34 (2.3)	r	29 (2.3)	r	31 (2.2)
Morocco		44 (2.2)		54 (2.4)		47 (2.9)		39 (2.6)
Netherlands	r	29 (1.9)	r	16 (2.3)	r	16 (2.2)	r	27 (1.7)
New Zealand		59 (4.6)		31 (4.3)		53 (5.9)		12 (2.7)
Norway	r	32 (4.5)	r	16 (3.3)	r	23 (4.1)	r	11 (3.2)
Palestinian Nat'l Auth.		34 (4.3)		12 (3.1)		19 (3.7)		1 (0.0)
Philippines	r	72 (4.0)	r	7 (2.6)	r	18 (3.5)		– –
Romania		24 (1.0)		38 (1.6)		33 (1.7)		22 (0.7)
Russian Federation		48 (1.4)		26 (0.6)		42 (1.2)		30 (1.1)
Saudi Arabia		78 (4.4)		42 (5.1)		54 (6.2)		21 (3.5)
Scotland	s	50 (3.1)	s	44 (3.0)	s	59 (3.1)	s	12 (2.1)
Serbia		30 (1.1)		32 (1.1)		44 (1.3)		26 (0.5)
Singapore		47 (2.7)		51 (2.4)		63 (2.6)		2 (0.9)
Slovak Republic		– –		29 (1.0)		37 (1.4)		18 (1.5)
Slovenia		58 (1.6)		34 (1.7)		57 (1.9)		0 (0.1)
South Africa	r	53 (4.1)	r	37 (3.7)	r	27 (3.6)	r	16 (3.2)
Sweden		61 (3.1)		53 (3.2)		64 (3.1)		20 (2.6)
Tunisia		81 (3.3)		10 (2.6)		22 (3.3)		65 (3.7)
United States		46 (3.3)	r	14 (2.3)	r	25 (2.7)	r	22 (2.3)
‡ England	s	59 (4.1)	s	39 (4.5)	s	47 (4.8)	s	16 (3.8)
International Avg.		46 (0.5)		32 (0.4)		40 (0.5)		19 (0.4)
Basque Country, Spain		26 (4.7)		12 (3.6)		19 (4.2)		6 (2.5)
Indiana State, US		– –		– –		– –		– –
Ontario Province, Can.		36 (5.0)		12 (3.6)		13 (3.3)		18 (3.8)
Quebec Province, Can.		52 (4.0)		17 (3.4)		32 (4.1)	r	15 (3.3)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

1 Teachers who responded that they majored in more than one area are reflected in all categories that apply.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

A dash (–) indicates data are not available.

An "r" indicates 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.

average, 46 percent of students were taught by teachers majoring in biology, 40 percent by chemistry majors, 32 percent by physics majors, and just 19 percent by teachers majoring in earth science.

In today's fast-paced world of frequent important discoveries and new technologies in the fields of pedagogy and science, it is very important for teachers to continually update their knowledge. To provide context for considering this important part of teacher training in the TIMSS countries, Exhibits 6.7 through 6.9 contain information about teachers' opportunities for and participation in professional development activities.

Exhibit 6.7 presents schools' reports about the opportunities provided to teachers in five major areas: supporting implementation of the official curriculum, supporting school-level goals, improving content knowledge, improving teaching skills, and using technology. Within each area, schools reported the frequency of teachers' involvement. At both grades, schools reported that their professional development programs emphasized improving content knowledge and teaching skills. About 80 percent of the students were taught science by teachers having a least some professional development training in these areas.

Exhibit 6.8 presents teachers' reports about their professional development participation in six different aspects of science teaching. The results were relatively consistent across the six topics – content, pedagogy, curriculum, technology, critical thinking/inquiry skills, and assessment. At the eighth grade, from 45 to 58 percent of the students, on average, internationally, were taught by teachers having participated in professional development in the area during the past two years. The highest percentage (58%) was for science content. At the fourth grade, on average, the percentages were somewhat lower, ranging from 27 to 37 percent. The highest percentages were for content and pedagogy (37% each). The lowest percentage was for integrating information technology into science (27%).

Because opportunities for professional development do not necessarily have to be structured by the school, teachers also were asked

Exhibit 6.7: Professional Development Opportunities for Teachers in Mathematics and Science

SCIENCE Grade 8

Countries	Percentage of Students by Their School's Report of Teachers' Involvement in Professional Development Opportunities in Mathematics and Science					
	Supporting the Implementation of the National or Regional Curriculum			Designing or Supporting the School's Own Improvement Goals		
	3 Times or More a Year	1-2 Times a Year	Never	3 Times or More a Year	1-2 Times a Year	Never
Armenia	r 4 (1.8)	34 (4.2)	63 (4.5)	r 21 (4.6)	35 (4.8)	44 (4.7)
Australia	48 (5.0)	38 (5.1)	14 (2.9)	60 (4.5)	35 (4.3)	4 (1.9)
Bahrain	60 (0.2)	23 (0.2)	16 (0.1)	66 (0.2)	19 (0.1)	16 (0.1)
Belgium (Flemish)	11 (2.7)	67 (4.2)	22 (3.7)	12 (3.2)	62 (4.5)	26 (3.9)
Botswana	30 (4.3)	38 (4.7)	32 (3.8)	43 (4.7)	42 (4.7)	15 (3.0)
Bulgaria	2 (1.1)	30 (4.2)	68 (4.3)	11 (2.8)	36 (4.2)	53 (4.5)
Chile	27 (4.0)	55 (4.7)	19 (3.4)	50 (3.8)	39 (3.8)	11 (2.3)
Chinese Taipei	11 (2.8)	46 (4.3)	43 (4.2)	43 (4.3)	46 (4.1)	11 (2.7)
Cyprus	10 (0.2)	90 (0.2)	0 (0.0)	50 (0.3)	47 (0.3)	3 (0.0)
Egypt	88 (2.7)	8 (2.4)	3 (1.5)	88 (2.4)	9 (2.0)	3 (1.2)
Estonia	20 (3.6)	62 (4.0)	18 (3.3)	25 (3.6)	46 (4.5)	29 (4.3)
Ghana	17 (3.7)	33 (4.4)	50 (5.1)	45 (4.3)	29 (4.4)	26 (3.5)
Hong Kong, SAR	47 (4.6)	46 (4.4)	7 (2.5)	44 (5.1)	51 (5.1)	5 (2.0)
Hungary	15 (3.1)	32 (3.7)	53 (3.8)	69 (3.5)	28 (3.6)	3 (1.5)
Indonesia	16 (3.2)	34 (4.4)	50 (4.7)	26 (4.0)	49 (4.3)	25 (4.0)
Iran, Islamic Rep. of	20 (3.4)	48 (4.1)	32 (3.7)	31 (4.1)	43 (3.9)	25 (3.3)
Israel	91 (2.0)	6 (1.8)	3 (1.2)	81 (3.7)	17 (3.4)	2 (1.3)
Italy	28 (3.4)	34 (3.5)	38 (3.5)	35 (3.7)	38 (3.7)	27 (3.4)
Japan	15 (3.1)	28 (3.8)	57 (4.3)	31 (3.8)	40 (3.8)	29 (3.8)
Jordan	39 (4.2)	41 (4.1)	20 (3.3)	41 (4.6)	40 (3.6)	19 (3.6)
Korea, Rep. of	9 (2.3)	73 (3.8)	18 (3.6)	9 (2.1)	55 (3.9)	36 (3.7)
Latvia	11 (3.0)	42 (4.7)	46 (5.0)	28 (3.4)	59 (4.0)	13 (2.9)
Lebanon	24 (3.9)	37 (4.6)	39 (4.0)	38 (4.2)	34 (4.2)	28 (3.7)
Lithuania	5 (2.1)	35 (4.1)	60 (4.3)	53 (4.6)	45 (4.6)	2 (1.2)
Macedonia, Rep. of	26 (4.1)	54 (4.0)	20 (3.3)	41 (4.3)	44 (3.6)	15 (3.2)
Malaysia	49 (4.3)	43 (4.3)	8 (2.0)	55 (4.2)	40 (4.1)	5 (2.0)
Moldova, Rep. of	r 40 (4.9)	46 (4.9)	14 (3.5)	r 50 (5.1)	42 (4.8)	8 (2.7)
Morocco	s 12 (3.7)	24 (5.1)	64 (5.1)	s 2 (1.8)	32 (5.3)	66 (5.6)
Netherlands	2 (1.2)	43 (4.5)	56 (4.6)	23 (4.1)	52 (5.0)	25 (4.2)
New Zealand	41 (5.3)	53 (5.3)	5 (2.4)	47 (5.8)	48 (6.2)	5 (2.1)
Norway	10 (2.5)	43 (5.2)	47 (5.1)	10 (2.8)	36 (4.5)	54 (4.6)
Palestinian Nat'l Auth.	56 (4.4)	33 (3.7)	11 (2.9)	58 (4.3)	32 (4.3)	10 (2.5)
Philippines	58 (3.9)	38 (4.1)	4 (1.7)	70 (3.7)	26 (3.4)	4 (1.9)
Romania	61 (4.1)	25 (3.6)	14 (3.1)	78 (3.4)	17 (3.0)	5 (2.0)
Russian Federation	16 (2.9)	63 (3.5)	22 (4.9)	17 (2.7)	60 (4.6)	24 (4.3)
Saudi Arabia	20 (4.2)	27 (4.0)	54 (5.4)	37 (5.2)	28 (4.2)	35 (5.4)
Scotland	s 33 (5.8)	60 (5.7)	7 (3.0)	s 55 (5.6)	42 (5.4)	3 (2.0)
Serbia	13 (2.8)	33 (3.7)	54 (4.0)	46 (4.4)	38 (4.2)	17 (3.2)
Singapore	56 (0.0)	42 (0.0)	2 (0.0)	67 (0.0)	31 (0.0)	2 (0.0)
Slovak Republic	13 (3.1)	38 (4.8)	49 (4.4)	7 (2.0)	27 (3.9)	65 (4.0)
Slovenia	58 (4.3)	38 (4.1)	4 (1.7)	39 (4.5)	58 (4.4)	3 (1.3)
South Africa	55 (3.6)	27 (3.4)	18 (2.4)	49 (3.2)	33 (3.2)	18 (3.0)
Sweden	11 (2.6)	41 (4.4)	49 (4.6)	17 (3.1)	52 (4.0)	30 (4.1)
Tunisia	27 (3.6)	26 (3.5)	47 (4.1)	31 (4.1)	33 (4.4)	37 (4.2)
United States	63 (3.6)	34 (3.5)	4 (1.4)	72 (3.0)	25 (3.0)	3 (1.4)
‡ England	s 68 (6.0)	27 (5.9)	4 (2.1)	s 46 (7.6)	48 (7.4)	6 (3.0)
International Avg.	31 (0.5)	40 (0.6)	29 (0.5)	42 (0.6)	39 (0.6)	20 (0.5)
Benchmarking Participants						
Basque Country, Spain	20 (4.4)	23 (4.4)	57 (5.4)	49 (5.1)	26 (5.0)	25 (4.6)
Indiana State, US	64 (5.5)	31 (5.7)	5 (3.1)	67 (6.7)	32 (6.7)	1 (0.0)
Ontario Province, Can.	31 (4.6)	58 (4.8)	11 (2.8)	40 (4.8)	53 (4.9)	8 (2.6)
Quebec Province, Can.	15 (3.5)	51 (4.8)	34 (4.3)	24 (4.5)	45 (5.1)	30 (4.6)

Background data provided by schools.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals 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) 2003

Exhibit 6.7: Professional Development Opportunities for Teachers in Mathematics and Science *(Continued…)*

Countries	Percentage of Students by Their School's Report of Teachers' Involvement in Professional Development Opportunities in Mathematics and Science					
	Improving the Content Knowledge			Improving Teaching Skills		
	3 Times or More a Year	1-2 Times a Year	Never	3 Times or More a Year	1-2 Times a Year	Never
Armenia	r 32 (4.4)	35 (4.8)	34 (4.3)	r 33 (4.3)	37 (4.6)	30 (4.4)
Australia	40 (4.6)	48 (4.6)	12 (3.6)	50 (4.5)	47 (4.2)	3 (1.4)
Bahrain	67 (0.2)	26 (0.1)	7 (0.1)	87 (0.2)	7 (0.0)	6 (0.2)
Belgium (Flemish)	16 (3.5)	66 (4.1)	18 (3.1)	14 (3.1)	60 (4.3)	26 (4.1)
Botswana	32 (4.2)	36 (4.9)	33 (4.3)	40 (4.6)	36 (4.3)	25 (3.4)
Bulgaria	41 (4.5)	39 (4.0)	20 (3.6)	42 (4.7)	42 (4.1)	17 (3.0)
Chile	38 (4.0)	49 (4.3)	12 (2.5)	46 (4.3)	45 (4.6)	9 (2.2)
Chinese Taipei	61 (4.2)	36 (4.1)	3 (1.4)	55 (4.1)	43 (3.9)	2 (1.1)
Cyprus	32 (0.3)	59 (0.3)	10 (0.2)	41 (0.3)	58 (0.3)	1 (0.0)
Egypt	94 (2.0)	5 (1.8)	2 (0.9)	95 (1.7)	3 (1.4)	1 (1.0)
Estonia	56 (3.9)	43 (3.8)	1 (0.8)	35 (4.5)	61 (4.4)	4 (1.8)
Ghana	49 (4.6)	29 (4.1)	21 (3.8)	48 (4.5)	35 (4.6)	17 (3.0)
Hong Kong, SAR	55 (4.9)	43 (5.0)	2 (1.1)	51 (4.8)	46 (4.7)	3 (1.3)
Hungary	55 (3.8)	38 (4.0)	8 (2.3)	66 (3.6)	27 (3.9)	7 (2.0)
Indonesia	42 (4.2)	47 (4.3)	11 (2.8)	43 (4.1)	47 (4.1)	10 (2.9)
Iran, Islamic Rep. of	34 (3.6)	49 (3.7)	17 (3.0)	25 (3.5)	57 (4.1)	18 (3.2)
Israel	87 (2.9)	12 (2.8)	1 (1.0)	83 (3.4)	13 (2.9)	4 (1.7)
Italy	26 (3.4)	33 (3.8)	41 (3.9)	39 (3.9)	33 (3.8)	28 (3.4)
Japan	44 (3.8)	49 (4.1)	7 (2.2)	42 (3.7)	49 (4.1)	9 (2.1)
Jordan	51 (4.3)	40 (4.1)	9 (2.7)	49 (3.9)	41 (4.1)	10 (2.5)
Korea, Rep. of	18 (3.3)	75 (3.7)	6 (2.0)	21 (3.0)	68 (3.9)	11 (2.8)
Latvia	40 (4.4)	58 (4.4)	2 (1.3)	44 (4.6)	54 (4.4)	3 (1.6)
Lebanon	39 (4.3)	33 (4.3)	28 (3.4)	47 (4.4)	30 (4.2)	24 (3.7)
Lithuania	59 (5.0)	41 (5.1)	1 (0.6)	61 (4.6)	39 (4.6)	0 (0.0)
Macedonia, Rep. of	32 (3.7)	56 (3.9)	12 (3.0)	28 (3.8)	55 (4.1)	17 (3.3)
Malaysia	68 (3.6)	32 (3.7)	1 (0.8)	62 (4.3)	36 (4.3)	2 (1.2)
Moldova, Rep. of	r 61 (4.9)	37 (4.9)	2 (1.1)	r 78 (4.5)	20 (4.2)	3 (1.5)
Morocco	s 12 (3.2)	33 (5.3)	55 (5.6)	s 23 (4.4)	43 (5.0)	35 (4.5)
Netherlands	9 (2.7)	70 (4.3)	21 (4.2)	18 (3.7)	54 (5.5)	28 (4.8)
New Zealand	36 (5.6)	60 (5.7)	4 (1.3)	35 (4.8)	56 (4.8)	8 (3.0)
Norway	15 (3.4)	68 (4.1)	17 (3.1)	9 (2.5)	58 (4.5)	33 (4.3)
Palestinian Nat'l Auth.	62 (4.5)	34 (4.2)	5 (1.9)	67 (4.1)	26 (3.5)	6 (2.4)
Philippines	73 (3.7)	24 (3.6)	3 (1.6)	85 (3.1)	14 (3.0)	1 (0.9)
Romania	83 (3.2)	14 (2.9)	4 (1.7)	86 (3.2)	13 (2.9)	2 (1.3)
Russian Federation	44 (3.4)	50 (3.4)	7 (1.8)	43 (3.5)	51 (3.6)	6 (1.9)
Saudi Arabia	41 (5.4)	30 (4.3)	30 (5.3)	39 (5.5)	38 (5.0)	22 (5.1)
Scotland	s 41 (4.9)	50 (4.9)	9 (3.3)	s 35 (4.7)	59 (5.3)	6 (2.9)
Serbia	45 (3.8)	49 (3.7)	6 (2.0)	37 (3.6)	51 (3.9)	13 (3.2)
Singapore	59 (0.0)	40 (0.0)	0 (0.0)	68 (0.0)	32 (0.0)	0 (0.0)
Slovak Republic	46 (4.4)	42 (4.3)	12 (2.9)	44 (4.0)	49 (3.9)	7 (2.0)
Slovenia	40 (4.8)	53 (5.0)	7 (2.5)	36 (4.2)	53 (4.3)	11 (2.5)
South Africa	60 (3.2)	29 (3.3)	12 (2.3)	63 (3.0)	24 (3.1)	13 (2.2)
Sweden	16 (2.9)	62 (4.0)	22 (3.6)	15 (3.2)	47 (4.4)	38 (3.6)
Tunisia	59 (4.0)	25 (3.4)	16 (2.7)	62 (4.5)	23 (3.7)	15 (3.1)
United States	56 (3.3)	37 (3.4)	7 (1.8)	59 (3.4)	36 (3.5)	6 (1.6)
‡ England	s 55 (7.2)	36 (6.8)	9 (4.0)	s 68 (6.5)	30 (6.3)	2 (0.1)
International Avg.	46 (0.6)	42 (0.6)	12 (0.4)	48 (0.6)	40 (0.6)	12 (0.4)
Benchmarking Participants						
Basque Country, Spain	33 (4.9)	37 (4.7)	30 (5.0)	41 (5.1)	42 (5.1)	17 (4.1)
Indiana State, US	50 (6.0)	41 (5.9)	9 (4.2)	47 (6.6)	46 (6.4)	7 (3.5)
Ontario Province, Can.	23 (4.2)	62 (4.6)	15 (3.7)	29 (4.0)	58 (4.6)	13 (3.5)
Quebec Province, Can.	14 (3.6)	45 (5.0)	41 (5.0)	21 (4.6)	58 (4.4)	21 (3.6)

Background data provided by schools.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals 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) 2003

Exhibit 6.7: Professional Development Opportunities for Teachers in Mathematics and Science *(…Continued)*

Countries		Percentage of Students by Their School's Report of Teachers' Involvement in Professional Development Opportunities in Mathematics and Science: Using Information and Communication Technology for Educational Purposes		
		3 Times or More a Year	1-2 Times a Year	Never
Armenia	r	23 (4.0)	31 (4.9)	46 (4.9)
Australia		46 (3.9)	50 (3.5)	4 (1.7)
Bahrain		44 (0.2)	35 (0.2)	22 (0.2)
Belgium (Flemish)		29 (4.0)	64 (4.3)	7 (2.3)
Botswana		23 (3.8)	21 (4.2)	56 (5.1)
Bulgaria		18 (3.9)	30 (4.2)	52 (4.5)
Chile		47 (3.9)	40 (3.6)	13 (2.7)
Chinese Taipei		46 (4.2)	50 (4.3)	4 (1.7)
Cyprus		30 (0.3)	45 (0.3)	24 (0.2)
Egypt		85 (2.8)	9 (2.3)	6 (2.1)
Estonia		25 (3.5)	62 (4.0)	12 (2.5)
Ghana		15 (3.9)	15 (3.2)	70 (4.1)
Hong Kong, SAR		69 (4.3)	29 (4.1)	2 (1.3)
Hungary		38 (4.0)	42 (4.3)	20 (3.2)
Indonesia		14 (3.0)	33 (3.7)	52 (4.1)
Iran, Islamic Rep. of		21 (3.2)	35 (3.6)	44 (4.0)
Israel		51 (4.5)	29 (4.3)	20 (3.5)
Italy		52 (4.2)	37 (3.7)	12 (2.8)
Japan		25 (3.3)	38 (3.9)	37 (3.8)
Jordan		29 (4.6)	31 (3.7)	39 (4.5)
Korea, Rep. of		30 (3.5)	65 (3.7)	5 (1.9)
Latvia		31 (4.2)	58 (4.7)	11 (2.7)
Lebanon		34 (4.0)	29 (4.2)	38 (3.5)
Lithuania		34 (4.1)	64 (4.3)	2 (1.3)
Macedonia, Rep. of		20 (3.8)	45 (4.3)	36 (4.3)
Malaysia		28 (3.8)	41 (4.1)	31 (3.7)
Moldova, Rep. of	r	53 (4.6)	32 (4.2)	15 (3.8)
Morocco	s	8 (2.2)	23 (5.0)	69 (5.5)
Netherlands		14 (3.6)	50 (4.9)	36 (4.6)
New Zealand		38 (5.8)	54 (5.8)	8 (2.8)
Norway		41 (4.3)	49 (4.4)	10 (2.7)
Palestinian Nat'l Auth.		35 (3.9)	32 (3.9)	33 (4.0)
Philippines		55 (4.4)	32 (4.5)	13 (3.2)
Romania		50 (4.2)	23 (3.7)	27 (4.1)
Russian Federation		18 (2.6)	41 (4.5)	42 (4.0)
Saudi Arabia		29 (5.5)	23 (3.6)	48 (5.6)
Scotland	s	60 (5.9)	38 (5.8)	2 (1.2)
Serbia		32 (4.0)	45 (4.1)	22 (3.2)
Singapore		77 (0.0)	23 (0.0)	0 (0.0)
Slovak Republic		40 (4.5)	41 (4.8)	19 (3.1)
Slovenia		26 (4.1)	57 (4.8)	17 (3.1)
South Africa		38 (3.0)	25 (3.4)	37 (3.4)
Sweden		13 (3.0)	46 (4.4)	42 (4.3)
Tunisia		29 (3.9)	32 (3.7)	40 (3.7)
United States		52 (3.4)	37 (3.5)	11 (2.2)
‡ England	s	59 (6.7)	37 (6.4)	4 (2.5)
International Avg.		36 (0.6)	38 (0.6)	25 (0.5)
Benchmarking Participants				
Basque Country, Spain		50 (4.6)	37 (4.5)	13 (3.4)
Indiana State, US		33 (6.6)	57 (7.1)	10 (4.1)
Ontario Province, Can.		31 (4.5)	56 (4.5)	13 (3.4)
Quebec Province, Can.		14 (3.3)	47 (5.0)	39 (4.8)

Background data provided by schools.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals 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) 2003

Exhibit 6.7: Professional Development Opportunities for Teachers in Mathematics and Science *(Continued…)*

Countries	Percentage of Students by Their School's Report of Teachers' Involvement in Professional Development Opportunities in Mathematics and Science					
	Supporting the Implementation of the National or Regional Curriculum			Designing or Supporting the School's Own Improvement Goals		
	3 Times or More a Year	1-2 Times a Year	Never	3 Times or More a Year	1-2 Times a Year	Never
Armenia	r 4 (1.9)	22 (4.2)	75 (4.0)	s 19 (3.9)	36 (4.8)	46 (5.1)
Australia	43 (4.3)	34 (4.2)	23 (3.9)	46 (4.3)	38 (4.4)	16 (2.7)
Belgium (Flemish)	28 (3.6)	47 (4.3)	25 (3.9)	33 (3.8)	43 (4.0)	25 (3.9)
Chinese Taipei	3 (1.4)	30 (3.7)	67 (3.8)	25 (3.8)	61 (4.1)	14 (2.7)
Cyprus	21 (3.4)	68 (3.8)	12 (2.9)	20 (4.2)	61 (4.8)	19 (4.0)
England	r 61 (5.5)	33 (5.5)	5 (2.6)	r 50 (5.4)	45 (5.6)	5 (2.5)
Hong Kong, SAR	46 (5.2)	48 (4.8)	5 (2.0)	43 (4.7)	50 (5.2)	7 (2.9)
Hungary	13 (2.6)	24 (4.2)	64 (4.0)	69 (4.0)	29 (3.9)	2 (1.2)
Iran, Islamic Rep. of	14 (3.7)	38 (4.2)	48 (4.7)	29 (4.7)	33 (4.5)	38 (4.8)
Italy	24 (3.3)	25 (3.4)	51 (3.7)	35 (3.7)	29 (3.5)	36 (3.4)
Japan	7 (2.2)	27 (3.6)	66 (3.7)	24 (3.3)	46 (3.4)	30 (3.7)
Latvia	r 9 (2.8)	36 (4.7)	55 (4.9)	r 20 (3.6)	59 (4.1)	21 (3.4)
Lithuania	r 3 (1.5)	16 (3.1)	81 (3.1)	31 (4.7)	61 (4.4)	7 (2.8)
Moldova, Rep. of	r 27 (4.7)	50 (5.4)	23 (4.3)	r 41 (4.8)	42 (4.2)	17 (3.5)
Morocco	r 6 (1.8)	16 (3.0)	78 (3.3)	r 9 (3.2)	19 (3.3)	72 (4.0)
Netherlands	7 (2.6)	18 (3.3)	75 (4.0)	52 (4.8)	34 (4.6)	14 (3.6)
New Zealand	45 (3.2)	35 (3.6)	20 (3.0)	47 (3.8)	45 (4.0)	8 (1.9)
Norway	16 (3.6)	44 (4.6)	40 (4.3)	20 (4.3)	30 (4.3)	50 (4.6)
Philippines	53 (4.3)	37 (4.2)	10 (2.4)	72 (3.9)	25 (3.9)	3 (1.2)
Russian Federation	19 (3.2)	56 (3.7)	25 (3.8)	13 (2.2)	56 (3.3)	30 (3.6)
Scotland	38 (5.2)	58 (5.2)	4 (1.9)	38 (4.7)	55 (5.2)	6 (2.2)
Singapore	57 (4.3)	39 (4.1)	3 (1.5)	72 (3.6)	27 (3.6)	1 (0.6)
Slovenia	57 (4.3)	38 (4.3)	5 (1.8)	38 (4.7)	55 (4.5)	7 (2.4)
Tunisia	r 29 (4.2)	31 (4.3)	39 (4.4)	r 37 (4.2)	45 (4.7)	18 (3.4)
United States	50 (3.6)	40 (3.5)	9 (2.0)	61 (3.3)	31 (3.1)	8 (1.9)
International Avg.	27 (0.7)	36 (0.8)	36 (0.7)	38 (0.8)	42 (0.9)	20 (0.6)
Benchmarking Participants						
Indiana State, US	52 (7.1)	42 (7.0)	6 (3.2)	48 (7.7)	41 (6.6)	11 (4.6)
Ontario Province, Can.	29 (4.6)	56 (5.0)	15 (3.5)	42 (5.0)	44 (4.9)	14 (3.3)
Quebec Province, Can.	25 (4.4)	55 (5.0)	20 (3.9)	24 (4.3)	47 (5.0)	29 (4.5)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by schools.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals 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 6.7: Professional Development Opportunities for Teachers in Mathematics and Science *(…Continued)*

Countries	Percentage of Students By Their School's Report of Teachers' Involvement in Professional Development Opportunities in Mathematics and Science					
	Improving the Content Knowledge			Improving Teaching Skills		
	3 Times or More a Year	1-2 Times a Year	Never	3 Times or More a Year	1-2 Times a Year	Never
Armenia	r 28 (4.3)	35 (4.9)	37 (4.6)	r 29 (4.1)	33 (4.6)	38 (4.8)
Australia	40 (4.7)	37 (4.6)	23 (2.8)	44 (4.8)	42 (5.1)	14 (3.0)
Belgium (Flemish)	25 (4.0)	57 (4.3)	18 (3.4)	22 (3.3)	49 (4.4)	29 (3.6)
Chinese Taipei	47 (4.0)	47 (4.1)	6 (2.1)	53 (4.3)	43 (4.4)	4 (1.7)
Cyprus	16 (3.9)	57 (5.1)	28 (4.5)	27 (4.2)	62 (5.3)	11 (3.5)
England	r 49 (5.6)	45 (5.7)	5 (2.4)	r 59 (5.8)	36 (5.7)	6 (2.5)
Hong Kong, SAR	53 (5.4)	45 (5.4)	3 (1.5)	56 (5.2)	42 (5.4)	2 (1.3)
Hungary	56 (3.7)	36 (3.7)	8 (2.1)	68 (3.8)	26 (3.7)	6 (1.8)
Iran, Islamic Rep. of	22 (3.9)	48 (4.2)	29 (3.8)	26 (4.4)	50 (4.7)	23 (3.5)
Italy	26 (3.4)	31 (4.1)	43 (4.1)	35 (3.6)	33 (3.7)	32 (3.6)
Japan	44 (4.2)	47 (4.1)	9 (2.2)	49 (4.2)	46 (4.1)	5 (1.8)
Latvia	r 28 (4.2)	58 (4.4)	15 (3.2)	35 (4.6)	55 (4.5)	9 (2.6)
Lithuania	40 (4.4)	56 (4.5)	4 (1.6)	46 (4.2)	50 (4.1)	5 (1.9)
Moldova, Rep. of	r 62 (4.8)	34 (4.9)	4 (1.9)	r 72 (5.0)	22 (4.5)	7 (2.6)
Morocco	r 15 (3.8)	27 (3.9)	58 (4.5)	r 16 (3.8)	31 (5.1)	53 (5.2)
Netherlands	30 (5.2)	37 (4.8)	33 (5.0)	38 (4.7)	37 (4.4)	26 (4.5)
New Zealand	48 (3.6)	40 (3.7)	13 (2.5)	54 (3.5)	33 (3.5)	12 (2.7)
Norway	19 (3.5)	53 (4.3)	27 (4.6)	12 (3.1)	41 (4.4)	46 (4.9)
Philippines	74 (4.0)	23 (3.9)	2 (1.2)	80 (3.5)	20 (3.4)	0 (0.2)
Russian Federation	32 (3.9)	47 (4.3)	20 (3.2)	42 (3.5)	46 (4.0)	12 (2.7)
Scotland	30 (5.2)	54 (5.8)	16 (3.6)	32 (5.2)	49 (5.8)	19 (3.9)
Singapore	67 (3.7)	33 (3.7)	0 (0.0)	78 (3.0)	21 (3.0)	0 (0.3)
Slovenia	32 (4.3)	56 (4.7)	13 (2.9)	35 (4.6)	59 (4.4)	6 (1.7)
Tunisia	49 (4.7)	38 (4.7)	13 (2.7)	56 (4.2)	35 (4.2)	9 (2.6)
United States	49 (3.3)	43 (3.2)	8 (1.7)	58 (3.9)	36 (3.6)	6 (1.6)
International Avg.	39 (0.9)	43 (0.9)	17 (0.6)	45 (0.8)	40 (0.9)	15 (0.6)
Benchmarking Participants						
Indiana State, US	43 (6.9)	41 (7.3)	16 (5.6)	51 (6.8)	43 (5.9)	7 (3.4)
Ontario Province, Can.	30 (4.6)	49 (4.9)	21 (3.3)	28 (4.3)	56 (4.7)	15 (3.4)
Quebec Province, Can.	20 (4.3)	61 (5.1)	19 (3.5)	21 (4.2)	50 (4.4)	30 (4.2)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by schools.

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

An "r" indicates data are available for at least 70 but less than 85% of the students.

Exhibit 6.7: Professional Development Opportunities for Teachers in Mathematics and Science

Countries		Percentage of Students By Their School's Report of Teachers' Involvement in Professional Development Opportunities in Mathematics and Science: Using Information and Communication Technology for Educational Purposes		
		3 Times or More a Year	1-2 Times a Year	Never
Armenia	r	19 (3.5)	29 (4.8)	52 (5.0)
Australia		48 (4.4)	39 (4.5)	13 (2.8)
Belgium (Flemish)		35 (4.4)	47 (4.6)	18 (3.3)
Chinese Taipei		46 (4.1)	51 (4.1)	4 (1.6)
Cyprus		26 (4.6)	52 (4.5)	21 (3.9)
England	r	60 (5.6)	36 (5.2)	4 (2.1)
Hong Kong, SAR		75 (3.8)	23 (3.8)	1 (0.9)
Hungary		37 (4.6)	44 (4.5)	18 (3.1)
Iran, Islamic Rep. of		20 (3.4)	33 (5.1)	47 (5.1)
Italy		47 (3.9)	30 (3.7)	24 (3.5)
Japan		23 (3.5)	37 (4.0)	39 (4.1)
Latvia		22 (4.0)	47 (4.8)	31 (4.2)
Lithuania		19 (3.6)	65 (4.5)	16 (3.0)
Moldova, Rep. of	r	60 (5.1)	19 (4.0)	21 (3.9)
Morocco	r	7 (2.4)	13 (3.7)	79 (4.0)
Netherlands		46 (5.2)	33 (4.6)	20 (4.2)
New Zealand		58 (3.3)	35 (3.0)	8 (2.1)
Norway		41 (4.2)	39 (4.6)	20 (4.1)
Philippines		50 (5.0)	31 (4.5)	19 (3.6)
Russian Federation		5 (1.4)	22 (2.4)	74 (2.6)
Scotland		54 (5.2)	39 (5.0)	7 (2.9)
Singapore		82 (3.0)	18 (2.9)	0 (0.3)
Slovenia		20 (3.5)	65 (4.2)	15 (3.5)
Tunisia	r	3 (1.5)	5 (2.1)	92 (2.6)
United States		46 (3.6)	42 (3.3)	11 (2.1)
International Avg.		38 (0.8)	36 (0.8)	26 (0.7)
Benchmarking Participants				
Indiana State, US		41 (6.0)	46 (6.1)	12 (4.8)
Ontario Province, Can.		30 (4.6)	51 (4.8)	19 (4.2)
Quebec Province, Can.		16 (3.6)	48 (4.5)	36 (4.1)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by schools.

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

An "r" indicates data are available for at least 70 but less than 85% of the students.

Exhibit 6.8: Teachers' Participation in Professional Development in Science

SCIENCE Grade 8

Countries	Percentage of Students by Their Teachers' Participation in Professional Development in Science in the Past Two Years											
	Science Content		Science Pedagogy/ Instruction		Science Curriculum		Integrating Information Technology into Science		Improving Students' Critical Thinking or Inquiry Skills		Science Assessment	
Armenia	r	19 (1.8)	r	34 (3.0)	r	27 (2.6)	r	14 (1.8)	r	35 (2.3)	r	32 (2.7)
Australia	r	69 (3.7)	r	57 (4.1)	r	71 (3.1)	r	64 (3.7)	r	53 (4.2)	r	60 (3.9)
Bahrain		66 (3.1)		68 (3.5)		50 (3.8)		62 (4.0)		41 (3.5)		52 (3.4)
Belgium (Flemish)		47 (3.1)		35 (3.2)		44 (3.3)		50 (3.3)		11 (2.0)		15 (2.2)
Botswana		27 (3.4)		22 (3.6)		10 (2.7)		18 (3.5)		32 (3.8)		33 (4.2)
Bulgaria	r	22 (2.6)	r	23 (2.7)	r	25 (3.0)	r	11 (1.9)	r	19 (2.9)	r	17 (2.5)
Chile		69 (3.4)		65 (3.1)		45 (3.4)		39 (3.6)		40 (4.0)		46 (3.9)
Chinese Taipei		82 (3.3)		74 (3.9)		78 (3.5)		82 (3.0)		38 (3.5)		59 (4.0)
Cyprus		61 (1.4)		59 (1.0)		56 (1.4)		59 (1.0)		46 (1.4)		38 (0.9)
Egypt		41 (4.6)		56 (4.1)		27 (4.0)		49 (4.2)		66 (4.2)		66 (4.3)
Estonia		66 (2.8)		71 (2.2)		65 (2.7)		70 (2.5)		39 (2.4)		33 (2.5)
Ghana		50 (5.3)		39 (4.4)		45 (4.9)		30 (4.7)		44 (4.9)		53 (5.1)
Hong Kong, SAR		79 (3.6)		69 (4.2)		67 (3.9)		68 (4.3)		61 (4.5)		45 (4.2)
Hungary		53 (2.7)		41 (2.6)		48 (2.6)		16 (1.8)		23 (2.3)		23 (2.3)
Indonesia		60 (3.4)		66 (3.3)		54 (3.4)		29 (3.6)		51 (3.6)		53 (3.4)
Iran, Islamic Rep. of		81 (3.0)		89 (2.6)		32 (3.8)		49 (3.9)		62 (4.1)		x x
Israel		68 (3.7)		56 (3.6)		61 (3.8)		64 (3.5)		65 (3.9)		60 (3.4)
Italy		35 (3.4)		24 (3.0)		11 (2.3)		24 (3.2)		8 (1.9)		10 (2.3)
Japan		77 (3.4)		66 (3.7)		53 (3.8)		33 (4.0)		18 (3.0)		62 (3.8)
Jordan		51 (4.6)		68 (4.2)		46 (4.8)		39 (4.3)		63 (4.2)		54 (4.1)
Korea, Rep. of	r	49 (3.8)	r	35 (3.5)	r	40 (3.4)	r	44 (3.8)	r	27 (3.2)	r	24 (2.9)
Latvia	r	67 (2.6)	r	66 (2.9)	r	70 (2.5)	r	55 (2.9)	r	49 (3.7)	r	64 (2.4)
Lebanon		65 (3.2)		63 (3.9)		66 (3.4)		41 (3.5)		58 (3.3)		70 (3.3)
Lithuania		74 (1.9)		61 (2.3)		71 (2.0)		70 (2.3)		44 (2.6)		53 (2.8)
Macedonia, Rep. of		64 (2.5)		53 (2.7)		66 (2.5)		18 (2.1)		49 (2.6)		39 (3.0)
Malaysia		67 (4.1)		71 (3.8)		67 (4.1)		53 (4.5)		70 (3.9)		33 (4.1)
Moldova, Rep. of	r	34 (3.3)	r	38 (2.5)	r	43 (2.9)	r	37 (3.1)	r	66 (2.7)	r	65 (3.1)
Morocco		29 (4.6)		58 (6.1)		37 (5.6)		23 (3.8)		63 (5.0)		60 (5.2)
Netherlands	r	42 (2.9)	r	37 (3.2)	r	13 (1.8)	r	35 (2.8)	r	33 (3.7)	r	9 (2.0)
New Zealand		72 (5.0)		46 (5.3)		79 (3.6)		52 (5.1)		45 (4.2)		84 (3.6)
Norway		20 (2.7)		18 (2.9)		9 (2.7)		16 (3.1)		4 (1.6)		8 (2.4)
Palestinian Nat'l Auth.		85 (3.1)		88 (2.9)		85 (3.2)		52 (4.5)		61 (4.2)		68 (3.9)
Philippines		79 (3.5)		68 (3.8)		66 (4.4)		56 (5.0)		72 (4.4)		57 (4.6)
Romania		51 (2.6)		62 (2.5)		51 (2.9)		37 (2.6)		42 (2.4)		61 (2.5)
Russian Federation		60 (3.0)		68 (2.9)		70 (2.2)		50 (2.9)		36 (2.7)		46 (2.1)
Saudi Arabia		39 (5.2)		49 (6.7)		34 (6.0)		14 (3.9)		34 (6.4)		29 (3.5)
Scotland	s	65 (3.0)	s	67 (2.7)	s	56 (2.8)	s	68 (2.9)	s	50 (3.5)	s	44 (2.9)
Serbia		75 (2.1)		63 (2.5)		67 (2.0)		42 (2.8)		39 (2.8)		48 (2.5)
Singapore		79 (2.0)		76 (2.6)		66 (2.7)		82 (2.3)		63 (2.4)		70 (2.2)
Slovak Republic		67 (2.8)		47 (3.4)		52 (2.9)		43 (2.5)		30 (2.4)		35 (2.5)
Slovenia		90 (1.6)		71 (2.5)		74 (2.4)		61 (2.9)		55 (2.5)		76 (2.3)
South Africa	r	64 (3.8)	r	40 (3.9)	r	55 (4.1)	r	39 (3.8)	r	52 (3.9)	r	67 (4.0)
Sweden		48 (3.3)		40 (3.3)		26 (2.9)		20 (2.5)		27 (2.9)		22 (2.8)
Tunisia		29 (4.0)		56 (4.2)		42 (4.2)		28 (3.4)		48 (4.2)		54 (4.0)
United States		82 (2.3)		65 (3.2)		85 (2.0)		80 (2.7)		77 (2.6)		65 (2.6)
‡ England	s	67 (4.7)	s	82 (3.6)	s	73 (3.8)	s	64 (5.0)	s	54 (4.5)	s	59 (4.2)
International Avg.		58 (0.5)		56 (0.5)		52 (0.5)		45 (0.5)		45 (0.5)		47 (0.5)
Benchmarking Participants												
Basque Country, Spain		21 (4.4)		43 (5.0)		33 (4.4)		50 (5.3)		27 (4.9)		34 (4.6)
Indiana State, US	s	81 (5.4)	s	75 (4.4)	s	80 (4.8)	s	90 (2.4)	s	80 (5.0)	s	54 (6.1)
Ontario Province, Can.		70 (4.1)		62 (5.0)		74 (4.2)		53 (5.5)		53 (4.4)		53 (4.3)
Quebec Province, Can.	r	35 (4.4)	r	43 (4.3)	r	35 (4.5)	r	42 (5.0)	r	36 (4.7)	r	17 (3.8)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9)

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

Exhibit 6.8: Teachers' Participation in Professional Development in Science

Countries	Percentage of Students by Their Teachers' Participation in Professional Development in Science in the Past Two Years					
	Science Content	Science Pedagogy/ Instruction	Science Curriculum	Integrating Information Technology into Science	Improving Students' Critical Thinking or Problem Solving Skills	Science Assessment
Armenia	x x	x x	x x	x x	x x	x x
Australia	38 (4.2)	27 (4.0)	44 (4.2)	27 (4.0)	41 (4.5)	21 (3.9)
Belgium (Flemish)	18 (2.7)	20 (2.7)	4 (1.4)	10 (2.4)	17 (3.0)	6 (1.6)
Chinese Taipei	64 (4.1)	67 (4.2)	63 (3.9)	67 (3.7)	39 (4.2)	45 (4.3)
Cyprus	46 (4.8)	52 (4.3)	21 (3.7)	35 (4.2)	40 (4.4)	15 (3.4)
England	r 43 (4.8)	r 47 (4.9)	r 47 (5.1)	r 31 (4.9)	r 37 (4.9)	r 30 (4.3)
Hong Kong, SAR	38 (4.3)	31 (4.2)	28 (4.0)	51 (5.1)	47 (4.6)	26 (4.3)
Hungary	21 (3.7)	21 (3.7)	13 (3.2)	6 (2.1)	19 (3.6)	10 (2.8)
Iran, Islamic Rep. of	46 (4.9)	52 (4.6)	33 (4.5)	20 (4.0)	31 (4.2)	39 (4.4)
Italy	22 (2.9)	15 (2.3)	10 (2.0)	11 (2.3)	5 (1.2)	5 (1.3)
Japan	37 (3.8)	42 (3.8)	17 (2.7)	19 (3.3)	10 (2.1)	19 (2.9)
Latvia	47 (4.8)	50 (5.0)	47 (4.8)	22 (3.9)	57 (4.0)	54 (4.9)
Lithuania	22 (3.0)	36 (3.4)	18 (2.8)	26 (3.7)	50 (4.1)	34 (3.8)
Moldova, Rep. of	28 (4.3)	37 (4.4)	37 (4.5)	36 (4.5)	53 (4.9)	60 (4.4)
Morocco	x x	x x	x x	x x	x x	x x
Netherlands	4 (1.9)	9 (2.5)	2 (1.3)	8 (2.9)	10 (2.7)	5 (2.0)
New Zealand	r 33 (3.1)	r 22 (2.9)	r 36 (3.2)	r 29 (3.5)	r 41 (3.5)	r 26 (2.9)
Norway	9 (1.8)	6 (1.9)	7 (1.8)	4 (1.1)	4 (1.2)	2 (0.9)
Philippines	70 (4.5)	51 (4.9)	74 (4.3)	52 (5.0)	62 (4.5)	61 (4.7)
Russian Federation	46 (3.4)	51 (3.3)	56 (4.3)	27 (3.3)	32 (4.1)	45 (4.1)
Scotland	r 38 (4.7)	r 44 (5.1)	r 39 (4.5)	s 21 (4.6)	r 24 (4.4)	r 20 (4.6)
Singapore	54 (4.4)	59 (3.9)	45 (3.7)	48 (3.6)	51 (3.8)	41 (4.2)
Slovenia	74 (3.7)	58 (4.7)	63 (4.2)	34 (4.1)	45 (4.3)	55 (4.5)
Tunisia	10 (2.7)	27 (4.0)	19 (3.8)	7 (2.3)	30 (3.8)	33 (4.0)
United States	48 (2.8)	38 (3.1)	r 51 (3.0)	35 (2.6)	43 (3.0)	34 (3.1)
International Avg.	37 (0.8)	37 (0.8)	34 (0.8)	27 (0.8)	34 (0.8)	30 (0.8)
Benchmarking Participants						
Indiana State, US	21 (4.0)	21 (4.4)	30 (4.9)	19 (3.8)	33 (4.4)	18 (3.8)
Ontario Province, Can.	32 (4.6)	23 (3.8)	41 (4.6)	27 (4.6)	31 (4.6)	30 (4.4)
Quebec Province, Can.	38 (4.4)	37 (4.3)	44 (4.4)	24 (4.0)	24 (4.2)	11 (2.6)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

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

Exhibit 6.9: Types of Interactions Among Science Teachers

SCIENCE Grade 8

Countries	Percentage of Students by Their Teachers' Interactions with Other Teachers						
	Discussion About How to Teach a Particular Concept			Working on Preparing Instructional Materials			
	At Least Weekly	2 or 3 Times per Month	Never or Almost Never	At Least Weekly	2 or 3 Times per Month	Never or Almost Never
Armenia	r 50 (3.0)	44 (3.0)	7 (1.3)	r 29 (2.3)	49 (2.6)	22 (2.3)
Australia	r 54 (3.5)	37 (3.2)	9 (2.0)	r 51 (3.9)	30 (3.4)	19 (3.2)
Bahrain	64 (2.5)	33 (2.5)	3 (1.5)	70 (3.0)	26 (3.5)	5 (1.7)
Belgium (Flemish)	36 (3.2)	46 (3.0)	18 (2.4)	19 (2.3)	39 (3.1)	42 (3.2)
Botswana	60 (4.7)	34 (4.4)	6 (2.2)	66 (4.1)	28 (3.7)	6 (2.2)
Bulgaria	r 44 (2.9)	41 (2.5)	14 (2.1)	r 59 (3.1)	33 (2.7)	8 (1.6)
Chile	40 (3.6)	33 (3.8)	28 (3.4)	39 (3.3)	27 (3.4)	34 (3.9)
Chinese Taipei	45 (4.5)	47 (4.6)	8 (2.4)	15 (3.3)	49 (4.1)	36 (4.0)
Cyprus	61 (1.0)	31 (0.9)	8 (0.6)	58 (1.3)	33 (1.3)	8 (1.0)
Egypt	89 (2.8)	11 (2.8)	1 (0.0)	73 (3.5)	24 (3.7)	3 (1.4)
Estonia	49 (2.6)	44 (2.4)	7 (1.5)	35 (2.1)	49 (2.2)	16 (1.6)
Ghana	39 (4.8)	36 (4.4)	25 (4.0)	44 (4.2)	32 (4.2)	23 (3.7)
Hong Kong, SAR	32 (3.9)	57 (4.1)	10 (3.0)	15 (3.3)	51 (4.7)	34 (4.8)
Hungary	38 (2.4)	53 (2.3)	9 (1.3)	48 (2.8)	40 (2.5)	12 (1.3)
Indonesia	45 (3.3)	50 (3.3)	5 (1.5)	68 (3.0)	29 (3.1)	3 (1.0)
Iran, Islamic Rep. of	43 (4.2)	54 (4.2)	3 (1.5)	44 (3.9)	42 (3.7)	14 (2.8)
Israel	40 (3.6)	49 (3.7)	11 (2.0)	38 (4.0)	50 (4.1)	11 (2.1)
Italy	33 (3.4)	46 (3.8)	21 (2.9)	23 (3.1)	44 (3.3)	33 (3.4)
Japan	29 (3.3)	51 (4.0)	20 (3.1)	18 (3.3)	40 (3.8)	42 (4.0)
Jordan	66 (4.4)	29 (4.4)	5 (2.0)	51 (4.6)	43 (4.9)	5 (2.0)
Korea, Rep. of	r 36 (3.7)	41 (3.8)	23 (3.5)	r 51 (3.8)	39 (3.5)	10 (2.5)
Latvia	36 (2.7)	54 (2.9)	10 (1.4)	25 (2.4)	56 (2.9)	20 (2.8)
Lebanon	43 (3.4)	41 (3.3)	16 (2.2)	46 (3.7)	41 (3.9)	13 (2.2)
Lithuania	25 (1.8)	59 (2.3)	15 (1.6)	33 (2.2)	48 (2.3)	18 (1.9)
Macedonia, Rep. of	53 (2.4)	41 (2.4)	6 (1.0)	54 (2.7)	38 (2.5)	7 (1.4)
Malaysia	64 (4.6)	34 (4.5)	2 (1.3)	41 (4.4)	47 (4.1)	13 (3.0)
Moldova, Rep. of	60 (2.2)	31 (2.4)	9 (1.4)	61 (2.8)	30 (2.5)	10 (1.6)
Morocco	29 (4.5)	38 (2.8)	32 (4.4)	32 (4.4)	35 (5.9)	33 (5.5)
Netherlands	24 (2.2)	47 (3.2)	29 (2.8)	18 (2.3)	44 (2.9)	39 (2.9)
New Zealand	60 (4.4)	34 (4.7)	7 (2.3)	48 (4.7)	42 (4.7)	10 (2.2)
Norway	51 (4.5)	42 (4.2)	7 (2.2)	29 (4.1)	52 (4.8)	19 (3.6)
Palestinian Nat'l Auth.	74 (3.8)	22 (3.4)	4 (1.8)	66 (3.8)	31 (3.8)	3 (1.4)
Philippines	60 (4.4)	32 (4.2)	8 (2.7)	62 (4.5)	30 (4.3)	8 (2.6)
Romania	54 (2.6)	43 (2.5)	3 (0.8)	70 (2.1)	24 (1.7)	6 (1.4)
Russian Federation	49 (2.8)	47 (2.6)	4 (0.8)	47 (2.6)	43 (2.1)	10 (1.4)
Saudi Arabia	57 (5.4)	30 (5.7)	13 (4.4)	59 (4.4)	31 (4.3)	10 (2.6)
Scotland	s 40 (3.4)	42 (3.3)	18 (2.4)	s 36 (2.7)	43 (3.0)	21 (2.5)
Serbia	48 (2.6)	44 (2.6)	9 (1.3)	39 (2.3)	49 (2.4)	12 (1.6)
Singapore	39 (2.2)	50 (2.2)	11 (1.5)	41 (2.7)	36 (2.6)	23 (2.1)
Slovak Republic	39 (2.7)	48 (2.8)	13 (1.9)	43 (2.9)	41 (2.8)	16 (1.7)
Slovenia	43 (2.5)	41 (2.9)	16 (2.1)	16 (2.1)	40 (2.4)	44 (2.7)
South Africa	53 (3.8)	37 (3.5)	10 (2.2)	67 (3.4)	24 (3.1)	9 (2.4)
Sweden	60 (3.2)	31 (2.8)	9 (1.9)	50 (2.7)	31 (2.5)	19 (2.5)
Tunisia	58 (3.9)	35 (4.0)	7 (1.6)	25 (3.8)	34 (3.9)	41 (4.2)
United States	42 (3.0)	36 (3.3)	21 (2.8)	42 (3.1)	35 (2.9)	22 (2.7)
‡ England	s 54 (4.8)	34 (4.1)	12 (3.0)	s 41 (4.2)	38 (4.7)	21 (4.3)
International Avg.	48 (0.5)	40 (0.5)	12 (0.3)	44 (0.5)	38 (0.5)	18 (0.4)
Benchmarking Participants						
Basque Country, Spain	55 (5.4)	29 (4.7)	16 (3.9)	46 (5.1)	39 (5.3)	15 (3.8)
Indiana State, US	42 (6.1)	42 (5.4)	16 (4.5)	41 (6.5)	35 (6.8)	24 (5.0)
Ontario Province, Can.	42 (4.4)	40 (4.6)	18 (3.3)	34 (4.7)	43 (4.9)	23 (3.7)
Quebec Province, Can.	40 (4.4)	35 (4.7)	25 (4.5)	32 (4.5)	43 (4.5)	25 (4.2)

Background data provided by teachers.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals 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) 2003

Exhibit 6.9: Types of Interactions Among Science Teachers *(Continued...)*

Countries	Percentage of Students by Their Teachers' Interactions with Other Teachers							
	Visit to Another Teacher's Classroom to Observe Teaching				Informal Observations of Their Classroom by Another Teacher			
		At Least Weekly	2 or 3 Times per Month	Never or Almost Never		At Least Weekly	2 or 3 Times per Month	Never or Almost Never
Armenia	r	24 (2.1)	61 (2.7)	15 (2.2)	r	13 (1.6)	63 (2.4)	24 (2.7)
Australia	r	6 (1.4)	13 (2.3)	81 (2.7)	r	5 (1.6)	19 (2.8)	75 (2.9)
Bahrain		7 (2.3)	53 (2.9)	40 (2.9)		5 (1.2)	41 (3.1)	53 (3.2)
Belgium (Flemish)		1 (0.4)	1 (0.6)	98 (0.7)		4 (1.2)	5 (1.3)	91 (1.7)
Botswana		6 (2.0)	43 (4.7)	51 (4.6)		7 (2.3)	49 (4.4)	44 (4.5)
Bulgaria	r	3 (0.8)	23 (2.6)	74 (2.6)	r	2 (0.6)	19 (2.5)	79 (2.5)
Chile		7 (2.2)	12 (2.3)	81 (2.6)		14 (3.1)	17 (2.6)	69 (3.6)
Chinese Taipei		2 (1.1)	29 (3.7)	69 (3.8)		3 (1.5)	13 (2.6)	84 (3.0)
Cyprus		5 (0.5)	16 (0.8)	80 (0.8)		24 (0.9)	30 (1.1)	46 (1.2)
Egypt		35 (4.2)	37 (3.9)	28 (3.7)		12 (2.6)	34 (4.0)	54 (4.3)
Estonia		2 (0.7)	32 (2.3)	66 (2.4)		2 (0.7)	30 (2.6)	68 (2.6)
Ghana		30 (4.0)	43 (4.4)	26 (3.4)		42 (4.8)	35 (4.2)	23 (3.8)
Hong Kong, SAR		1 (0.9)	26 (3.6)	74 (3.7)		2 (1.3)	16 (3.0)	83 (3.2)
Hungary		3 (0.7)	43 (2.5)	54 (2.5)		1 (0.4)	23 (2.0)	77 (2.1)
Indonesia		12 (2.4)	32 (3.3)	56 (3.7)		9 (2.2)	33 (3.2)	58 (3.5)
Iran, Islamic Rep. of		3 (1.2)	15 (2.9)	82 (2.9)		3 (1.3)	25 (3.2)	72 (3.3)
Israel		2 (0.7)	7 (1.4)	91 (1.6)		4 (1.5)	14 (2.5)	82 (2.8)
Italy		2 (1.0)	3 (1.6)	95 (1.9)		11 (2.5)	15 (2.9)	75 (3.1)
Japan		4 (1.6)	18 (3.1)	78 (3.2)		4 (1.6)	10 (2.5)	86 (2.8)
Jordan		4 (1.7)	60 (4.4)	37 (4.3)		8 (2.8)	37 (4.4)	54 (4.3)
Korea, Rep. of	r	2 (0.7)	11 (2.3)	87 (2.4)	r	2 (0.6)	8 (2.1)	90 (2.2)
Latvia		5 (1.1)	41 (3.1)	54 (3.0)		6 (1.2)	39 (3.3)	55 (3.1)
Lebanon		9 (2.1)	23 (3.5)	69 (3.7)		12 (2.6)	36 (3.5)	52 (3.9)
Lithuania		2 (0.7)	40 (2.8)	58 (3.0)		4 (0.9)	38 (2.6)	58 (2.7)
Macedonia, Rep. of	r	10 (1.7)	45 (2.7)	45 (3.0)		10 (1.7)	44 (2.6)	47 (2.9)
Malaysia		8 (2.3)	39 (4.3)	52 (4.2)		7 (2.2)	50 (4.1)	43 (4.2)
Moldova, Rep. of		20 (2.1)	60 (2.6)	20 (2.4)	r	15 (2.2)	50 (2.9)	35 (3.2)
Morocco		2 (1.5)	8 (2.3)	89 (2.8)		3 (1.7)	5 (2.3)	92 (2.7)
Netherlands		2 (0.8)	9 (2.1)	89 (2.2)	r	2 (0.8)	9 (1.8)	89 (2.0)
New Zealand		6 (2.0)	30 (5.0)	64 (5.2)		13 (3.1)	39 (5.5)	48 (6.1)
Norway		11 (3.0)	11 (2.5)	78 (3.5)		22 (3.7)	12 (2.6)	66 (4.0)
Palestinian Nat'l Auth.		5 (1.8)	46 (4.3)	49 (4.5)		6 (1.8)	28 (3.9)	66 (4.2)
Philippines		8 (2.6)	41 (4.3)	50 (4.6)		13 (2.9)	59 (4.4)	28 (4.0)
Romania		7 (1.2)	61 (2.6)	32 (2.4)		37 (2.5)	41 (2.6)	22 (2.2)
Russian Federation		12 (1.1)	74 (2.4)	14 (1.9)		8 (1.0)	60 (1.8)	32 (2.0)
Saudi Arabia		5 (1.9)	47 (5.9)	47 (6.0)		5 (2.1)	25 (5.5)	70 (5.7)
Scotland	s	8 (1.9)	17 (2.2)	75 (2.7)	s	17 (2.5)	20 (2.8)	63 (3.1)
Serbia		10 (1.3)	29 (2.3)	61 (2.6)		10 (1.4)	29 (2.4)	60 (2.5)
Singapore		3 (0.9)	12 (1.6)	85 (1.8)		2 (0.8)	23 (2.3)	75 (2.4)
Slovak Republic		4 (1.0)	25 (2.3)	71 (2.6)		3 (0.7)	28 (2.7)	69 (2.8)
Slovenia		3 (0.9)	8 (1.5)	89 (1.6)		2 (0.7)	13 (2.1)	85 (2.1)
South Africa		11 (2.2)	28 (3.6)	61 (3.7)		14 (2.6)	32 (3.4)	53 (3.8)
Sweden		4 (1.2)	11 (2.1)	85 (2.2)		5 (1.4)	12 (2.0)	83 (2.4)
Tunisia		x x	x x	x x		7 (2.2)	10 (2.7)	83 (3.4)
United States		8 (1.6)	13 (1.9)	79 (2.3)		7 (1.5)	18 (2.2)	75 (2.4)
‡ England	s	3 (1.0)	24 (4.0)	73 (3.9)	s	8 (2.9)	30 (4.2)	62 (4.4)
International Avg.		7 (0.3)	29 (0.5)	63 (0.5)		9 (0.3)	28 (0.5)	63 (0.5)
Benchmarking Participants								
Basque Country, Spain		5 (2.6)	5 (2.5)	89 (3.5)		8 (2.9)	8 (2.4)	84 (3.3)
Indiana State, US		4 (2.8)	13 (4.5)	82 (5.2)		2 (1.9)	29 (6.3)	68 (6.5)
Ontario Province, Can.		5 (1.9)	12 (3.4)	83 (3.8)		7 (2.5)	12 (3.3)	81 (4.1)
Quebec Province, Can.		1 (0.7)	0 (0.1)	99 (0.7)		1 (1.3)	4 (1.8)	95 (2.2)

Background data provided by teachers.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 6.9: Types of Interactions Among Science Teachers *(…Continued)*

Countries	Percentage of Students by Their Teachers' Interactions with Other Teachers						
	Discussion About How to Teach a Particular Concept			Working on Preparing Instructional Materials			
	At Least Weekly	2 or 3 Times per Month	Never or Almost Never	At Least Weekly	2 or 3 Times per Month	Never or Almost Never
Armenia	s 44 (5.9)	50 (5.5)	6 (2.7)	s 34 (5.7)	53 (6.0)	13 (3.7)
Australia	51 (4.2)	37 (4.8)	12 (2.7)	54 (4.6)	31 (4.9)	15 (2.9)
Belgium (Flemish)	52 (3.8)	39 (3.7)	9 (2.0)	41 (4.0)	39 (3.6)	21 (2.7)
Chinese Taipei	41 (3.7)	53 (3.8)	6 (2.0)	24 (3.3)	54 (3.7)	22 (3.2)
Cyprus	58 (4.1)	29 (3.8)	13 (3.2)	61 (3.8)	28 (3.4)	11 (2.3)
England	r 61 (5.2)	28 (5.0)	10 (2.7)	r 62 (4.9)	20 (4.2)	17 (3.5)
Hong Kong, SAR	41 (4.5)	51 (4.7)	8 (2.4)	24 (4.3)	52 (5.0)	24 (3.8)
Hungary	55 (4.3)	41 (4.2)	4 (1.2)	57 (4.2)	35 (3.9)	7 (2.3)
Iran, Islamic Rep. of	62 (4.3)	35 (4.2)	3 (1.7)	64 (4.6)	31 (4.5)	5 (2.0)
Italy	47 (3.0)	42 (3.0)	11 (2.0)	55 (3.6)	32 (3.3)	13 (2.5)
Japan	46 (4.2)	40 (4.2)	14 (2.9)	39 (3.7)	42 (4.2)	20 (2.9)
Latvia	41 (4.3)	46 (4.4)	14 (2.9)	30 (3.9)	57 (4.4)	13 (3.1)
Lithuania	60 (3.5)	33 (3.4)	7 (1.9)	68 (3.2)	27 (3.0)	5 (1.8)
Moldova, Rep. of	57 (4.3)	37 (4.2)	6 (2.0)	74 (3.3)	18 (3.1)	8 (2.2)
Morocco	s 22 (3.7)	40 (5.3)	38 (4.9)	s 12 (2.9)	18 (3.3)	69 (4.0)
Netherlands	42 (4.7)	42 (4.7)	16 (3.2)	25 (4.4)	44 (4.7)	32 (4.4)
New Zealand	64 (3.3)	31 (2.8)	5 (1.5)	54 (3.4)	35 (3.2)	12 (2.2)
Norway	64 (2.9)	28 (3.9)	8 (2.6)	50 (3.6)	30 (3.9)	20 (3.3)
Philippines	58 (5.0)	38 (5.1)	3 (1.4)	71 (4.6)	26 (4.6)	3 (1.3)
Russian Federation	55 (3.3)	43 (3.2)	2 (1.0)	46 (3.4)	48 (3.9)	6 (1.9)
Scotland	r 43 (4.9)	41 (4.7)	16 (3.2)	r 39 (4.7)	37 (4.5)	24 (3.5)
Singapore	46 (4.4)	45 (4.5)	9 (2.5)	38 (3.8)	52 (4.0)	10 (2.6)
Slovenia	64 (4.0)	30 (3.7)	6 (2.2)	38 (4.5)	45 (4.6)	17 (3.4)
Tunisia	55 (4.4)	23 (3.3)	23 (3.7)	r 29 (3.9)	29 (3.7)	42 (4.4)
United States	63 (3.0)	30 (2.5)	7 (1.7)	60 (2.8)	29 (2.7)	11 (1.9)
International Avg.	52 (0.8)	38 (0.8)	10 (0.5)	46 (0.8)	36 (0.8)	18 (0.6)
Benchmarking Participants						
Indiana State, US	60 (5.4)	33 (5.1)	7 (2.6)	49 (4.8)	37 (4.4)	14 (2.7)
Ontario Province, Can.	46 (4.8)	45 (4.7)	9 (2.7)	47 (5.1)	33 (4.6)	20 (3.7)
Quebec Province, Can.	53 (5.0)	33 (4.4)	13 (2.9)	47 (4.7)	30 (4.4)	23 (3.6)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals 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 6.9: Types of Interactions Among Science Teachers

Countries	Percentage of Students by Their Teachers' Interactions with Other Teachers						
	Visit to Another Teacher's Classroom to Observe Teaching			Informal Observations of Their Classroom by Another Teacher			
	At Least Weekly	2 or 3 Times per Month	Never or Almost Never	At Least Weekly	2 or 3 Times per Month	Never or Almost Never	
Armenia	s 17 (4.0)	78 (4.5)	5 (2.0)	s 12 (3.5)	64 (4.8)	24 (4.8)	
Australia	9 (2.3)	23 (4.0)	68 (4.3)	18 (3.6)	22 (3.5)	60 (4.3)	
Belgium (Flemish)	1 (0.4)	4 (1.3)	95 (1.4)	5 (1.6)	11 (2.4)	85 (2.8)	
Chinese Taipei	6 (2.0)	57 (3.9)	37 (3.7)	5 (1.9)	30 (4.0)	65 (4.3)	
Cyprus	7 (2.5)	28 (3.2)	65 (3.1)	30 (4.1)	42 (4.8)	28 (4.1)	
England	r 2 (1.5)	31 (4.2)	66 (4.4)	r 3 (1.6)	39 (4.9)	58 (4.8)	
Hong Kong, SAR	0 (0.0)	37 (4.3)	62 (4.3)	0 (0.2)	13 (3.2)	87 (3.2)	
Hungary	3 (1.4)	52 (4.4)	45 (4.3)	2 (1.2)	31 (3.6)	66 (3.5)	
Iran, Islamic Rep. of	12 (3.3)	35 (4.7)	54 (5.0)	9 (2.9)	43 (5.0)	48 (5.2)	
Italy	8 (1.8)	12 (2.5)	80 (2.9)	9 (1.8)	15 (2.4)	76 (3.0)	
Japan	4 (1.3)	47 (3.8)	49 (3.6)	9 (2.4)	21 (3.4)	69 (3.8)	
Latvia	3 (1.5)	88 (2.8)	9 (2.4)	r 7 (2.1)	76 (3.7)	17 (3.2)	
Lithuania	1 (0.6)	64 (3.7)	35 (3.7)	1 (0.7)	53 (4.1)	46 (4.1)	
Moldova, Rep. of	18 (3.3)	67 (3.9)	15 (2.9)	11 (2.7)	50 (3.9)	39 (4.2)	
Morocco	s 5 (2.9)	6 (2.7)	89 (3.8)	s 3 (1.6)	3 (2.1)	93 (2.6)	
Netherlands	1 (0.9)	8 (2.8)	92 (3.0)	1 (0.9)	11 (3.2)	88 (3.3)	
New Zealand	r 5 (1.6)	30 (3.2)	65 (3.1)	r 11 (2.2)	39 (2.9)	50 (3.3)	
Norway	13 (3.1)	10 (2.0)	77 (3.5)	27 (3.6)	11 (2.6)	62 (4.4)	
Philippines	18 (3.3)	38 (4.4)	44 (4.1)	22 (4.3)	48 (5.0)	30 (4.2)	
Russian Federation	12 (2.6)	83 (2.8)	5 (1.3)	9 (2.3)	63 (3.6)	28 (3.1)	
Scotland	r 1 (0.7)	11 (2.7)	88 (2.7)	r 11 (2.9)	29 (5.1)	61 (5.4)	
Singapore	0 (0.5)	10 (2.3)	89 (2.3)	3 (1.5)	16 (2.9)	81 (3.3)	
Slovenia	0 (0.2)	11 (2.9)	88 (2.9)	1 (0.6)	9 (2.4)	89 (2.4)	
Tunisia	8 (2.2)	15 (2.9)	77 (3.4)	r 5 (1.5)	9 (2.6)	85 (2.8)	
United States	5 (1.2)	16 (1.9)	79 (2.2)	5 (1.3)	18 (2.1)	77 (2.4)	
International Avg.	6 (0.4)	34 (0.7)	59 (0.7)	9 (0.5)	31 (0.7)	61 (0.8)	
Benchmarking Participants							
Indiana State, US	3 (1.6)	8 (2.4)	89 (2.5)	6 (1.9)	7 (2.1)	87 (3.0)	
Ontario Province, Can.	6 (2.4)	12 (2.8)	82 (3.8)	8 (2.6)	15 (3.4)	78 (4.2)	
Quebec Province, Can.	2 (1.2)	10 (2.9)	88 (3.1)	5 (1.9)	12 (3.1)	83 (3.2)	

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

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

about how often they interacted with their colleagues. More specifically, they were asked about discussing teaching strategies for particular concepts, preparing instructional materials, and classroom observations. As shown in Exhibit 6.9, on average, the results for the TIMSS participants were consistent across grades. Teachers of most students (80% or more) reported weekly or monthly interaction about instructional issues. In contrast, observing other teachers or being observed themselves was relatively infrequent (63% never).

How Ready Do Teachers Think They Are to Teach Science?

TIMSS 2003 asked teachers how ready they felt to teach the science topics included in the TIMSS 2003 science assessment. Across the five major content areas (life science, chemistry, physics, earth science, and environmental science), the eighth-grade teachers were asked about 21 topics (sub-areas). Exhibit 6.10 contains teachers' reports, indicating that the teachers of almost all the eighth-grade students felt ready to teach nearly all the topics. On average, internationally, the results ranged from 86 to 97 percent, with the results above 90 percent for all but the three earth science topics (Earth's structure and physical features; Earth's processes, cycles, and history; and Earth in the solar system and the universe) and two of the three environmental science topics (trends in human population and its effects on the environment; and changes in environments).

Although in most countries essentially all students were taught the topics in the basic science subjects – life science, chemistry, and physics – by teachers who felt ready to teach the topics, there were some notable exceptions, including Morocco, for all three subjects, and the Philippines and Tunisia for chemistry and physics. Also, teachers in Singapore and Sweden felt somewhat less ready to teach the topics in biology than in the other two subjects, and teachers in Belgium (Flemish) less ready to teach the physics topics. Among the benchmarking participants, Quebec teachers felt somewhat less ready to teach the biology topics and the majority of topics in chemistry and physics. Con-

sistent with information presented in Chapter 5 showing that topics in earth science and environmental science were included less often in the intended curricula of TIMSS participants and taught less often to the students, teachers in many countries reported that they felt less ready to teach these than the other science subjects.

At the fourth grade, teachers felt generally less well-prepared. Teachers were asked about 19 science topics, with the results ranging from 66 to 94 percent, on average, internationally. The results were above 90 percent for 8 of the 19 topics: two of the six life science topics (relationships in a living community and changes in environments), two of the seven physical science topics (states of matter and differences in their physical properties; and common energy sources and forms and their practical uses), and four of six earth science topics (features on Earth's landscape; water on Earth; air; and common features of Earth's landscape and their relationship to human use). However, results dipped below 70 percent for three topics: reproduction and development in plants and animals (life science - 66%); forming and separating mixtures (physical science – 66%); and fossils of animals and plants (earth science – 69%).

In every country, there were at least some fourth-grade science topics that teachers indicated they were less ready to teach. However, in Belgium (Flemish), the Netherlands, and Quebec, for all topics in both life science and physical science and the majority in earth science, the percentage of students taught by teachers ready to teach the topics was below 90 percent. For Japan, this was true also for all topics in earth science.

Exhibit 6.10: **Readiness to Teach Science**

SCIENCE Grade 8

Countries	Percentage of Students Whose Teachers Report Feeling Ready to Teach Science Topics										
	Life Science					Chemistry				
	Major organs and organ systems in humans and other organisms	Cells and their functions, including respiration and photosynthesis as cellular processes	Reproduction and heredity	Role of variation and adaptation in survival/extinction of species in a changing environment	Interaction of living organisms and the physical environment in an ecosystem.	Classification and composition of matter	Particulate structure of matter	Properties of solutions	Properties and uses of common acids and bases	Chemical change
Armenia	r 100 (0.0)	r 100 (0.5)	r 99 (0.7)	r 100 (0.0)	s 100 (0.4)	r 99 (0.9)	r 99 (1.0)	r 99 (0.1)	r 98 (0.9)	r 97 (1.0)
Australia	r 98 (1.1)	r 98 (0.9)	r 96 (1.4)	r 97 (1.3)	r 99 (0.8)	r 98 (1.3)	r 99 (0.4)	r 99 (0.8)	r 98 (1.2)	r 98 (0.9)
Bahrain	100 (0.0)	100 (0.0)	96 (1.1)	91 (2.0)	99 (1.2)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
Belgium (Flemish)	97 (0.7)	96 (0.9)	93 (1.8)	73 (3.4)	87 (2.2)	– –	– –	– –	– –	– –
Botswana	99 (0.5)	100 (0.0)	95 (2.0)	95 (2.2)	98 (1.3)	97 (1.5)	95 (2.0)	99 (0.9)	94 (2.2)	91 (2.6)
Bulgaria	r 100 (0.0)	r 100 (0.0)	r 100 (0.5)	r 95 (2.7)	r 97 (2.6)	r 100 (0.0)	r 100 (0.0)	r 97 (2.4)	r 100 (0.0)	r 97 (2.5)
Chile	99 (0.6)	99 (0.6)	99 (0.6)	99 (0.6)	100 (0.1)	96 (1.6)	93 (1.9)	91 (1.7)	82 (2.8)	82 (2.5)
Chinese Taipei	– –	– –	– –	– –	– –	99 (0.7)	99 (0.7)	99 (0.7)	99 (0.7)	99 (0.7)
Cyprus	– –	– –	– –	– –	– –	99 (0.7)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
Egypt	100 (0.0)	99 (0.8)	99 (1.0)	95 (2.0)	99 (0.7)	100 (0.0)	100 (0.0)	100 (0.1)	99 (0.8)	100 (0.1)
Estonia	100 (0.0)	100 (0.0)	100 (0.0)	99 (0.6)	99 (0.6)	r 100 (0.0)	r 100 (0.0)	r 100 (0.0)	r 100 (0.0)	r 100 (0.0)
Ghana	97 (1.6)	97 (1.7)	r 98 (1.5)	88 (3.0)	r 95 (1.9)	97 (1.9)	98 (1.4)	98 (1.7)	r 94 (2.0)	87 (3.1)
Hong Kong, SAR	92 (2.4)	99 (1.0)	91 (2.6)	87 (2.9)	94 (2.3)	98 (1.2)	97 (1.7)	98 (1.4)	99 (1.0)	96 (1.9)
Hungary	100 (0.0)	99 (0.7)	99 (0.9)	85 (3.3)	94 (1.7)	98 (1.2)	98 (1.2)	98 (1.2)	98 (1.2)	98 (1.2)
Indonesia	r 100 (0.0)	r 98 (1.4)	r 92 (2.8)	r 95 (2.3)	r 97 (2.0)	– –	– –	– –	– –	– –
Iran, Islamic Rep. of	99 (0.8)	100 (0.0)	97 (1.6)	91 (2.4)	97 (1.2)	97 (1.3)	98 (1.2)	98 (1.0)	96 (1.4)	97 (1.2)
Israel	92 (1.6)	93 (1.7)	92 (1.8)	90 (2.0)	92 (1.7)	97 (1.0)	97 (1.0)	95 (1.7)	90 (2.4)	95 (1.6)
Italy	99 (0.8)	99 (0.8)	98 (1.1)	96 (1.3)	98 (0.9)	98 (1.1)	99 (0.8)	98 (1.2)	87 (2.5)	85 (2.6)
Japan	99 (1.0)	95 (1.9)	89 (2.7)	81 (3.0)	91 (2.4)	100 (0.0)	97 (1.6)	97 (1.4)	96 (1.6)	99 (0.7)
Jordan	97 (1.5)	97 (1.5)	95 (1.6)	94 (2.0)	97 (1.3)	98 (1.2)	99 (0.7)	99 (0.9)	96 (1.7)	98 (1.1)
Korea, Rep. of	s 91 (2.1)	s 96 (1.4)	s 92 (2.1)	s 87 (2.7)	s 92 (1.9)	s 95 (2.0)	s 96 (1.9)	s 94 (2.1)	s 90 (2.7)	s 93 (2.3)
Latvia	s 97 (2.1)	s 96 (2.0)	s 94 (2.6)	s 89 (3.8)	s 95 (2.3)	x x	x x	x x	x x	x x
Lebanon	s 91 (2.0)	s 92 (1.8)	s 91 (1.9)	s 84 (2.9)	s 84 (2.9)	r 98 (1.0)	r 97 (1.1)	r 95 (1.6)	r 95 (1.4)	r 96 (1.4)
Lithuania	100 (0.0)	100 (0.0)	99 (1.0)	98 (1.3)	100 (0.0)	98 (1.2)	98 (1.2)	96 (1.8)	96 (1.5)	98 (1.3)
Macedonia, Rep. of	100 (0.2)	100 (0.2)	100 (0.0)	100 (0.0)	r 100 (0.0)	98 (1.1)	99 (1.0)	99 (0.8)	99 (1.1)	r 100 (0.0)
Malaysia	98 (1.1)	99 (0.9)	89 (2.5)	97 (1.5)	98 (1.2)	97 (1.3)	92 (2.0)	98 (1.2)	98 (1.4)	95 (1.9)
Moldova, Rep. of	x x	x x	x x	x x	x x	x x	x x	x x	x x	x x
Morocco	s 88 (3.1)	s 89 (3.7)	s 78 (4.3)	s 69 (6.0)	s 83 (4.7)	s 88 (4.6)	s 82 (4.7)	s 84 (5.4)	s 85 (5.1)	s 87 (4.9)
Netherlands	r 100 (0.0)	r 99 (0.7)	r 100 (0.0)	r 99 (0.7)	r 99 (0.8)	r 93 (3.0)	r 98 (1.5)	r 89 (3.6)	r 83 (4.4)	r 79 (4.9)
New Zealand	99 (0.8)	99 (0.7)	99 (0.4)	99 (0.5)	99 (0.7)	100 (0.2)	100 (0.2)	100 (0.2)	100 (0.2)	98 (1.3)
Norway	97 (1.2)	98 (1.2)	98 (1.1)	97 (1.3)	96 (1.4)	93 (2.1)	97 (1.2)	84 (3.2)	94 (2.1)	76 (3.7)
Palestinian Nat'l Auth.	100 (0.0)	100 (0.0)	100 (0.0)	99 (1.0)	100 (0.0)	99 (0.7)	98 (1.2)	99 (0.7)	99 (0.7)	98 (1.2)
Philippines	99 (0.8)	99 (0.9)	96 (1.8)	99 (1.2)	100 (0.0)	r 82 (3.9)	r 73 (4.3)	r 69 (4.4)	r 74 (3.7)	r 59 (4.7)
Romania	99 (0.6)	99 (0.6)	99 (0.9)	97 (1.4)	98 (0.8)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	98 (1.2)
Russian Federation	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –
Saudi Arabia	r 99 (0.7)	r 97 (1.4)	r 96 (1.7)	r 92 (2.4)	r 95 (1.9)	r 97 (1.2)	r 92 (4.8)	r 94 (4.7)	r 91 (4.9)	r 90 (4.8)
Scotland	s 92 (1.6)	s 94 (1.4)	s 90 (1.5)	s 87 (1.7)	s 93 (1.2)	s 100 (0.2)	s 99 (0.6)	s 99 (0.4)	s 95 (1.4)	s 96 (1.3)
Serbia	91 (2.3)	92 (2.3)	91 (2.4)	93 (2.2)	90 (2.7)	96 (1.7)	93 (2.2)	97 (1.5)	93 (2.3)	94 (2.2)
Singapore	r 89 (2.1)	r 89 (2.0)	r 88 (2.0)	r 82 (2.4)	r 92 (1.8)	r 97 (0.7)	r 99 (0.5)	r 96 (1.0)	r 97 (1.0)	r 94 (1.5)
Slovak Republic	98 (1.4)	98 (1.3)	99 (0.5)	93 (2.6)	94 (1.7)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
Slovenia	99 (1.2)	99 (0.9)	99 (1.0)	99 (0.9)	99 (0.6)	99 (0.9)	99 (0.9)	99 (0.9)	100 (0.0)	r 100 (0.0)
South Africa	r 92 (2.4)	r 94 (2.3)	r 91 (2.7)	r 88 (2.6)	r 94 (1.9)	r 98 (1.1)	r 92 (2.3)	r 86 (3.0)	r 87 (3.0)	r 77 (3.4)
Sweden	89 (1.7)	88 (1.7)	88 (1.7)	87 (1.8)	88 (1.7)	94 (1.1)	95 (1.1)	90 (1.7)	92 (1.4)	90 (1.7)
Tunisia	90 (2.7)	94 (2.2)	84 (3.3)	87 (3.2)	95 (1.9)	r 58 (4.6)	s 49 (4.9)	r 58 (4.7)	s 65 (4.8)	r 55 (5.0)
United States	r 92 (1.7)	r 93 (1.3)	r 92 (1.7)	r 94 (1.6)	r 96 (1.4)	r 95 (1.3)	r 95 (1.3)	r 93 (1.6)	r 91 (1.8)	r 92 (1.5)
‡ England	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –
International Avg.	97 (0.2)	97 (0.2)	95 (0.3)	92 (0.4)	96 (0.3)	96 (0.3)	95 (0.3)	95 (0.3)	94 (0.3)	92 (0.4)
Benchmarking Participants										
Basque Country, Spain	98 (2.2)	97 (2.3)	97 (2.3)	98 (1.5)	98 (1.4)	100 (0.3)	98 (1.3)	98 (1.1)	88 (3.5)	88 (3.3)
Indiana State, US	s 99 (0.6)	s 97 (1.5)	s 96 (2.8)	s 99 (1.0)	s 99 (1.0)	s 98 (2.5)	s 95 (0.4)	s 94 (1.0)	s 90 (3.6)	s 93 (1.3)
Ontario Province, Can.	99 (0.6)	99 (0.5)	93 (2.3)	96 (1.7)	98 (1.4)	89 (3.0)	82 (3.5)	96 (1.7)	76 (3.9)	75 (4.1)
Quebec Province, Can.	r 81 (4.0)	r 85 (3.5)	r 83 (4.2)	r 80 (4.0)	r 84 (3.2)	r 94 (2.2)	r 85 (3.9)	r 99 (0.4)	r 83 (4.0)	r 84 (3.9)

Background data provided by teachers.

Does not include students whose teachers report that they do not teach the content area.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 6.10: **Readiness to Teach Science** *(Continued...)*

Countries	Percentage of Students Whose Teachers Report Feeling Ready to Teach Science Topics							
	Physics					Earth Science		
	Physical states and changes in matter	Energy types, sources, and conversions including heat transfers	Basic properties/ behaviors of light	Electric circuits	Forces and motion	Earth's structure and physical features	Earth's processes, cycles and history	Earth in the solar system and the universe
Armenia	s 97 (1.4)	s 97 (1.4)	s 97 (1.4)	s 97 (1.4)	s 97 (1.4)	r 100 (0.0)	r 96 (2.8)	r 95 (2.9)
Australia	r 99 (0.4)	r 100 (0.0)	r 95 (1.3)	r 98 (0.7)	r 99 (0.5)	r 98 (1.0)	r 95 (1.8)	r 99 (0.3)
Bahrain	96 (1.4)	98 (1.3)	98 (1.3)	99 (0.0)	95 (1.1)	76 (2.3)	76 (2.9)	91 (2.1)
Belgium (Flemish)	88 (3.3)	81 (5.9)	82 (4.2)	79 (6.2)	87 (4.0)	92 (1.7)	87 (2.4)	85 (2.5)
Botswana	92 (2.1)	97 (1.5)	95 (1.9)	89 (3.1)	86 (3.2)	77 (3.6)	84 (3.7)	72 (4.4)
Bulgaria	r 99 (0.7)	r 100 (0.0)	r 99 (0.6)	r 99 (1.0)	r 99 (0.9)	r 99 (0.9)	r 99 (0.9)	r 99 (0.9)
Chile	94 (1.6)	95 (1.5)	75 (3.4)	74 (3.4)	91 (2.3)	92 (2.0)	93 (2.0)	96 (1.5)
Chinese Taipei	99 (1.0)	98 (1.3)	99 (1.0)	99 (1.0)	99 (1.0)	– –	– –	– –
Cyprus	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	99 (0.8)	99 (0.4)
Egypt	99 (0.8)	99 (0.7)	100 (0.0)	100 (0.0)	95 (1.9)	89 (2.9)	88 (3.0)	97 (1.6)
Estonia	99 (0.7)	100 (0.0)	100 (0.0)	99 (0.7)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
Ghana	92 (2.6)	r 96 (1.8)	93 (2.8)	95 (2.0)	93 (2.4)	r 78 (4.2)	77 (4.0)	r 98 (1.4)
Hong Kong, SAR	98 (1.3)	100 (0.0)	96 (1.8)	98 (1.2)	95 (1.7)	65 (4.2)	66 (4.2)	77 (3.8)
Hungary	99 (0.8)	99 (0.8)	98 (1.2)	97 (1.3)	97 (1.3)	99 (0.9)	99 (0.6)	99 (0.6)
Indonesia	r 99 (1.0)	r 98 (1.4)	r 97 (1.6)	r 89 (3.3)	r 100 (0.0)	– –	– –	– –
Iran, Islamic Rep. of	99 (0.7)	99 (0.5)	97 (1.5)	94 (1.8)	97 (1.5)	96 (1.5)	94 (1.7)	93 (2.1)
Israel	96 (1.1)	94 (1.3)	80 (2.9)	96 (1.3)	82 (2.9)	56 (3.8)	57 (3.6)	62 (3.4)
Italy	98 (1.1)	97 (1.4)	86 (2.5)	86 (2.4)	96 (1.5)	95 (1.6)	92 (2.1)	94 (1.8)
Japan	83 (3.3)	91 (2.5)	95 (1.9)	97 (1.6)	96 (1.4)	89 (2.7)	92 (2.4)	94 (2.0)
Jordan	97 (1.4)	97 (1.5)	95 (1.7)	95 (2.0)	94 (2.0)	92 (2.4)	94 (2.2)	91 (2.9)
Korea, Rep. of	s 93 (2.1)	s 93 (2.0)	s 82 (2.5)	s 93 (2.1)	s 97 (1.6)	s 96 (1.4)	s 94 (1.8)	s 89 (2.4)
Latvia	s 99 (0.9)	s 97 (1.5)	s 95 (2.7)	s 95 (2.3)	s 94 (2.7)	– –	– –	– –
Lebanon	r 93 (1.8)	r 92 (1.6)	r 93 (1.6)	r 91 (1.8)	r 92 (1.7)	r 84 (2.4)	r 84 (2.5)	r 80 (2.8)
Lithuania	99 (1.0)	99 (1.0)	99 (1.0)	97 (1.4)	99 (1.0)	97 (1.5)	94 (2.5)	94 (2.0)
Macedonia, Rep. of	99 (0.9)	99 (0.8)	99 (0.9)	98 (1.1)	99 (0.9)	98 (1.0)	97 (1.4)	97 (1.4)
Malaysia	92 (2.1)	95 (1.9)	97 (1.4)	81 (3.2)	98 (1.4)	78 (3.5)	76 (3.7)	82 (3.0)
Moldova, Rep. of	x x	x x	x x	x x	x x	x x	x x	x x
Morocco	s 84 (4.9)	s 62 (7.1)	s 62 (6.8)	r 76 (5.4)	r 66 (7.0)	s 87 (4.4)	x x	s 56 (6.2)
Netherlands	100 (0.0)	98 (1.2)	99 (0.7)	99 (0.7)	100 (0.0)	99 (1.1)	96 (1.7)	85 (3.4)
New Zealand	100 (0.2)	99 (1.3)	98 (1.4)	98 (1.4)	100 (0.2)	99 (0.8)	99 (0.8)	99 (0.3)
Norway	91 (2.4)	97 (1.1)	94 (1.8)	94 (1.7)	93 (2.0)	93 (1.6)	85 (2.5)	93 (2.0)
Palestinian Nat'l Auth.	97 (1.5)	97 (1.6)	98 (1.2)	98 (1.2)	95 (2.0)	92 (2.4)	90 (2.9)	98 (1.1)
Philippines	r 56 (4.8)	r 62 (4.8)	r 44 (4.5)	r 38 (4.5)	r 57 (5.0)	r 82 (3.5)	r 85 (3.4)	r 84 (3.5)
Romania	99 (1.0)	99 (0.8)	100 (0.0)	100 (0.0)	99 (0.9)	99 (0.7)	95 (1.8)	99 (0.9)
Russian Federation	– –	– –	– –	– –	– –	– –	– –	– –
Saudi Arabia	r 88 (4.3)	r 98 (0.9)	r 97 (1.6)	r 90 (2.5)	r 93 (1.9)	r 90 (2.5)	r 81 (5.9)	r 96 (1.2)
Scotland	s 94 (1.6)	s 98 (1.2)	s 93 (1.9)	s 96 (1.5)	s 91 (2.3)	s 80 (2.4)	s 84 (2.1)	s 80 (2.4)
Serbia	r 95 (1.9)	r 96 (1.8)	95 (1.8)	r 94 (2.1)	r 94 (1.9)	99 (0.7)	99 (0.9)	99 (1.0)
Singapore	r 96 (1.3)	r 96 (1.2)	r 95 (1.5)	r 93 (1.7)	r 92 (1.7)	r 37 (3.0)	r 41 (2.6)	r 53 (2.8)
Slovak Republic	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.1)	100 (0.0)	100 (0.3)	92 (4.1)	99 (1.1)
Slovenia	100 (0.0)	100 (0.0)	100 (0.0)	98 (1.3)	100 (0.0)	– –	– –	– –
South Africa	r 82 (3.4)	r 86 (2.5)	r 77 (3.5)	r 94 (1.8)	r 90 (2.3)	r 67 (3.9)	r 69 (3.7)	r 64 (3.9)
Sweden	92 (1.4)	94 (1.1)	91 (1.5)	89 (2.1)	92 (1.4)	r 68 (3.1)	r 80 (2.8)	r 86 (2.4)
Tunisia	s 42 (5.0)	s 53 (5.4)	s 40 (5.0)	s 32 (4.6)	s 49 (5.5)	r 89 (3.0)	r 88 (2.9)	r 50 (4.7)
United States	r 93 (1.4)	r 92 (1.7)	r 90 (1.9)	r 83 (2.0)	r 94 (1.4)	95 (1.3)	94 (1.5)	96 (1.2)
‡ England	– –	– –	– –	– –	– –	– –	– –	– –
International Avg.	93 (0.3)	94 (0.3)	91 (0.3)	91 (0.4)	93 (0.3)	88 (0.4)	87 (0.4)	88 (0.4)
Benchmarking Participants								
Basque Country, Spain	97 (1.7)	96 (1.8)	91 (3.0)	91 (3.2)	96 (2.0)	100 (0.4)	93 (2.7)	100 (0.0)
Indiana State, US	s 96 (2.6)	s 97 (2.6)	s 91 (4.4)	s 85 (5.3)	s 89 (4.4)	s 97 (2.6)	s 97 (2.5)	s 93 (3.8)
Ontario Province, Can.	94 (2.2)	95 (2.1)	86 (3.8)	65 (3.8)	88 (3.1)	93 (2.6)	88 (3.4)	89 (3.1)
Quebec Province, Can.	r 93 (2.7)	r 92 (2.6)	r 73 (4.4)	r 80 (4.1)	r 75 (4.8)	r 83 (3.5)	r 86 (3.0)	r 89 (2.8)

Background data provided by teachers.

Does not include students whose teachers report that they do not teach the content area.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 6.10: **Readiness to Teach Science** *(...Continued)*

Countries	Percentage of Students Whose Teachers Report Feeling Ready to Teach Science Topics		
	Environmental Science		
	Trends in human population and its effects on the enviornment	Use and conservation of Earth's natural resources	Changes in environments
Armenia	x x	x x	x x
Australia	r 94 (2.0)	r 95 (1.9)	r 96 (1.7)
Bahrain	80 (3.3)	84 (3.0)	85 (2.5)
Belgium (Flemish)	r 78 (2.8)	r 78 (2.6)	r 75 (2.6)
Botswana	94 (2.2)	98 (1.4)	91 (2.8)
Bulgaria	s 85 (2.3)	s 88 (2.2)	s 96 (1.3)
Chile	96 (1.5)	99 (0.9)	94 (1.9)
Chinese Taipei	89 (2.4)	90 (2.5)	87 (2.7)
Cyprus	s 91 (1.0)	s 95 (0.6)	s 95 (0.7)
Egypt	81 (3.6)	96 (1.8)	84 (3.4)
Estonia	s 88 (1.8)	s 96 (1.4)	s 96 (1.4)
Ghana	96 (1.9)	94 (2.1)	93 (1.5)
Hong Kong, SAR	90 (2.6)	95 (2.1)	94 (2.2)
Hungary	x x	x x	x x
Indonesia	x x	x x	x x
Iran, Islamic Rep. of	98 (1.3)	95 (2.0)	96 (1.5)
Israel	83 (2.9)	84 (2.8)	86 (2.4)
Italy	87 (2.3)	95 (1.5)	94 (1.6)
Japan	71 (3.8)	83 (3.3)	85 (3.0)
Jordan	93 (2.6)	94 (2.3)	93 (2.3)
Korea, Rep. of	s 89 (2.3)	s 85 (2.6)	s 89 (2.5)
Latvia	– –	– –	– –
Lebanon	r 86 (2.8)	r 95 (1.4)	r 85 (2.8)
Lithuania	s 87 (1.6)	s 94 (1.2)	s 95 (1.2)
Macedonia, Rep. of	x x	x x	x x
Malaysia	91 (2.5)	94 (2.1)	95 (1.9)
Moldova, Rep. of	x x	x x	x x
Morocco	s 60 (6.2)	x x	s 68 (7.2)
Netherlands	r 96 (1.0)	r 96 (1.2)	r 96 (1.4)
New Zealand	90 (3.4)	97 (1.3)	92 (3.5)
Norway	95 (1.8)	96 (1.6)	97 (1.3)
Palestinian Nat'l Auth.	87 (2.8)	96 (1.3)	92 (2.1)
Philippines	r 93 (2.6)	95 (2.2)	r 92 (2.9)
Romania	x x	x x	x x
Russian Federation	– –	– –	– –
Saudi Arabia	r 91 (3.5)	r 94 (3.2)	r 93 (4.9)
Scotland	s 83 (2.2)	s 94 (1.4)	s 87 (1.9)
Serbia	x x	x x	x x
Singapore	r 72 (2.7)	r 84 (2.2)	r 80 (2.2)
Slovak Republic	x x	x x	x x
Slovenia	r 89 (1.6)	r 94 (1.2)	r 92 (1.2)
South Africa	r 81 (3.3)	r 86 (2.7)	r 76 (3.5)
Sweden	84 (2.2)	92 (1.9)	89 (2.3)
Tunisia	r 44 (4.8)	r 82 (3.5)	r 80 (3.6)
United States	95 (1.4)	96 (1.2)	95 (1.2)
‡ England	– –	– –	– –
International Avg.	86 (0.5)	92 (0.4)	89 (0.5)
Benchmarking Participants			
Basque Country, Spain	98 (1.7)	99 (1.1)	99 (1.1)
Indiana State, US	s 96 (2.6)	s 99 (1.1)	s 98 (2.3)
Ontario Province, Can.	94 (2.4)	97 (1.6)	97 (1.7)
Quebec Province, Can.	r 91 (2.6)	r 90 (2.8)	r 92 (2.3)

Background data provided by teachers.

Does not include students whose teachers report that they do not teach the content area.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 6.10: **Readiness to Teach Science** *(Continued...)*

Countries	Percentage of Students Whose Teachers Report Feeling Ready to Teach Science Topics					
	Life Science					
	Major body structures and their functions in humans and other organisms	Reproduction and development in plants and animals	Physical features, behavior, and survival of organisms living in different environments	Relationships in a living community	Changes in environments	Human health
Armenia	x x	x x	x x	x x	x x	x x
Australia	83 (4.3)	64 (4.3)	76 (3.4)	89 (2.4)	93 (2.1)	73 (4.2)
Belgium (Flemish)	48 (4.0)	30 (3.5)	43 (3.8)	82 (2.6)	81 (2.6)	39 (3.8)
Chinese Taipei	97 (1.5)	87 (2.7)	95 (1.9)	99 (0.7)	98 (1.1)	97 (1.5)
Cyprus	98 (1.2)	93 (2.5)	87 (2.5)	99 (0.8)	98 (1.2)	98 (0.8)
England	– –	– –	– –	– –	– –	– –
Hong Kong, SAR	86 (3.2)	61 (4.4)	85 (3.4)	95 (2.4)	92 (2.5)	91 (2.4)
Hungary	93 (2.2)	68 (4.4)	– –	97 (1.2)	91 (2.3)	53 (4.0)
Iran, Islamic Rep. of	94 (2.0)	97 (1.4)	92 (2.4)	98 (1.2)	92 (2.1)	89 (2.3)
Italy	89 (2.2)	84 (2.8)	82 (2.9)	98 (1.0)	90 (2.2)	63 (3.7)
Japan	65 (3.6)	49 (4.0)	56 (3.8)	93 (2.2)	74 (3.7)	85 (2.8)
Latvia	s 79 (4.4)	s 63 (6.1)	s 77 (4.6)	s 98 (1.1)	s 94 (2.5)	s 42 (6.0)
Lithuania	82 (3.1)	46 (3.8)	82 (2.5)	87 (2.2)	96 (1.1)	70 (3.4)
Moldova, Rep. of	r 83 (3.5)	r 65 (4.9)	79 (3.7)	96 (1.2)	92 (2.1)	r 72 (4.0)
Morocco	x x	x x	x x	x x	x x	x x
Netherlands	63 (4.6)	38 (4.5)	59 (4.5)	82 (3.2)	87 (3.0)	53 (4.4)
New Zealand	r 92 (1.4)	r 78 (2.7)	r 77 (2.8)	r 93 (1.7)	r 94 (1.7)	r 88 (2.1)
Norway	67 (3.9)	46 (4.1)	74 (3.9)	91 (1.7)	93 (2.3)	71 (3.8)
Philippines	91 (3.0)	89 (3.3)	93 (2.3)	100 (0.0)	95 (2.4)	77 (3.4)
Russian Federation	– –	– –	– –	– –	– –	– –
Scotland	s 76 (4.1)	s 65 (5.3)	s 67 (5.0)	s 88 (3.6)	s 93 (3.1)	s 78 (4.6)
Singapore	98 (1.3)	72 (4.3)	80 (3.5)	99 (0.5)	96 (1.6)	87 (3.0)
Slovenia	89 (3.2)	72 (4.2)	69 (4.6)	91 (2.3)	95 (2.2)	90 (2.9)
Tunisia	r 93 (2.4)	r 52 (3.9)	r 55 (4.6)	98 (1.1)	97 (1.4)	r 69 (4.1)
United States	93 (1.3)	74 (2.6)	82 (1.9)	94 (1.3)	93 (1.5)	86 (2.0)
International Avg.	84 (0.7)	66 (0.9)	76 (0.8)	94 (0.4)	92 (0.5)	75 (0.8)
Benchmarking Participants						
Indiana State, US	93 (3.0)	72 (5.3)	82 (5.1)	99 (1.0)	94 (2.6)	84 (3.9)
Ontario Province, Can.	94 (2.1)	63 (5.0)	75 (4.4)	91 (2.5)	93 (2.6)	76 (4.0)
Quebec Province, Can.	73 (3.7)	42 (4.2)	43 (4.7)	84 (3.4)	75 (4.1)	46 (4.7)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

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

Exhibit 6.10: **Readiness to Teach Science** *(...Continued)*

Countries	Percentage of Students Whose Teachers Report Feeling Ready to Teach Science Topics						
	Physical Science						
	Classification of objects/ materials based on physical properties	Forming and separating mixtures	Chemical and physical changes	States of matter and differences in their physical properties, including changes in state of water by heating and cooling	Common energy sources/ forms and their practical uses	Common uses of electricity and electrical circuits	Forces that cause objects to move
Armenia	x x	x x	x x	x x	x x	x x	x x
Australia	86 (2.9)	64 (4.3)	76 (3.4)	89 (2.4)	93 (2.1)	73 (4.2)	86 (2.9)
Belgium (Flemish)	55 (4.0)	30 (3.5)	43 (3.8)	82 (2.6)	81 (2.6)	39 (3.8)	55 (4.0)
Chinese Taipei	96 (1.8)	87 (2.7)	95 (1.9)	99 (0.7)	98 (1.1)	97 (1.5)	96 (1.8)
Cyprus	98 (1.2)	93 (2.5)	87 (2.5)	99 (0.8)	98 (1.2)	98 (0.8)	98 (1.2)
England	– –	– –	– –	– –	– –	– –	– –
Hong Kong, SAR	84 (3.6)	61 (4.4)	85 (3.4)	95 (2.4)	92 (2.5)	91 (2.4)	84 (3.6)
Hungary	58 (3.4)	68 (4.4)	– –	97 (1.2)	91 (2.3)	53 (4.0)	58 (3.4)
Iran, Islamic Rep. of	91 (2.2)	97 (1.4)	92 (2.4)	98 (1.2)	92 (2.1)	89 (2.3)	91 (2.2)
Italy	82 (2.9)	84 (2.8)	82 (2.9)	98 (1.0)	90 (2.2)	63 (3.7)	82 (2.9)
Japan	68 (3.9)	49 (4.0)	56 (3.8)	93 (2.2)	74 (3.7)	85 (2.8)	68 (3.9)
Latvia	s 65 (5.5)	s 63 (6.1)	s 77 (4.6)	s 98 (1.1)	s 94 (2.5)	s 42 (6.0)	s 65 (5.5)
Lithuania	61 (4.0)	46 (3.8)	82 (2.5)	87 (2.2)	96 (1.1)	70 (3.4)	61 (4.0)
Moldova, Rep. of	r 73 (4.1)	r 65 (4.9)	79 (3.7)	96 (1.2)	92 (2.1)	r 72 (4.0)	r 73 (4.1)
Morocco	x x	x x	x x	x x	x x	x x	x x
Netherlands	65 (3.9)	38 (4.5)	59 (4.5)	82 (3.2)	87 (3.0)	53 (4.4)	65 (3.9)
New Zealand	r 92 (1.8)	r 78 (2.7)	r 77 (2.8)	r 93 (1.7)	r 94 (1.7)	r 88 (2.1)	r 92 (1.8)
Norway	84 (3.2)	46 (4.1)	74 (3.9)	91 (1.7)	93 (2.3)	71 (3.8)	84 (3.2)
Philippines	91 (3.3)	89 (3.3)	93 (2.3)	100 (0.0)	95 (2.4)	77 (3.4)	91 (3.3)
Russian Federation	– –	– –	– –	– –	– –	– –	– –
Scotland	s 88 (3.4)	s 65 (5.3)	s 67 (5.0)	s 88 (3.6)	s 93 (3.1)	s 78 (4.6)	s 88 (3.4)
Singapore	82 (3.4)	72 (4.3)	80 (3.5)	99 (0.5)	96 (1.6)	87 (3.0)	82 (3.4)
Slovenia	73 (4.2)	72 (4.2)	69 (4.6)	91 (2.3)	95 (2.2)	90 (2.9)	73 (4.2)
Tunisia	r 84 (3.4)	r 52 (3.9)	r 55 (4.6)	98 (1.1)	97 (1.4)	r 69 (4.1)	r 84 (3.4)
United States	92 (1.5)	74 (2.6)	82 (1.9)	94 (1.3)	93 (1.5)	86 (2.0)	92 (1.5)
International Avg.	79 (0.7)	66 (0.9)	76 (0.8)	94 (0.4)	92 (0.5)	75 (0.8)	79 (0.7)
Benchmarking Participants							
Indiana State, US	92 (2.6)	72 (5.3)	82 (5.1)	99 (1.0)	94 (2.6)	84 (3.9)	92 (2.6)
Ontario Province, Can.	93 (2.6)	63 (5.0)	75 (4.4)	91 (2.5)	93 (2.6)	76 (4.0)	93 (2.6)
Quebec Province, Can.	53 (4.2)	42 (4.2)	43 (4.7)	84 (3.4)	75 (4.1)	46 (4.7)	53 (4.2)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

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Exhibit 6.10: **Readiness to Teach Science**

Countries	Percentage of Students Whose Teachers Report Feeling Ready to Teach Science Topics					
	Earth Science					
	Features on Earth's landscape	Water on Earth	Air	Common features of the Earth's landscape and relationship to human use	Fossils of animals and plants	Earth's solar system
Armenia	x x	x x	x x	x x	x x	x x
Australia	98 (0.9)	94 (2.3)	92 (2.2)	98 (1.2)	82 (3.1)	97 (1.3)
Belgium (Flemish)	93 (2.0)	82 (3.3)	68 (3.3)	91 (2.3)	46 (4.0)	81 (2.9)
Chinese Taipei	97 (1.3)	98 (1.2)	98 (1.1)	98 (1.3)	85 (3.1)	95 (1.8)
Cyprus	93 (2.1)	93 (2.1)	99 (0.6)	96 (1.9)	67 (4.1)	88 (2.7)
England	– –	– –	– –	– –	– –	– –
Hong Kong, SAR	92 (3.0)	86 (3.4)	97 (1.3)	92 (3.0)	68 (4.3)	86 (3.0)
Hungary	100 (0.0)	99 (0.9)	96 (1.7)	96 (2.0)	63 (4.1)	92 (1.7)
Iran, Islamic Rep. of	94 (1.7)	94 (1.9)	91 (2.3)	95 (1.9)	74 (3.7)	90 (2.5)
Italy	100 (0.0)	100 (0.0)	100 (0.0)	98 (0.8)	86 (2.7)	97 (1.3)
Japan	75 (3.4)	75 (3.1)	76 (3.6)	76 (3.4)	47 (4.4)	77 (3.4)
Latvia	s 100 (0.3)	s 99 (0.6)	s 99 (0.6)	s 99 (0.5)	s 76 (5.0)	s 97 (1.9)
Lithuania	99 (0.7)	97 (1.2)	98 (0.8)	97 (1.4)	78 (3.3)	94 (1.8)
Moldova, Rep. of	97 (1.5)	97 (1.5)	99 (0.8)	100 (0.0)	78 (3.7)	95 (1.4)
Morocco	x x	x x	x x	x x	x x	x x
Netherlands	95 (2.2)	93 (2.6)	88 (2.8)	95 (2.0)	70 (4.1)	65 (4.6)
New Zealand	r 98 (0.8)	r 96 (1.3)	r 88 (2.3)	r 95 (1.3)	r 80 (2.8)	r 97 (1.1)
Norway	96 (1.9)	91 (2.4)	89 (2.5)	92 (1.8)	75 (3.1)	96 (1.3)
Philippines	93 (2.5)	89 (2.9)	88 (3.1)	89 (3.0)	77 (4.3)	94 (2.4)
Russian Federation	– –	– –	– –	– –	– –	– –
Scotland	s 98 (1.3)	s 97 (1.4)	s 82 (3.5)	s 93 (2.3)	s 67 (4.4)	s 97 (1.2)
Singapore	71 (3.4)	71 (3.9)	92 (2.0)	70 (4.2)	45 (4.3)	74 (3.6)
Slovenia	97 (1.8)	98 (1.1)	99 (0.7)	98 (1.2)	67 (4.2)	82 (3.6)
Tunisia	r 69 (4.5)	r 65 (4.4)	r 92 (2.2)	r 72 (4.0)	r 32 (4.3)	r 48 (4.7)
United States	99 (0.3)	96 (1.0)	90 (1.6)	98 (0.9)	84 (2.0)	94 (1.3)
International Avg.	93 (0.4)	91 (0.5)	91 (0.5)	92 (0.5)	69 (0.8)	87 (0.6)
Benchmarking Participants						
Indiana State, US	100 (0.0)	95 (3.5)	91 (3.9)	100 (0.0)	83 (4.4)	95 (2.1)
Ontario Province, Can.	100 (0.4)	95 (2.0)	87 (3.1)	97 (1.7)	86 (3.6)	89 (3.0)
Quebec Province, Can.	97 (1.5)	87 (3.1)	89 (2.9)	93 (2.4)	59 (4.3)	81 (3.5)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

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

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7

Chapter 7

Classroom Characteristics and Instruction

Although the school provides the general context for learning, it is in the classroom setting and through guidance by the teacher that most instruction and learning take place. To provide information about the environment of science classrooms and the instruction that takes place, Chapter 7 presents teachers' reports from the second part of the teacher questionnaire about their science classrooms and instructional practices, as well as students' reports about the classroom activities they do in learning science. Data are presented about class size, various limitations on instruction, instructional time, instructional emphases given different science topics, and science investigations. Information also is presented about textbook use, classroom activities, the use of computers in science lessons, the role of homework, and the reliance on different types of assessment approaches.

Teachers and the instructional approaches they use ultimately determine the science students learn. Teachers structure the content and pace of lessons, introducing new material, selecting various instructional activities, and monitoring students' developing understanding of the science concepts being studied. Teachers may help students use technology and tools to investigate scientific ideas, analyze students' work for misconceptions, and promote positive attitudes

toward science. They may also assign homework and conduct informal as well as formal assessments to evaluate achievement outcomes.

How Do the Characteristics of Science Classrooms Impact Instruction?

Because it can affect pedagogical strategies, class size data are shown in Exhibit 7.1. Teachers' reports about the sizes of their eighth-grade science classes reveal that across countries the average class size was 31 students, but there was considerable variation – from more than 54 students in the Philippines to 20 students in Belgium (Flemish). At the fourth grade, classes typically were smaller. The average class size for the TIMSS participants was 26 students, ranging from 40 in the Philippines to 20 in Belgium (Flemish), Italy, and Slovenia.

The relationship between class size and achievement is difficult to disentangle, given the variety of policies and practices that countries have in determining class size. For example, countries and schools cannot always control class size. Because of this, the ability to cap class sizes can indicate the availability of more resources in general. As another complicating factor, smaller classes can be used for advanced or practical classes such as computer or science laboratories on one hand, and for remedial learning or students with special needs on the other. The complexity of this issue is evidenced in the TIMSS results that show a curvilinear relationship, on average, between class size and science achievement at both the eighth and fourth grades.

At the eighth grade, science teachers were asked about the instructional impact of six characteristics of their students – differing academic abilities, range in backgrounds, students with special needs, uninterested students, low morale among students, and disruptive students. Responses were given on a four-point scale; "not at all," "a little," "some," and "a lot." TIMSS used the teachers' responses to construct an index and the results are presented in Exhibit 7.2. Students were placed in the high category, if, on average, teachers reported their classrooms were impacted only a little (or less) and in the low category, if,

on average, these factors impacted instruction at least somewhat. The remaining students fell in the medium category. The results show that average science achievement is related to the impact of student characteristics on classroom instruction, with lower achievement related to having more instructionally challenging and diverse students in the class. On average, internationally, 21 percent of the students were in such classrooms.

Exhibit 7.1: Class Size for Science Instruction

SCIENCE Grade 8

Countries		Overall Average Class Size	1 - 24 Students		25 - 32 Students		33 - 40 Students		41 or More Students	
			Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	s	31 (0.8)	30 (2.5)	470 (7.6)	40 (3.4)	469 (6.4)	9 (1.9)	443 (7.4)	21 (2.8)	455 (5.8)
Australia	r	26 (0.4)	33 (3.8)	524 (7.7)	65 (3.9)	529 (4.2)	2 (0.9)	~ ~	0 (0.0)	~ ~
Bahrain		32 (0.2)	5 (0.8)	452 (7.4)	53 (2.3)	440 (2.2)	39 (2.2)	432 (3.2)	3 (0.0)	455 (6.0)
Belgium (Flemish)		20 (0.3)	88 (2.4)	515 (2.6)	12 (2.4)	532 (7.6)	0 (0.0)	~ ~	0 (0.0)	~ ~
Botswana		37 (0.4)	2 (0.9)	~ ~	14 (2.7)	392 (14.2)	57 (4.9)	357 (3.7)	27 (4.6)	363 (6.1)
Bulgaria	r	22 (0.6)	68 (4.7)	483 (4.9)	27 (4.2)	478 (9.0)	4 (3.0)	428 (5.0)	1 (0.0)	~ ~
Chile		35 (0.4)	8 (1.5)	412 (16.6)	25 (2.7)	408 (6.0)	45 (3.6)	416 (5.9)	22 (3.6)	415 (6.9)
Chinese Taipei		37 (0.4)	4 (1.5)	584 (21.1)	14 (2.8)	554 (7.8)	66 (4.1)	563 (3.9)	17 (3.2)	607 (6.3)
Cyprus		25 (0.1)	30 (1.7)	443 (3.2)	70 (1.7)	439 (2.3)	0 (0.0)	~ ~	0 (0.0)	~ ~
Egypt		39 (0.7)	2 (1.1)	~ ~	8 (1.9)	452 (11.1)	58 (4.7)	418 (5.1)	31 (4.3)	418 (7.9)
Estonia		28 (0.4)	27 (2.7)	545 (3.7)	45 (4.1)	549 (4.0)	28 (3.3)	565 (5.2)	0 (0.2)	~ ~
Ghana	r	37 (1.1)	17 (2.8)	205 (12.2)	17 (3.1)	224 (13.8)	28 (4.0)	273 (11.7)	38 (5.0)	266 (12.3)
Hong Kong, SAR		40 (0.3)	0 (0.0)	~ ~	4 (1.6)	481 (22.0)	52 (4.2)	548 (5.3)	44 (4.3)	574 (4.5)
Hungary		23 (0.4)	60 (4.1)	535 (3.8)	37 (4.1)	551 (5.2)	3 (1.2)	589 (12.8)	0 (0.0)	~ ~
Indonesia		40 (0.5)	3 (1.7)	437 (27.3)	8 (2.3)	391 (19.6)	41 (4.2)	420 (7.1)	48 (4.4)	429 (5.8)
Iran, Islamic Rep. of		29 (0.4)	21 (2.9)	442 (4.6)	49 (4.3)	456 (4.0)	26 (3.7)	457 (5.0)	4 (1.5)	448 (11.0)
Israel	r	34 (0.4)	10 (2.3)	507 (14.1)	18 (3.5)	494 (8.4)	69 (4.1)	484 (4.1)	3 (1.4)	522 (15.2)
Italy		22 (0.3)	78 (3.1)	490 (3.2)	22 (3.1)	496 (8.4)	0 (0.0)	~ ~	0 (0.0)	~ ~
Japan		35 (0.2)	2 (1.0)	~ ~	18 (2.4)	547 (3.0)	79 (2.3)	552 (2.4)	1 (1.0)	~ ~
Jordan		35 (0.6)	13 (2.6)	481 (7.3)	25 (3.5)	473 (12.0)	33 (4.4)	465 (6.0)	29 (3.8)	482 (6.8)
Korea, Rep. of	s	37 (0.4)	1 (0.8)	~ ~	20 (2.8)	550 (4.5)	56 (4.3)	562 (2.1)	23 (3.5)	566 (4.5)
Latvia	r	28 (0.9)	44 (3.6)	504 (3.8)	38 (3.8)	520 (4.3)	6 (1.5)	517 (9.4)	13 (2.6)	520 (9.3)
Lebanon		28 (0.6)	35 (3.6)	385 (7.9)	44 (4.4)	388 (6.9)	15 (2.4)	417 (11.9)	6 (2.7)	435 (7.8)
Lithuania	r	25 (0.3)	39 (2.7)	510 (3.9)	61 (2.7)	523 (2.4)	0 (0.3)	~ ~	0 (0.2)	~ ~
Macedonia, Rep. of		28 (0.4)	26 (3.5)	449 (8.4)	57 (3.9)	451 (5.7)	16 (3.4)	448 (11.9)	1 (1.1)	~ ~
Malaysia		37 (0.4)	2 (0.8)	~ ~	18 (3.5)	519 (10.2)	59 (4.6)	507 (4.4)	22 (3.4)	515 (9.4)
Moldova, Rep. of	s	25 (0.5)	54 (4.4)	465 (5.6)	38 (4.4)	473 (5.9)	5 (1.2)	481 (10.9)	3 (1.1)	484 (12.9)
Morocco	s	41 (1.2)	9 (4.2)	395 (12.6)	22 (5.0)	395 (7.5)	16 (3.6)	420 (11.4)	53 (4.9)	391 (5.7)
Netherlands	r	26 (0.3)	30 (3.7)	521 (8.0)	69 (3.9)	545 (4.6)	1 (1.2)	~ ~	0 (0.0)	~ ~
New Zealand		27 (0.4)	22 (3.4)	502 (7.2)	72 (4.0)	526 (6.5)	6 (3.6)	557 (10.9)	0 (0.0)	~ ~
Norway	r	25 (0.3)	33 (3.8)	498 (3.6)	65 (3.7)	490 (2.8)	0 (0.0)	~ ~	1 (0.8)	~ ~
Palestinian Nat'l Auth.		39 (0.6)	7 (2.1)	442 (17.2)	16 (2.7)	445 (6.8)	28 (3.7)	440 (7.2)	48 (3.5)	431 (4.7)
Philippines		54 (0.8)	1 (0.0)	~ ~	1 (0.8)	~ ~	6 (1.8)	433 (35.3)	93 (1.9)	376 (6.1)
Romania		24 (0.5)	52 (4.3)	465 (7.2)	44 (4.4)	470 (6.5)	2 (1.3)	~ ~	1 (0.8)	~ ~
Russian Federation		23 (0.4)	49 (3.7)	505 (4.0)	46 (3.5)	519 (4.6)	5 (2.7)	532 (11.0)	0 (0.0)	~ ~
Saudi Arabia		29 (0.9)	32 (5.0)	399 (8.3)	29 (5.6)	400 (9.3)	31 (5.7)	393 (6.7)	8 (3.3)	398 (4.7)
Scotland	s	19 (0.3)	94 (1.5)	516 (4.2)	4 (1.3)	547 (11.5)	2 (0.7)	~ ~	1 (0.4)	~ ~
Serbia		26 (0.5)	38 (3.6)	456 (4.1)	50 (3.8)	472 (3.7)	11 (2.9)	481 (7.1)	1 (0.4)	~ ~
Singapore		38 (0.2)	2 (0.6)	~ ~	8 (1.6)	587 (21.2)	63 (2.7)	577 (5.9)	26 (2.4)	583 (6.2)
Slovak Republic		25 (0.4)	40 (4.4)	509 (4.3)	54 (4.6)	520 (5.0)	5 (1.9)	543 (19.6)	0 (0.0)	~ ~
Slovenia		23 (0.3)	71 (3.7)	519 (2.2)	29 (3.7)	527 (3.4)	0 (0.0)	~ ~	0 (0.0)	~ ~
South Africa	s	45 (1.2)	4 (1.2)	247 (44.5)	12 (2.9)	250 (37.6)	31 (3.6)	268 (19.8)	53 (3.9)	230 (11.7)
Sweden	r	21 (0.4)	73 (3.4)	524 (3.3)	24 (3.5)	528 (5.3)	1 (0.4)	~ ~	2 (0.7)	~ ~
Tunisia		34 (0.3)	2 (1.2)	~ ~	25 (3.4)	398 (3.4)	72 (3.4)	405 (2.5)	1 (0.7)	~ ~
United States	r	24 (0.5)	50 (2.9)	534 (4.3)	39 (2.8)	526 (5.4)	7 (1.8)	542 (13.8)	3 (1.2)	539 (8.9)
‡ England	s	27 (0.6)	33 (4.6)	549 (12.3)	59 (4.5)	555 (7.6)	6 (2.5)	574 (29.1)	2 (1.0)	~ ~
International Avg.		31 (0.1)	29 (0.4)	471 (2.0)	33 (0.5)	477 (1.6)	24 (0.4)	472 (2.0)	14 (0.4)	454 (1.7)
Benchmarking Participants										
Basque Country, Spain		24 (0.4)	49 (3.7)	483 (3.7)	48 (4.1)	495 (3.7)	3 (2.0)	525 (7.2)	0 (0.0)	~ ~
Indiana State, US		26 (1.5)	48 (6.2)	529 (6.8)	41 (5.9)	539 (7.4)	2 (2.2)	~ ~	9 (3.6)	518 (15.8)
Ontario Province, Can.		27 (0.4)	23 (3.7)	532 (4.2)	69 (4.1)	533 (3.8)	7 (2.7)	523 (7.0)	0 (0.0)	~ ~
Quebec Province, Can.	r	30 (0.4)	14 (2.9)	521 (5.7)	61 (4.2)	530 (4.8)	26 (3.3)	552 (5.3)	0 (0.0)	~ ~

Background data provided by teachers.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

A tilde (~) indicates insuffcient 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) 2003

Exhibit 7.1: Class Size for Science Instruction

Countries		Overall Average Class Size	1 - 19 Students		20 - 26 Students		27 - 32 Students		33 or More Students	
			Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia		x x	x x	x x	x x	x x	x x	x x	x x	x x
Australia		26 (0.5)	14 (2.9)	518 (9.0)	28 (3.5)	523 (6.1)	55 (4.4)	521 (8.2)	3 (1.7)	519 (7.5)
Belgium (Flemish)		20 (0.3)	41 (3.4)	517 (3.4)	52 (3.6)	519 (2.2)	6 (2.0)	518 (3.2)	1 (0.0)	~ ~
Chinese Taipei		32 (0.3)	2 (0.7)	~ ~	7 (2.0)	535 (12.0)	37 (4.0)	552 (3.0)	54 (3.7)	554 (2.3)
Cyprus		23 (0.3)	18 (2.2)	476 (3.7)	55 (4.5)	484 (3.7)	26 (4.2)	478 (4.1)	1 (0.5)	~ ~
England	r	28 (0.8)	8 (2.8)	531 (22.6)	28 (4.5)	542 (6.1)	46 (5.2)	542 (5.8)	18 (4.3)	535 (10.1)
Hong Kong, SAR	r	34 (0.4)	1 (0.6)	~ ~	2 (1.3)	~ ~	31 (4.7)	532 (5.2)	66 (4.7)	549 (3.6)
Hungary		24 (0.5)	19 (3.2)	511 (7.6)	53 (4.1)	526 (4.6)	27 (4.1)	544 (6.1)	1 (0.9)	~ ~
Iran, Islamic Rep. of		27 (0.6)	16 (2.6)	378 (11.6)	28 (3.7)	417 (5.9)	27 (4.0)	411 (9.0)	29 (4.0)	436 (6.5)
Italy		20 (0.3)	45 (3.4)	521 (5.2)	53 (3.4)	511 (5.1)	1 (0.7)	~ ~	0 (0.0)	~ ~
Japan		32 (0.3)	5 (1.1)	556 (6.4)	12 (2.3)	538 (4.8)	28 (3.0)	545 (2.5)	55 (2.8)	543 (2.2)
Latvia		x x	x x	x x	x x	x x	x x	x x	x x	x x
Lithuania		21 (0.4)	30 (3.0)	494 (5.9)	59 (3.5)	518 (2.4)	11 (2.5)	522 (6.0)	0 (0.3)	~ ~
Moldova, Rep. of	r	24 (0.4)	20 (3.6)	491 (9.0)	48 (4.7)	499 (5.8)	30 (3.8)	505 (10.1)	2 (1.3)	~ ~
Morocco		x x	x x	x x	x x	x x	x x	x x	x x	x x
Netherlands		23 (0.4)	24 (3.4)	530 (4.0)	41 (4.6)	522 (4.3)	33 (4.2)	529 (2.3)	2 (1.5)	~ ~
New Zealand	r	28 (0.3)	9 (1.4)	503 (11.5)	20 (2.3)	520 (7.5)	61 (3.2)	529 (3.0)	10 (2.6)	513 (8.4)
Norway		21 (0.4)	38 (3.2)	464 (5.1)	47 (3.5)	466 (3.6)	13 (3.2)	476 (5.0)	2 (1.3)	~ ~
Philippines		40 (1.0)	3 (1.0)	279 (39.9)	7 (2.4)	333 (31.6)	16 (3.8)	364 (38.8)	75 (4.2)	326 (9.0)
Russian Federation		21 (0.3)	33 (3.2)	523 (7.2)	45 (3.6)	532 (8.6)	20 (2.5)	514 (8.7)	1 (0.9)	~ ~
Scotland	s	26 (0.5)	17 (3.6)	506 (7.9)	26 (4.4)	502 (5.7)	49 (4.8)	508 (4.8)	8 (2.6)	516 (10.2)
Singapore		38 (0.2)	0 (0.1)	~ ~	2 (0.8)	~ ~	3 (1.0)	472 (37.8)	96 (1.3)	569 (5.4)
Slovenia		20 (0.4)	45 (4.0)	489 (4.0)	49 (4.3)	491 (3.7)	5 (2.1)	496 (9.4)	0 (0.0)	~ ~
Tunisia	r	30 (0.5)	5 (1.5)	297 (33.0)	19 (3.1)	295 (15.3)	40 (4.1)	316 (9.4)	37 (4.4)	316 (11.2)
United States	r	23 (0.4)	24 (2.7)	543 (6.4)	53 (3.3)	540 (3.5)	18 (2.4)	521 (5.3)	5 (1.3)	534 (14.9)
International Avg.		26 (0.1)	19 (0.6)	480 (3.4)	33 (0.7)	491 (2.2)	27 (0.8)	495 (2.9)	21 (0.5)	492 (2.5)
Benchmarking Participants										
Indiana State, US	r	23 (0.6)	19 (5.6)	553 (11.7)	69 (7.2)	550 (5.2)	7 (2.8)	555 (13.9)	5 (2.7)	560 (19.0)
Ontario Province, Can.		25 (0.5)	13 (3.2)	543 (8.1)	45 (5.2)	542 (6.9)	39 (5.3)	538 (5.4)	4 (1.7)	532 (10.1)
Quebec Province, Can.		26 (0.3)	5 (1.6)	512 (10.3)	49 (4.6)	495 (4.1)	46 (4.5)	505 (3.4)	0 (0.1)	~ ~

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

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

A tilde (~) indicates insuffcient 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 the students.

Exhibit 7.2: Index of Teachers' Reports on Teaching Science Classes with Few or No Limitations on Instruction Due to Student Factors (SCFL)

SCIENCE Grade 8

Index of Teachers' Reports on Teaching Science Classes with Few or No Limitations on Instruction Due to Student Factors

Index based on teachers' responses to six statements about student factors limiting science instruction: 1) Students with different academic abilities; 2) Students who come from a wide range of backgrounds; 3) Students with special needs; 4) Uninterested students ; 5) Low morale among students ; 6) Disruptive students. Average is computed across the six statements based on a 4-point scale: 1. Not at all/Not applicable; 2. A little; 3. Some; 4. A lot. High level indicates average is less than or equal to 2. Medium level indicates average is greater than 2 and less than 3. Low level indicates average is greater than or equal to 3.

Countries		High SCFL		Medium SCFL		Low SCFL	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Netherlands	r	76 (2.8)	548 (3.8)	21 (2.7)	505 (4.6)	3 (1.1)	486 (8.6)
Lithuania		72 (1.6)	523 (2.2)	27 (1.6)	509 (3.0)	1 (0.5)	~ ~
Belgium (Flemish)		66 (3.2)	532 (2.8)	28 (3.3)	493 (7.1)	7 (1.5)	470 (19.6)
Malaysia		63 (4.3)	524 (4.2)	33 (4.0)	492 (6.3)	4 (1.6)	454 (16.7)
Japan		61 (3.0)	558 (2.4)	38 (3.2)	542 (2.9)	1 (1.0)	~ ~
Sweden		58 (3.0)	533 (2.8)	36 (3.0)	519 (4.5)	6 (1.7)	491 (11.0)
Estonia	r	57 (2.6)	565 (2.8)	32 (2.5)	547 (3.4)	11 (1.7)	543 (3.4)
Hungary		55 (2.7)	554 (3.2)	38 (2.6)	528 (3.4)	7 (1.1)	524 (5.7)
Latvia	r	55 (2.8)	516 (3.0)	37 (2.7)	510 (3.5)	9 (1.6)	513 (5.8)
Australia	r	49 (3.6)	541 (5.2)	36 (3.1)	522 (6.4)	16 (2.4)	504 (7.4)
Norway		46 (4.4)	500 (2.6)	41 (4.4)	491 (3.4)	13 (3.0)	478 (9.0)
Slovenia		44 (3.0)	522 (2.6)	43 (3.0)	519 (2.3)	13 (1.6)	526 (2.9)
United States	r	44 (3.0)	541 (4.8)	38 (3.0)	528 (4.3)	18 (2.1)	510 (7.6)
Macedonia, Rep. of		43 (2.8)	454 (4.7)	41 (2.6)	459 (4.9)	16 (2.0)	433 (9.7)
Scotland	s	43 (2.9)	524 (5.5)	40 (2.8)	517 (5.0)	17 (2.4)	493 (10.6)
Russian Federation		42 (2.0)	524 (4.1)	37 (1.8)	509 (3.7)	20 (2.6)	499 (6.6)
New Zealand		40 (4.7)	552 (8.8)	39 (4.6)	510 (3.6)	20 (3.3)	485 (8.2)
Philippines		38 (4.8)	417 (8.2)	39 (4.6)	358 (10.2)	23 (3.8)	348 (12.9)
Serbia		38 (2.4)	467 (3.5)	42 (2.2)	468 (3.4)	20 (1.9)	464 (4.0)
Lebanon		38 (3.9)	406 (7.9)	40 (3.8)	377 (6.2)	22 (2.4)	401 (8.7)
Romania		38 (2.8)	488 (6.6)	39 (2.3)	463 (6.1)	23 (2.1)	450 (7.0)
Bulgaria	r	37 (3.3)	483 (5.4)	40 (3.0)	474 (7.0)	23 (3.2)	479 (8.6)
Singapore		36 (2.4)	619 (5.8)	40 (2.5)	574 (7.3)	23 (2.3)	524 (9.2)
Indonesia		36 (3.2)	433 (6.4)	48 (3.5)	418 (5.5)	17 (2.6)	414 (9.2)
Moldova, Rep. of	r	35 (2.8)	474 (4.9)	42 (3.3)	463 (5.5)	23 (2.5)	470 (5.5)
Italy		34 (3.9)	511 (6.2)	43 (4.0)	482 (4.1)	23 (2.7)	479 (6.1)
Korea, Rep. of	r	33 (3.3)	557 (2.8)	56 (3.1)	561 (2.9)	11 (2.4)	560 (5.9)
Chile		32 (3.7)	435 (6.0)	41 (4.0)	408 (4.8)	27 (3.8)	393 (5.4)
Armenia	r	32 (3.0)	466 (7.8)	45 (2.8)	460 (3.6)	23 (2.1)	463 (5.0)
Egypt		31 (3.5)	443 (6.7)	48 (4.1)	418 (5.6)	21 (3.4)	398 (10.5)
Ghana		31 (4.6)	267 (11.2)	48 (4.7)	252 (9.7)	21 (4.0)	238 (11.3)
Hong Kong, SAR		30 (4.0)	571 (5.3)	38 (4.3)	556 (5.2)	32 (4.3)	539 (7.4)
Israel		30 (3.4)	507 (5.7)	40 (3.6)	489 (4.7)	30 (3.0)	474 (5.6)
South Africa	r	29 (3.5)	272 (19.4)	42 (4.1)	242 (13.3)	29 (3.7)	229 (10.9)
Slovak Republic		27 (2.5)	536 (5.5)	47 (2.8)	509 (3.4)	26 (2.3)	511 (3.9)
Chinese Taipei		26 (4.1)	583 (6.8)	34 (3.7)	576 (5.5)	39 (4.4)	560 (4.8)
Saudi Arabia		25 (4.2)	400 (7.9)	51 (5.7)	399 (6.2)	24 (5.2)	390 (8.4)
Tunisia		21 (3.4)	406 (5.1)	50 (3.7)	402 (3.0)	28 (3.4)	403 (3.0)
Jordan		20 (3.2)	478 (6.8)	54 (4.2)	475 (6.0)	26 (3.7)	472 (7.5)
Palestinian Nat'l Auth.		20 (3.1)	435 (6.7)	46 (4.4)	436 (5.8)	35 (4.4)	434 (6.3)
Bahrain		18 (2.6)	449 (4.2)	45 (4.1)	440 (3.1)	37 (3.9)	431 (3.3)
Cyprus		18 (1.0)	446 (3.4)	40 (1.3)	438 (2.7)	42 (1.2)	440 (2.3)
Botswana		15 (3.5)	377 (8.6)	49 (4.6)	361 (5.8)	37 (4.1)	361 (4.5)
Iran, Islamic Rep. of		11 (2.6)	471 (12.2)	34 (4.1)	458 (4.9)	55 (3.7)	448 (2.8)
Morocco		5 (2.0)	377 (9.0)	41 (4.7)	400 (4.2)	54 (5.2)	400 (5.5)
‡ England	s	64 (4.0)	573 (7.3)	25 (3.1)	514 (10.5)	11 (2.9)	508 (9.3)
International Avg.		38 (0.5)	486 (1.0)	40 (0.5)	469 (0.9)	21 (0.4)	457 (1.3)
Benchmarking Participants							
Basque Country, Spain		31 (4.9)	492 (5.6)	46 (5.4)	492 (3.8)	23 (4.1)	481 (7.2)
Indiana State, US		36 (4.5)	538 (7.9)	46 (4.9)	532 (5.5)	18 (4.5)	515 (13.2)
Ontario Province, Can.		49 (4.8)	540 (2.9)	32 (4.7)	532 (4.9)	19 (3.3)	516 (8.4)
Quebec Province, Can.	r	65 (4.2)	542 (4.4)	30 (4.3)	521 (4.8)	5 (1.6)	510 (12.6)

Background data provided by teachers.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

A tilde (~) indicates insuffcient 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) 2003

How Much School Time Is Devoted to Science Instruction?

Exhibit 7.3 presents information about the amount of science instruction given to students at the eighth and fourth grades. Since different systems have school years of different lengths and different arrangements of weekly and daily instruction, the comparisons are given in terms of the average number of hours of science instruction over the school year as reported by science teachers. At the eighth grade, results are presented first for countries teaching science as a single subject and then by science subject for countries teaching the sciences separately.

In general, students in countries with separate science subjects had more total instructional hours in the sciences. Since these students study all of the subjects offered, the total time is the sum of the hours reported by each subject area teacher. Based on these sums, instructional hours for students with separate science courses ranged from 120 hours in Latvia (where students took biology and physics only) to 284 hours in the Slovak Republic (where students took all four science subjects). Not surprisingly, the countries offering all four subjects were those with the most instructional time. All of these were from central or eastern Europe, and in addition to the Slovak Republic, included Bulgaria (245 hours), Estonia (259 hours), Hungary (235 hours), Lithuania (230 hours), Macedonia (255 hours), Romania (232 hours), and Serbia (223 hours). Among countries teaching science as a single subject, instructional time ranged from 69 hours in Italy to 202 in the Philippines, with an international average of 117 hours.

The percentage of instructional time at the eighth grade that was devoted to science ranged from 18 percent in the Philippines to 7 percent in Norway for single science countries. Among countries teaching separate science subjects, the percentage was between 6 and 7 percent for each subject. Combining these percentages gives a range from 13 percent for Latvia to 30 percent for the Slovak Republic.

At the fourth grade, countries devote less instructional time to science than at the eighth grade, in terms of both the total instructional

hours and the percentage devoted to instruction. Total instructional time for science ranged from 33 hours in the Russian Federation to 176 in the Philippines. The figure for the Philippines was almost twice that for the next highest, the Canadian province of Ontario (93 hours). The percentage of instructional time at the fourth grade that was devoted to science ranged from 3 percent in Netherlands to 16 percent in the Philippines.

Exhibit 7.4 provides teachers' reports about how instructional time in science is allocated across the five major content areas assessed by TIMSS 2003. At the eighth grade, on average, internationally, the greatest percentage of science instructional time was devoted to life science (27%). Next were physics (24%) and then chemistry (21%). Earth science was given 13 percent, environmental science 9 percent, and other topics 5 percent. At the fourth grade, with fewer content areas, the profile was different. Again, life science received the largest amount of instructional time – 41 percent, on average, internationally. Earth science was given 28 percent, physical science 24 percent, and other 8 percent.

Exhibit 7.3

Exhibit 7.3: Instructional Time in the Sciences

SCIENCE Grade 8

Countries	Students' Average Yearly Science Instructional Time in Hours		Science Instructional Time as a Percent of Total Instructional Time[1]	
General/ Integrated Science				
[d] Philippines		202 (4.2)		18 (0.5)
United States	s	135 (2.2)		13 (0.2)
Jordan		135 (0.8)		15 (0.2)
New Zealand		132 (2.4)		14 (0.3)
Australia	s	132 (3.6)		13 (0.4)
Sweden	r	131 (7.6)	r	14 (0.8)
Malaysia		119 (1.8)		12 (0.2)
Bahrain		119 (1.1)		14 (0.1)
Chile	r	118 (2.2)	r	11 (0.3)
Singapore		107 (1.9)		12 (0.2)
Saudi Arabia	s	106 (1.6)		11 (0.2)
Iran, Islamic Rep. of	s	106 (3.7)		11 (0.4)
Hong Kong, SAR	s	103 (4.0)		11 (0.4)
Korea, Rep. of	s	103 (2.7)		9 (0.2)
Palestinian Nat'l Auth.	s	101 (1.8)		11 (0.2)
Japan	r	99 (1.5)	r	9 (0.1)
Norway		92 (2.5)		11 (0.3)
Italy	s	69 (1.1)		7 (0.1)
Botswana		x x		x x
Egypt		x x		x x
Ghana		x x		x x
Israel		x x		x x
Lebanon		x x		x x
Moldova, Rep. of		x x		x x
Scotland		x x		x x
South Africa		x x		x x
Tunisia		x x		x x
[‡] England		x x		x x
International Avg.		117 (0.7)		12 (0.1)
Benchmarking Participants				
Basque Country, Spain	r	94 (2.8)	r	9 (0.3)
Indiana State, US		147 (6.1)		13 (0.5)
Ontario Province, Can.	r	107 (5.8)	r	11 (0.6)
Quebec Province, Can.	r	113 (6.8)	r	12 (0.8)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Science instructional time provided by teachers, and total instructional time provided by schools.

1 Computed as the ratio of Science instructional time to the total instructional time averaged across students (1 hour = 60 minutes).

d Philippines: Data reported are for grade 8 biology teachers.

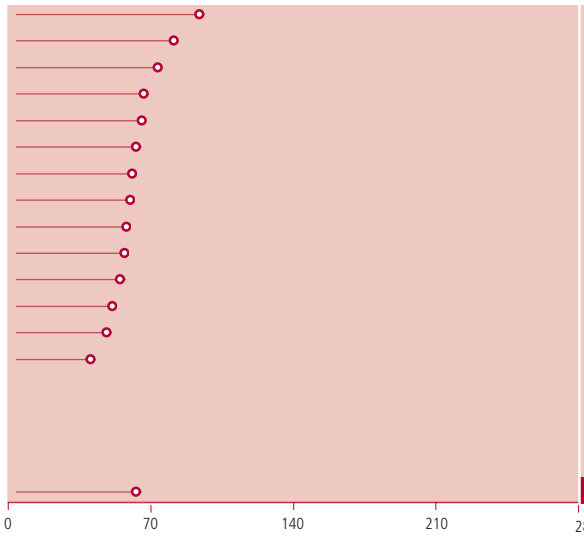
‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

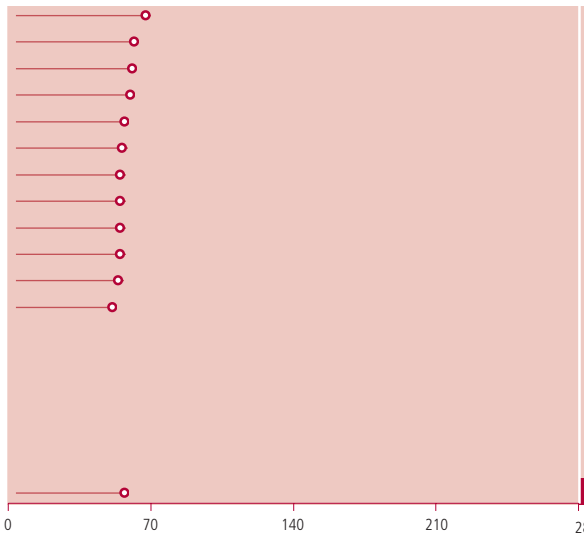
An "r" indicates data are available for at least 70 but less than 85% of the students. An "s" indicates data are available for at least 50 but less than 70% of the students. An "x" indicates data are available for less than 50% of the students.

Exhibit 7.3: Instructional Time in the Sciences *(Continued...)*

Countries	Students' Average Yearly Science Instructional Time in Hours	Science Instructional Time as a Percent of Total Instructional Time[1]
Biology		
Indonesia	s 93 (3.6)	7 (0.3)
Estonia	80 (4.8)	8 (0.5)
Slovak Republic	r 72 (5.2)	r 8 (0.5)
Bulgaria	s 65 (3.2)	8 (0.4)
Latvia	s 64 (4.2)	7 (0.4)
Hungary	s 61 (2.8)	6 (0.2)
Macedonia, Rep. of	r 59 (2.0)	r 7 (0.3)
Netherlands	s 58 (1.8)	5 (0.2)
Slovenia	56 (0.7)	5 (0.1)
Belgium (Flemish)	s 55 (3.3)	6 (0.3)
Serbia	s 53 (1.0)	7 (0.1)
Russian Federation	r 49 (0.8)	r 6 (0.1)
Lithuania	r 46 (3.5)	r 4 (0.4)
Romania	r 38 (2.6)	r 4 (0.3)
Armenia	x x	x x
[b] Morocco	x x	x x
Chinese Taipei	– –	– –
Cyprus	– –	– –
International Avg.	61 (0.8)	6 (0.1)



Earth Science		
Slovak Republic	r 66 (3.9)	r 7 (0.4)
Romania	r 60 (1.1)	r 6 (0.2)
Lithuania	r 59 (0.4)	r 6 (0.1)
Hungary	s 58 (2.5)	6 (0.2)
Estonia	55 (2.9)	5 (0.3)
Netherlands	s 54 (1.7)	5 (0.1)
Macedonia, Rep. of	r 53 (1.4)	r 6 (0.2)
Bulgaria	r 53 (2.2)	r 6 (0.2)
Cyprus	s 53 (0.7)	6 (0.1)
Serbia	s 53 (2.2)	7 (0.3)
Belgium (Flemish)	s 52 (3.2)	5 (0.3)
Russian Federation	r 49 (0.7)	r 6 (0.1)
Armenia	x x	x x
Chinese Taipei	– –	– –
Indonesia	– –	– –
Latvia	– –	– –
[b] Morocco	– –	– –
Slovenia	– –	– –
International Avg.	55 (0.6)	6 (0.1)



SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Science instructional time provided by teachers, and total instructional time provided by schools.

Does not include students whose teachers report that they do not teach content area.

1 Computed as the ratio of Science instructional time to the total instructional time averaged across students (1 hour = 60 minutes).

b Morocco: Data reported in biology panel are for grade 8 biology/earth science teachers.

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

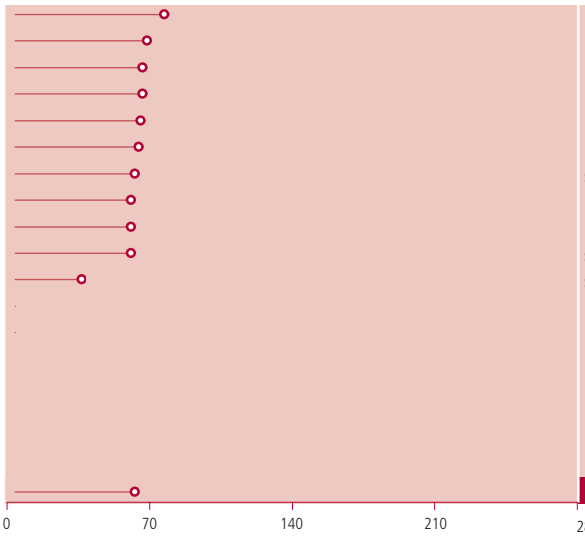
A dash (–) indicates comparable data are not available.

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 the students.

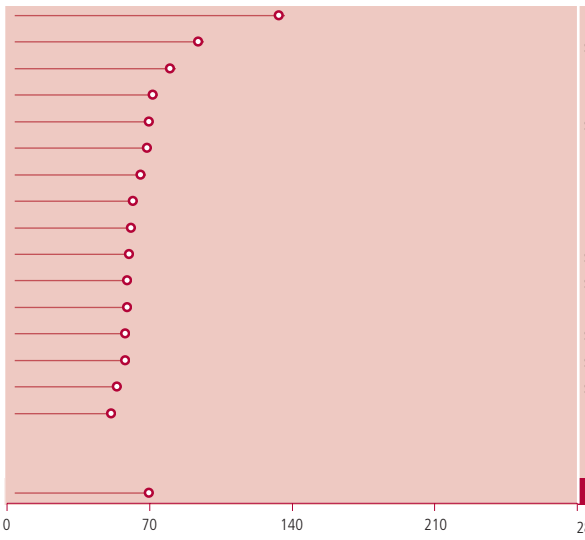
Exhibit 7.3: Instructional Time in the Sciences *(…Continued)*

SCIENCE Grade 8

Countries	Students' Average Yearly Science Instructional Time in Hours	Science Instructional Time as a Percent of Total Instructional Time[1]
Chemistry		
Slovak Republic	r 76 (3.8)	r 8 (0.4)
Romania	r 67 (2.4)	r 7 (0.2)
Estonia	65 (3.9)	6 (0.4)
Lithuania	r 65 (1.2)	r 6 (0.2)
Macedonia, Rep. of	r 64 (2.5)	r 7 (0.3)
Bulgaria	r 63 (2.9)	r 8 (0.4)
Serbia	s 61 (3.7)	8 (0.5)
Slovenia	59 (1.1)	6 (0.1)
Russian Federation	r 59 (1.2)	r 7 (0.2)
Hungary	s 59 (2.1)	5 (0.2)
Cyprus	s 34 (1.6)	4 (0.2)
Armenia	x x	x x
Latvia	x x	x x
Belgium (Flemish)	– –	– –
[a] Chinese Taipei	– –	– –
Indonesia	– –	– –
[b] Morocco	– –	– –
[c] Netherlands	– –	– –
International Avg.	61 (0.8)	7 (0.1)



Physics		
[a] Chinese Taipei	134 (2.0)	12 (0.2)
Indonesia	s 93 (3.3)	7 (0.3)
Macedonia, Rep. of	r 79 (1.5)	r 9 (0.2)
Slovak Republic	r 70 (4.5)	r 7 (0.4)
[c] Netherlands	s 68 (2.4)	6 (0.2)
Romania	r 67 (2.4)	r 7 (0.3)
Bulgaria	r 64 (3.3)	r 8 (0.4)
Lithuania	r 60 (0.8)	r 6 (0.1)
Estonia	59 (1.8)	6 (0.2)
Belgium (Flemish)	s 58 (2.7)	6 (0.3)
Hungary	s 57 (2.5)	5 (0.2)
Slovenia	r 57 (0.5)	r 5 (0.1)
Serbia	s 56 (2.5)	7 (0.3)
Latvia	s 56 (4.1)	6 (0.4)
Cyprus	s 52 (0.8)	6 (0.1)
Russian Federation	r 49 (0.9)	r 6 (0.1)
Armenia	x x	x x
[b] Morocco	x x	x x
International Avg.	68 (0.6)	7 (0.1)



SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Science instructional time provided by teachers, and total instructional time provided by schools.

Does not include students whose teachers report that they do not teach content area.

1 Computed as the ratio of Science instructional time to the total instructional time averaged across students (1 hour = 60 minutes).

a Chinese Taipei: Data reported in physics panel are for grade 8 physics/chemistry teachers.

b Morocco: Data reported in physics panel are for grade 8 physics/chemistry teachers.

c Netherlands: Data reported in physics panel are for grade 8 physics/chemistry teachers.

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

Exhibit 7.3: Instructional Time in the Sciences

Countries	Students' Average Yearly Science Instructional Time in Hours	Science Instructional Time as a Percent of Total Instructional Time[1]
Philippines	r 176 (3.2)	r 16 (0.4)
Chinese Taipei	84 (1.0)	11 (0.2)
United States	r 83 (3.0)	r 8 (0.3)
Japan	81 (1.2)	8 (0.2)
Hong Kong, SAR	s 77 (5.4)	8 (0.5)
Slovenia	r 75 (2.2)	r 9 (0.3)
Italy	r 73 (2.3)	r 8 (0.3)
New Zealand	s 65 (3.5)	7 (0.4)
Singapore	64 (0.6)	7 (0.1)
Hungary	s 54 (1.0)	6 (0.1)
Lithuania	53 (1.6)	6 (0.2)
Cyprus	s 46 (1.4)	5 (0.2)
Australia	s 45 (2.6)	5 (0.3)
Norway	r 38 (1.8)	r 4 (0.2)
Netherlands	s 33 (1.8)	3 (0.2)
Russian Federation	s 33 (1.2)	5 (0.2)
Armenia	x x	x x
Belgium (Flemish)	x x	x x
England	x x	x x
Iran, Islamic Rep. of	x x	x x
Latvia	x x	x x
Moldova, Rep. of	x x	x x
Morocco	x x	x x
Scotland	x x	x x
Tunisia	x x	x x
International Avg.	67 (0.6)	7 (0.1)
Benchmarking Participants		
Indiana State, US	r 79 (4.1)	r 8 (0.4)
Ontario Province, Can.	r 93 (3.3)	r 10 (0.3)
Quebec Province, Can.	r 47 (2.5)	r 5 (0.3)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Science instructional time provided by teachers, and total instructional time provided by schools.

1 Computed as the ratio of Science instructional time to the total instructional time averaged across students (1 hour = 60 minutes).

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

Exhibit 7.4: Percentage of Time in Science Class Devoted to TIMSS Content Areas During the School Year

Countries	Life Science	Chemistry	Physics	Earth Science	Environmental Science	Other
Armenia	x x	x x	x x	x x	x x	x x
Australia	r 26 (0.9)	r 23 (0.7)	r 21 (0.7)	r 16 (0.8)	r 11 (0.6)	r 3 (0.6)
Bahrain	30 (0.8)	26 (0.9)	36 (0.8)	3 (0.5)	3 (0.4)	2 (0.6)
Belgium (Flemish)	r 42 (1.4)	r 3 (0.4)	r 16 (1.1)	r 26 (1.2)	r 7 (0.7)	s 8 (1.1)
Botswana	r 38 (1.8)	r 20 (0.8)	r 22 (1.3)	r 5 (0.7)	r 8 (0.7)	r 7 (1.3)
Bulgaria	s 24 (1.1)	s 23 (0.9)	s 20 (1.0)	s 18 (0.9)	s 9 (0.7)	s 6 (1.0)
Chile	26 (1.1)	22 (0.9)	16 (0.6)	17 (0.7)	17 (0.7)	2 (0.4)
Chinese Taipei	3 (0.8)	48 (0.9)	43 (0.9)	2 (0.3)	3 (0.4)	0 (0.3)
Cyprus	r 3 (0.2)	r 39 (0.7)	r 29 (0.9)	r 19 (0.8)	r 6 (0.5)	s 5 (0.5)
Egypt	23 (0.6)	25 (0.5)	26 (0.9)	11 (0.4)	10 (0.5)	5 (0.4)
Estonia	r 23 (1.0)	r 24 (1.0)	r 24 (1.3)	r 15 (0.8)	r 9 (0.6)	r 7 (1.0)
Ghana	28 (0.8)	20 (0.7)	20 (0.6)	13 (0.5)	15 (0.6)	5 (0.7)
Hong Kong, SAR	29 (1.2)	26 (0.7)	31 (1.0)	5 (0.7)	7 (0.8)	1 (0.5)
Hungary	x x	x x	x x	x x	x x	x x
Indonesia	40 (1.4)	4 (0.5)	40 (1.4)	7 (0.6)	7 (0.6)	2 (0.4)
Iran, Islamic Rep. of	25 (0.5)	17 (0.4)	24 (0.8)	16 (0.4)	12 (0.6)	6 (0.6)
Israel	34 (1.7)	28 (1.3)	19 (1.1)	8 (1.0)	8 (0.7)	r 4 (0.8)
Italy	30 (1.2)	10 (0.6)	22 (1.1)	22 (0.9)	13 (0.5)	3 (0.6)
Japan	22 (0.7)	28 (1.2)	26 (0.9)	19 (1.0)	3 (0.6)	2 (0.8)
Jordan	25 (0.5)	24 (0.5)	25 (0.6)	15 (0.5)	9 (0.5)	2 (0.3)
Korea, Rep. of	r 28 (1.6)	r 21 (0.6)	r 23 (0.7)	r 22 (0.6)	r 6 (0.5)	r 1 (0.2)
Latvia	x x	x x	x x	x x	x x	x x
Lebanon	s 23 (1.4)	s 25 (1.1)	s 27 (1.3)	s 16 (0.9)	s 6 (0.6)	s 3 (0.6)
Lithuania	s 24 (1.0)	s 21 (0.9)	s 20 (1.1)	s 16 (0.9)	s 13 (0.6)	s 6 (1.0)
Macedonia, Rep. of	r 21 (1.1)	r 17 (1.0)	r 18 (1.1)	r 15 (1.0)	r 4 (0.6)	r 25 (2.4)
Malaysia	27 (1.0)	22 (0.5)	22 (0.6)	11 (0.6)	16 (0.5)	3 (0.6)
Moldova, Rep. of	x x	x x	x x	x x	x x	x x
Morocco	r 29 (2.1)	r 22 (1.5)	r 25 (1.7)	r 18 (1.7)	r 5 (0.7)	r 2 (0.6)
Netherlands	r 28 (1.1)	r 8 (0.6)	r 28 (1.3)	r 9 (0.5)	r 12 (0.6)	r 16 (0.9)
New Zealand	28 (1.5)	24 (0.7)	24 (0.8)	13 (0.8)	7 (0.6)	3 (0.7)
Norway	25 (0.7)	21 (0.5)	20 (0.6)	18 (0.7)	13 (0.5)	3 (0.6)
Palestinian Nat'l Auth.	25 (0.7)	24 (0.4)	30 (0.7)	13 (0.5)	5 (0.6)	3 (0.5)
Philippines	57 (2.4)	9 (0.9)	6 (0.9)	9 (0.9)	16 (0.9)	3 (0.8)
Romania	s 21 (0.9)	s 22 (1.0)	s 20 (1.0)	s 19 (1.1)	s 10 (0.7)	s 9 (1.3)
Russian Federation	– –	– –	– –	– –	– –	– –
Saudi Arabia	28 (1.2)	13 (1.4)	19 (1.1)	21 (0.8)	16 (1.1)	r 3 (0.6)
Scotland	– –	– –	– –	– –	– –	– –
Serbia	x x	x x	x x	x x	x x	x x
Singapore	33 (0.7)	24 (0.6)	33 (0.6)	3 (0.2)	6 (0.3)	2 (0.4)
Slovak Republic	r 8 (0.8)	r 22 (1.3)	r 24 (1.2)	r 14 (1.2)	r 13 (0.9)	r 20 (1.6)
Slovenia	r 29 (1.1)	r 28 (0.9)	r 29 (1.1)	r 3 (0.3)	r 8 (0.4)	r 5 (0.8)
South Africa	r 26 (1.1)	r 21 (0.8)	r 21 (0.9)	r 13 (0.6)	r 15 (0.6)	r 5 (0.7)
Sweden	32 (1.1)	r 27 (0.9)	r 28 (0.9)	r 2 (0.4)	r 5 (0.5)	r 7 (1.0)
Tunisia	60 (1.8)	5 (0.6)	3 (0.3)	16 (1.0)	8 (0.8)	r 10 (1.5)
United States	r 16 (1.4)	r 23 (1.3)	r 26 (1.5)	r 26 (1.9)	r 9 (0.5)	s 3 (0.5)
‡ England	– –	– –	– –	– –	– –	– –
International Avg.	27 (0.2)	21 (0.1)	24 (0.2)	13 (0.1)	9 (0.1)	5 (0.1)
Benchmarking Participants						
Basque Country, Spain	35 (1.6)	19 (1.0)	25 (1.3)	10 (0.8)	10 (0.9)	1 (0.5)
Indiana State, US	18 (1.5)	29 (1.7)	24 (1.7)	18 (2.4)	9 (0.7)	r 2 (0.5)
Ontario Province, Can.	24 (0.6)	18 (0.8)	25 (1.0)	16 (0.7)	14 (0.8)	r 4 (0.8)
Quebec Province, Can.	r 5 (0.8)	r 20 (1.1)	r 33 (1.8)	r 18 (1.1)	r 13 (1.5)	s 14 (2.2)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

Exhibit 7.4: Percentage of Time in Science Class Devoted to TIMSS Content Areas During the School Year

Countries	Life Science	Physical Science	Earth Science	Other
Armenia	x x	x x	x x	x x
Australia	r 42 (1.6)	r 21 (1.1)	r 31 (1.2)	r 7 (1.4)
Belgium (Flemish)	38 (1.1)	12 (0.9)	34 (1.0)	17 (1.6)
Chinese Taipei	30 (0.9)	34 (1.1)	33 (0.9)	3 (0.7)
Cyprus	35 (1.1)	49 (1.8)	15 (1.0)	2 (0.5)
England	– –	– –	– –	– –
Hong Kong, SAR	r 38 (1.5)	r 26 (1.4)	r 23 (1.2)	r 13 (1.9)
Hungary	42 (1.1)	9 (0.7)	38 (1.4)	r 11 (1.5)
Iran, Islamic Rep. of	35 (1.2)	21 (0.9)	27 (0.8)	17 (1.1)
Italy	56 (1.3)	18 (0.8)	22 (0.9)	5 (0.7)
Japan	36 (0.9)	41 (1.0)	21 (0.9)	2 (0.7)
Latvia	x x	x x	x x	x x
Lithuania	40 (1.4)	15 (0.7)	36 (1.2)	10 (1.0)
Moldova, Rep. of	r 42 (1.4)	r 15 (0.9)	r 30 (1.3)	r 13 (1.2)
Morocco	x x	x x	x x	x x
Netherlands	56 (1.8)	15 (1.0)	24 (1.4)	4 (0.9)
New Zealand	r 35 (1.0)	r 27 (0.8)	r 29 (0.8)	r 9 (1.0)
Norway	39 (1.4)	15 (0.6)	39 (1.2)	7 (1.5)
Philippines	r 40 (1.1)	r 24 (0.9)	r 30 (0.9)	r 6 (0.8)
Russian Federation	r 39 (1.5)	r 13 (0.9)	r 35 (1.3)	r 13 (1.2)
Scotland	– –	– –	– –	– –
Singapore	42 (1.4)	38 (1.6)	18 (1.0)	2 (0.6)
Slovenia	45 (1.5)	21 (0.9)	22 (0.9)	12 (1.5)
Tunisia	r 45 (0.9)	r 39 (1.0)	r 11 (1.0)	r 5 (0.8)
United States	r 36 (0.8)	r 24 (0.8)	r 34 (1.0)	r 6 (0.8)
International Avg.	41 (0.3)	24 (0.2)	28 (0.2)	8 (0.3)
Benchmarking Participants				
Indiana State, US	42 (1.9)	24 (1.4)	29 (1.5)	5 (2.1)
Ontario Province, Can.	31 (1.1)	32 (1.5)	29 (0.9)	7 (0.9)
Quebec Province, Can.	40 (1.6)	20 (1.7)	33 (1.8)	r 8 (1.9)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals 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 "x" indicates data are available for less than 50% of the students.

How Is Scientific Inquiry Emphasized in Science Lessons?

In many countries, the science curriculum places considerable emphasis on engaging the students in scientific inquiry. To examine the emphasis placed on that goal in the classroom, TIMSS asked eighth-grade students and teachers about how often students were asked to do a range of activities related to science investigations. At the eighth grade, these activities were: 1) watching the teacher demonstrate an experiment or investigation, 2) designing or planning experiments or investigations, 3) conducting experiments or investigations, 4) working in small groups on experiments or investigations, 5) writing explanations about what was observed and why it happened, and 6) relating what is being learned in science to our daily lives. Exhibits 7.5 and 7.6 present students' and teachers' reports, respectively. Results at the eighth grade are presented first for countries teaching science as a single subject and then by science subject for countries teaching the sciences separately.

In most of the integrated-science countries, students reported a moderate emphasis on doing these types of activities in science class. About two-thirds, on average, internationally, said that, in at least half their lessons, they were asked to write explanations about what was observed and why it happened (66%) or watch the teacher demonstrate an experiment or investigation (64%). More than half reported working in small groups on experiments or investigations (59%), conducting experiments or investigations (57%), or relating what is being learned in science to their daily lives (57%). Students reported the least attention to designing or planning an experiment or investigation (49%). Among countries teaching the sciences as separate subjects, students reported watching the teacher demonstrate an experiment or investigation most frequently in chemistry and physics class (63% and 58%, on average, respectively), and much less so in biology (39%) and earth science (28%). Relating what is being learned in science to their daily lives was reported by students in biology and earth science classes as the most frequent activity (51%, on average).

At fourth grade, most students reported that they watch the teacher do a science experiment and write or give an explanation for something they are studying in science once or twice a month or more (69%, on average, for each activity). More than half the students (57%) reported working with other students in small groups on a science experiment or investigation, and 50 percent reported either designing or planning a science experiment or investigation or actually doing such an activity.

On average, internationally, teachers at both grade levels reported less emphasis on students watching them demonstrate an experiment or investigation than did the students. For example, at eighth grade in integrated science countries, teachers of only 38 percent of the students reported asking their students to watch them demonstrate an experiment or investigation in at least half the lessons, whereas 64 percent of student reported this activity at this frequency. Similarly at fourth grade, teachers of only 23 percent of students reported asking them to do this activity, while 69 percent of students reported doing so.

Exhibit 7.5: Students' Reports on Doing Science Investigations

SCIENCE Grade 8

Countries	Percentage of Students Who Reported Doing the Activity About Half of the Lessons or More					
	Watch the Teacher Demonstrate an Experiment or Investigation	Design or Plan an Experiment or Investigation	Conduct an Experiment or Investigation	Work in Small Groups on an Experiment or Investigation	Write Explanations About What was Observed and Why it Happened	Relate What is Being Learned in Science to Our Daily Lives
General/ Integrated Science						
Australia	54 (1.6)	49 (1.7)	60 (2.2)	68 (2.1)	75 (1.5)	42 (1.1)
Bahrain	83 (0.8)	63 (0.8)	64 (0.8)	66 (1.1)	68 (0.9)	64 (0.9)
Botswana	61 (0.9)	45 (0.8)	48 (1.0)	50 (1.1)	61 (0.9)	71 (0.8)
Chile	57 (1.3)	56 (1.4)	54 (1.5)	61 (1.4)	69 (1.0)	62 (0.7)
[a] Chinese Taipei	48 (1.1)	24 (0.9)	36 (1.3)	37 (1.5)	37 (1.1)	40 (1.0)
Egypt	80 (0.7)	61 (1.0)	62 (1.0)	60 (0.8)	71 (0.7)	73 (0.7)
Ghana	73 (1.2)	54 (1.3)	55 (1.3)	54 (1.5)	64 (1.5)	75 (1.0)
Hong Kong, SAR	66 (1.2)	35 (1.0)	71 (1.5)	75 (1.2)	67 (1.2)	61 (0.8)
Iran, Islamic Rep. of	87 (1.0)	66 (1.4)	77 (1.2)	73 (1.5)	78 (1.0)	70 (1.0)
Israel	73 (1.6)	56 (1.4)	63 (1.6)	52 (1.8)	76 (1.3)	56 (1.0)
Italy	26 (1.3)	16 (0.9)	13 (0.8)	12 (0.8)	32 (1.4)	35 (1.1)
Japan	66 (1.5)	51 (1.7)	75 (1.7)	79 (1.6)	69 (1.5)	27 (1.1)
Jordan	67 (1.5)	56 (1.4)	55 (1.7)	53 (1.6)	66 (1.3)	70 (1.1)
Korea, Rep. of	31 (1.0)	14 (0.8)	20 (1.1)	39 (1.3)	44 (1.3)	36 (0.9)
Malaysia	83 (1.1)	46 (1.3)	71 (1.7)	77 (1.3)	73 (1.0)	72 (1.0)
Morocco	82 (1.2)	62 (1.3)	r 61 (1.2)	50 (1.3)	74 (1.0)	r 65 (1.2)
New Zealand	60 (2.0)	50 (2.1)	56 (2.5)	66 (2.3)	73 (1.8)	45 (1.3)
Norway	40 (1.5)	34 (1.6)	49 (2.2)	49 (2.2)	56 (1.9)	31 (0.9)
Palestinian Nat'l Auth.	70 (1.2)	56 (1.2)	57 (1.0)	54 (1.5)	66 (1.2)	69 (0.9)
[d] Philippines	74 (0.9)	58 (1.2)	57 (1.0)	62 (1.1)	72 (1.0)	76 (0.8)
Saudi Arabia	68 (1.3)	50 (1.3)	51 (1.4)	43 (1.4)	60 (1.3)	67 (1.0)
Scotland	69 (1.4)	54 (1.3)	74 (1.4)	81 (1.2)	83 (1.1)	47 (1.0)
Singapore	49 (0.9)	31 (0.6)	55 (1.0)	57 (0.8)	68 (0.8)	58 (0.7)
South Africa	72 (1.1)	64 (1.2)	63 (1.1)	70 (1.1)	73 (0.7)	77 (0.7)
Tunisia	79 (0.7)	65 (1.0)	69 (1.0)	55 (1.2)	73 (0.8)	54 (0.9)
United States	57 (1.3)	48 (1.2)	55 (1.4)	65 (1.5)	65 (1.4)	51 (0.9)
[‡] England	60 (1.9)	54 (1.6)	63 (1.7)	71 (1.8)	71 (1.6)	35 (1.6)
International Avg.	64 (0.2)	49 (0.2)	57 (0.3)	59 (0.3)	66 (0.2)	57 (0.2)
Benchmarking Participants						
Basque Country, Spain	50 (2.2)	34 (1.8)	35 (2.2)	41 (2.3)	55 (1.9)	51 (1.3)
Indiana State, US	59 (1.7)	49 (2.1)	56 (2.9)	66 (2.7)	62 (2.6)	51 (1.6)
Ontario Province, Can.	53 (1.6)	45 (1.6)	49 (1.8)	56 (2.0)	67 (1.5)	52 (1.4)
Quebec Province, Can.	60 (1.5)	54 (1.6)	60 (2.0)	65 (1.9)	62 (1.5)	45 (1.3)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

a Chinese Taipei: Students were asked about natural science; data pertain to grade 8 physics/chemistry course.

d Philippines: Students study only biology at grade 8.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

An "r" indicates data are available for at least 70 but less than 85% of the students.

Exhibit 7.5: Students' Reports on Doing Science Investigations *(Continued...)*

Countries	Percentage of Students Who Reported Doing the Activity About Half of the Lessons or More					
	Watch the Teacher Demonstrate an Experiment or Investigation	Design or Plan an Experiment or Investigation	Conduct an Experiment or Investigation	Work in Small Groups on an Experiment or Investigation	Write Explanations About What was Observed and Why it Happened	Relate What is Being Learned in Science to Our Daily Lives
Biology						
Armenia	51 (1.3)	30 (1.4)	30 (1.3)	23 (1.1)	40 (1.3)	65 (1.1)
Belgium (Flemish)	59 (1.6)	19 (0.9)	15 (1.0)	9 (0.9)	58 (1.4)	47 (1.1)
Bulgaria	39 (1.6)	20 (1.2)	18 (1.0)	18 (1.0)	26 (1.2)	50 (1.4)
Cyprus	x x	x x	x x	x x	x x	x x
Estonia	17 (1.1)	7 (0.6)	8 (0.6)	12 (0.9)	20 (1.2)	48 (1.1)
Hungary	37 (1.4)	18 (1.0)	12 (0.8)	6 (0.7)	34 (1.5)	61 (1.3)
Indonesia	56 (1.1)	23 (1.0)	23 (1.0)	36 (1.1)	41 (1.2)	41 (1.0)
Latvia	19 (1.1)	13 (0.9)	11 (0.9)	20 (1.4)	33 (1.5)	42 (1.3)
[b] Lebanon	67 (1.2)	52 (1.4)	53 (1.4)	45 (1.8)	69 (1.1)	69 (0.9)
Lithuania	14 (0.8)	10 (0.7)	8 (0.6)	14 (1.0)	26 (1.5)	38 (1.3)
Macedonia, Rep. of	47 (1.4)	30 (1.4)	26 (1.2)	29 (1.5)	45 (1.5)	74 (1.1)
Moldova, Rep. of	52 (1.5)	30 (1.3)	27 (1.1)	30 (1.6)	44 (1.5)	60 (1.2)
Netherlands	25 (1.4)	10 (1.0)	13 (1.3)	16 (1.3)	18 (1.3)	34 (1.4)
Romania	60 (1.5)	27 (1.3)	25 (1.2)	24 (1.4)	45 (1.3)	54 (1.4)
Russian Federation	20 (1.5)	17 (1.4)	12 (0.9)	14 (1.0)	42 (1.3)	55 (1.3)
Serbia	22 (1.1)	16 (0.8)	13 (0.9)	16 (1.1)	36 (1.1)	64 (1.2)
Slovak Republic	55 (1.7)	19 (1.2)	15 (1.0)	31 (1.6)	45 (1.7)	41 (1.3)
Slovenia	30 (1.2)	19 (1.0)	17 (1.0)	15 (1.0)	34 (1.4)	52 (1.2)
Sweden	40 (1.1)	29 (1.2)	38 (1.6)	43 (1.4)	49 (1.2)	29 (0.9)
International Avg.	39 (0.3)	22 (0.3)	20 (0.3)	22 (0.3)	39 (0.3)	51 (0.3)
Earth Science						
Armenia	44 (1.5)	28 (1.3)	28 (1.4)	22 (1.2)	38 (1.5)	57 (1.3)
Belgium (Flemish)	17 (0.8)	7 (0.5)	4 (0.4)	6 (0.8)	33 (1.0)	55 (1.3)
Bulgaria	29 (1.5)	21 (1.3)	17 (1.0)	18 (1.0)	29 (1.1)	41 (1.5)
Cyprus	45 (1.0)	36 (0.8)	31 (0.9)	25 (0.8)	69 (0.9)	57 (1.0)
Estonia	9 (0.8)	5 (0.5)	6 (0.5)	8 (0.7)	14 (0.8)	48 (1.1)
Hungary	29 (1.2)	13 (0.8)	10 (0.7)	7 (0.7)	30 (1.3)	56 (1.2)
Indonesia	– –	– –	– –	– –	– –	– –
Latvia	– –	– –	– –	– –	– –	– –
[b] Lebanon	– –	– –	– –	– –	– –	– –
Lithuania	9 (0.6)	8 (0.5)	5 (0.4)	9 (0.6)	15 (0.8)	42 (1.1)
Macedonia, Rep. of	38 (1.5)	27 (1.4)	22 (1.1)	26 (1.3)	42 (1.5)	68 (1.1)
Moldova, Rep. of	50 (1.5)	34 (1.2)	31 (0.9)	33 (1.2)	47 (1.3)	59 (1.1)
Netherlands	10 (0.8)	6 (0.7)	5 (0.6)	7 (0.7)	12 (1.3)	37 (1.4)
Romania	64 (1.4)	32 (1.2)	28 (1.3)	25 (1.2)	49 (1.2)	54 (1.1)
Russian Federation	15 (0.9)	14 (0.7)	11 (0.7)	15 (0.8)	38 (1.2)	56 (1.2)
Serbia	14 (0.8)	10 (0.6)	10 (0.6)	13 (0.9)	32 (1.2)	55 (1.1)
Slovak Republic	33 (1.1)	14 (0.8)	11 (0.8)	15 (1.0)	26 (1.1)	46 (1.4)
Slovenia	– –	– –	– –	– –	– –	– –
Sweden	19 (1.0)	14 (0.9)	15 (0.8)	29 (1.0)	30 (1.3)	37 (1.2)
International Avg.	28 (0.3)	18 (0.2)	16 (0.2)	17 (0.2)	34 (0.3)	51 (0.3)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

Does not include students who report that they do not study the content area.

b Lebanon: Data in biology panel pertain to grade 8 life and earth sciences course.

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

A dash (–) indicates comparable data are not available.

An "x" indicates data are available for less than 50% of the students.

Exhibit 7.5: Students' Reports on Doing Science Investigations *(…Continued)*

SCIENCE Grade 8

Countries	Percentage of Students Who Reported Doing the Activity About Half of the Lessons or More					
	Watch the Teacher Demonstrate an Experiment or Investigation	Design or Plan an Experiment or Investigation	Conduct an Experiment or Investigation	Work in Small Groups on an Experiment or Investigation	Write Explanations About What was Observed and Why it Happened	Relate What is Being Learned in Science to Our Daily Lives
Chemistry						
Armenia	58 (1.7)	39 (1.4)	41 (1.6)	26 (1.4)	45 (1.4)	53 (1.3)
Belgium (Flemish)	– –	– –	– –	– –	– –	– –
Bulgaria	59 (2.0)	38 (1.6)	42 (1.9)	25 (1.2)	37 (1.5)	35 (1.4)
Cyprus	82 (0.8)	71 (0.8)	73 (0.9)	56 (1.0)	78 (0.8)	51 (0.9)
Estonia	58 (2.0)	24 (1.3)	28 (1.7)	23 (1.6)	41 (1.7)	44 (1.4)
Hungary	77 (1.8)	66 (1.7)	67 (2.0)	14 (1.0)	68 (1.7)	58 (1.2)
Indonesia	– –	– –	– –	– –	– –	– –
Latvia	43 (1.9)	32 (1.5)	27 (1.5)	22 (1.2)	43 (1.5)	40 (1.2)
Lebanon	75 (1.2)	60 (1.4)	59 (1.5)	46 (1.6)	70 (1.2)	64 (1.3)
Lithuania	39 (1.9)	27 (1.2)	26 (1.4)	16 (1.0)	33 (1.4)	34 (1.2)
Macedonia, Rep. of	64 (1.8)	46 (1.7)	46 (1.8)	36 (1.8)	52 (1.5)	60 (1.4)
Moldova, Rep. of	70 (1.3)	47 (1.2)	49 (1.5)	34 (1.3)	48 (1.5)	53 (1.2)
[c] Netherlands	– –	– –	– –	– –	– –	– –
Romania	73 (1.3)	49 (1.5)	48 (1.6)	38 (1.6)	56 (1.5)	48 (1.3)
Russian Federation	62 (1.2)	46 (1.3)	33 (1.5)	26 (1.4)	54 (1.3)	47 (1.6)
Serbia	48 (2.2)	34 (1.7)	35 (1.9)	25 (1.5)	46 (1.5)	50 (1.2)
Slovak Republic	76 (1.4)	44 (1.7)	38 (1.7)	36 (1.6)	60 (1.6)	43 (1.3)
Slovenia	70 (1.5)	50 (1.4)	56 (1.5)	31 (1.4)	52 (1.3)	42 (1.2)
Sweden	59 (1.4)	47 (1.5)	60 (1.7)	56 (1.7)	57 (1.6)	28 (1.2)
International Avg.	63 (0.4)	45 (0.4)	45 (0.4)	32 (0.4)	52 (0.4)	47 (0.3)
Physics						
Armenia	62 (1.6)	40 (1.5)	44 (1.4)	r 28 (1.3)	47 (1.5)	62 (1.1)
Belgium (Flemish)	x x	x x	x x	x x	x x	x x
Bulgaria	53 (1.7)	34 (1.3)	36 (1.4)	25 (1.2)	34 (1.1)	45 (1.5)
Cyprus	79 (0.7)	70 (0.8)	71 (0.9)	54 (1.2)	78 (0.7)	61 (0.8)
Estonia	45 (1.7)	23 (1.2)	27 (1.4)	24 (1.4)	39 (1.4)	53 (1.1)
Hungary	69 (1.5)	46 (1.2)	56 (1.7)	15 (0.9)	58 (1.4)	58 (1.0)
Indonesia	63 (1.1)	24 (1.0)	24 (1.2)	29 (1.1)	46 (1.0)	40 (1.1)
Latvia	37 (1.7)	25 (1.1)	24 (1.3)	20 (1.0)	39 (1.3)	50 (1.2)
Lebanon	74 (1.3)	55 (1.4)	55 (1.7)	46 (1.8)	68 (1.3)	65 (1.1)
Lithuania	40 (2.1)	25 (1.3)	26 (1.4)	17 (0.8)	30 (1.3)	39 (1.2)
Macedonia, Rep. of	56 (1.8)	39 (1.5)	39 (1.5)	38 (1.7)	49 (1.5)	63 (1.3)
Moldova, Rep. of	68 (1.4)	47 (1.3)	47 (1.4)	35 (1.4)	48 (1.2)	55 (1.0)
[c] Netherlands	52 (2.0)	27 (1.5)	38 (2.1)	33 (2.0)	33 (1.8)	29 (1.3)
Romania	71 (1.5)	46 (1.6)	45 (1.7)	38 (1.6)	54 (1.5)	48 (1.3)
Russian Federation	57 (1.4)	37 (1.3)	31 (1.3)	27 (0.9)	49 (1.3)	51 (1.5)
Serbia	37 (1.5)	23 (1.0)	25 (1.2)	19 (1.0)	39 (1.1)	49 (1.2)
Slovak Republic	68 (1.6)	34 (1.5)	30 (1.3)	30 (1.4)	51 (1.6)	45 (1.2)
Slovenia	57 (1.7)	39 (1.4)	43 (1.8)	26 (1.4)	46 (1.5)	43 (1.3)
Sweden	51 (1.4)	41 (1.4)	52 (1.6)	50 (1.6)	48 (1.5)	32 (1.2)
International Avg.	58 (0.4)	38 (0.3)	40 (0.3)	31 (0.3)	47 (0.3)	49 (0.3)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

Does not include students who report that they do not study the content area.

c Netherlands: Data in physics panel pertain to grade 8 physics/chemistry course.

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

Exhibit 7.5: Students' Reports on Doing Science Investigations

Countries	Percentage of Students Who Reported Doing the Activity Once or Twice a Month or More				
	Watch the Teacher Do a Science Experiment	Design or Plan a Science Experiment or Investigation	Do a Science Experiment or Investigation	Work with Other Students in a Small Group on a Science Experiment or Investigation	Write or Give an Explanation For Something I am Studying in Science
Armenia	r 67 (1.4)	s 39 (1.2)	s 37 (1.5)	s 40 (1.1)	s 61 (1.4)
Australia	59 (1.9)	44 (1.9)	48 (1.8)	60 (2.1)	64 (1.9)
Belgium (Flemish)	57 (1.8)	35 (1.5)	29 (1.4)	40 (1.7)	52 (1.6)
Chinese Taipei	92 (0.5)	49 (1.1)	61 (1.1)	76 (1.1)	77 (0.9)
Cyprus	93 (0.6)	81 (0.9)	79 (1.0)	88 (0.9)	88 (0.7)
England	78 (1.7)	73 (1.5)	79 (1.3)	83 (1.3)	84 (0.9)
Hong Kong, SAR	44 (1.8)	22 (1.0)	23 (1.1)	28 (1.5)	37 (1.0)
Hungary	85 (1.0)	37 (1.2)	23 (1.0)	29 (1.3)	81 (0.7)
Iran, Islamic Rep. of	91 (0.9)	85 (1.4)	68 (2.2)	80 (1.5)	85 (1.0)
Italy	69 (1.7)	47 (1.5)	49 (1.3)	42 (1.6)	78 (0.9)
Japan	88 (1.1)	78 (1.0)	76 (0.8)	89 (0.7)	82 (0.8)
Latvia	51 (1.5)	36 (1.2)	30 (1.1)	32 (1.5)	60 (1.4)
Lithuania	48 (1.5)	31 (1.1)	31 (1.4)	31 (1.3)	78 (0.8)
Moldova, Rep. of	46 (2.3)	r 34 (2.1)	r 33 (1.9)	r 39 (2.4)	r 65 (2.5)
Morocco	84 (2.5)	r 68 (2.5)	r 58 (2.7)	r 70 (2.6)	r 71 (2.4)
Netherlands	60 (2.3)	53 (1.8)	39 (1.9)	50 (2.1)	50 (2.0)
New Zealand	55 (1.3)	46 (1.1)	47 (1.2)	62 (1.3)	65 (1.1)
Norway	71 (0.9)	46 (1.1)	49 (1.0)	54 (1.3)	61 (1.2)
Philippines	77 (1.4)	62 (1.6)	63 (1.4)	66 (1.8)	70 (1.6)
Russian Federation	– –	– –	– –	– –	– –
Scotland	60 (2.6)	47 (2.0)	50 (2.4)	61 (2.0)	65 (2.1)
Singapore	81 (1.4)	34 (1.1)	48 (1.3)	66 (1.6)	64 (1.3)
Slovenia	76 (1.7)	58 (2.0)	62 (1.7)	65 (1.8)	78 (1.4)
Tunisia	72 (1.8)	63 (2.0)	r 63 (1.9)	r 53 (1.8)	r 66 (1.6)
United States	63 (1.1)	42 (0.9)	53 (1.0)	65 (1.1)	73 (0.7)
International Avg.	69 (0.3)	50 (0.3)	50 (0.3)	57 (0.3)	69 (0.3)
Benchmarking Participants					
Indiana State, US	60 (2.4)	34 (1.5)	44 (1.9)	58 (2.3)	68 (2.0)
Ontario Province, Can.	71 (1.6)	55 (1.5)	61 (2.0)	72 (2.0)	82 (1.2)
Quebec Province, Can.	61 (1.8)	51 (1.6)	52 (1.7)	66 (1.7)	58 (1.6)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

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

Exhibit 7.6: Teachers' Reports on Students Doing Science Investigations

SCIENCE Grade 8

Countries	Percentage of Students Whose Teachers Reported Students Doing the Activity About Half of the Lessons or More					
	Watch Me Demonstrate an Experiment or Investigation	Design or Plan Experiments or Investigations	Conduct Experiments or Investigations	Work Together in Small Groups on Experiments or Investigations	Write Explanations About What was Observed and Why It Happened	Relate What Students are Learning in Science to Their Daily Lives
General/ Integrated Science						
Australia	r 17 (2.9)	r 19 (3.4)	r 73 (3.7)	r 71 (3.7)	r 68 (3.7)	r 63 (4.0)
Bahrain	55 (3.7)	35 (4.1)	58 (3.3)	64 (3.3)	72 (3.4)	86 (2.7)
Botswana	33 (4.6)	19 (3.4)	39 (4.3)	48 (4.7)	44 (4.5)	80 (4.1)
Chile	20 (3.4)	34 (4.0)	48 (3.9)	65 (3.0)	65 (4.2)	91 (2.1)
Egypt	66 (3.8)	41 (3.8)	48 (4.3)	57 (4.5)	67 (4.2)	94 (2.2)
Ghana	46 (4.9)	39 (4.6)	40 (4.1)	42 (4.3)	40 (4.7)	91 (2.8)
Hong Kong, SAR	20 (3.6)	13 (3.2)	77 (3.5)	75 (3.0)	70 (3.7)	62 (3.8)
Iran, Islamic Rep. of	78 (3.4)	37 (4.2)	62 (3.9)	67 (3.9)	53 (3.6)	76 (3.7)
Israel	39 (3.7)	36 (3.5)	45 (3.7)	44 (3.9)	63 (4.0)	76 (3.6)
Italy	7 (1.6)	10 (2.3)	6 (1.6)	7 (1.9)	23 (3.2)	64 (4.0)
Japan	39 (4.0)	35 (4.0)	77 (3.7)	81 (3.3)	69 (3.9)	54 (4.1)
Jordan	54 (4.3)	23 (4.0)	44 (4.3)	47 (4.1)	66 (4.1)	87 (2.8)
Korea, Rep. of	r 34 (3.7)	r 19 (3.0)	r 32 (3.4)	r 31 (3.7)	r 44 (4.0)	r 67 (4.1)
Lebanon	70 (4.5)	65 (4.8)	61 (4.4)	45 (4.6)	76 (3.1)	91 (2.7)
Malaysia	31 (4.2)	41 (4.2)	75 (3.2)	73 (3.6)	71 (4.2)	81 (3.3)
Moldova, Rep. of	85 (3.4)	61 (4.2)	60 (4.5)	81 (3.2)	81 (3.4)	96 (1.8)
New Zealand	17 (4.6)	16 (3.6)	61 (5.0)	66 (5.4)	61 (4.7)	71 (4.3)
Norway	8 (2.5)	21 (3.7)	36 (4.6)	35 (4.5)	31 (4.3)	54 (4.1)
Palestinian Nat'l Auth.	67 (4.4)	32 (4.1)	56 (4.7)	37 (4.2)	70 (3.9)	91 (2.5)
[d] Philippines	18 (3.5)	48 (4.7)	59 (5.0)	66 (4.8)	70 (4.3)	86 (3.2)
Saudi Arabia	58 (6.3)	21 (4.1)	40 (5.2)	30 (3.2)	49 (5.1)	94 (1.8)
Scotland	s 24 (2.9)	s 18 (2.2)	s 82 (2.3)	s 85 (2.4)	s 83 (2.6)	s 56 (3.5)
Singapore	13 (1.5)	6 (1.4)	53 (2.7)	51 (2.7)	49 (2.6)	60 (2.8)
South Africa	r 24 (3.4)	r 40 (4.6)	r 34 (3.4)	r 55 (4.0)	r 55 (4.1)	r 77 (3.4)
Sweden	26 (2.8)	35 (4.0)	71 (3.0)	74 (3.3)	64 (3.3)	74 (3.0)
Tunisia	64 (4.5)	66 (4.0)	61 (3.8)	68 (3.9)	68 (3.7)	68 (4.0)
United States	r 21 (2.8)	r 29 (2.5)	r 49 (3.0)	r 65 (3.2)	r 56 (3.4)	r 78 (2.7)
[‡] England	s 30 (4.8)	s 14 (2.8)	s 66 (5.2)	s 68 (5.4)	s 69 (5.2)	s 64 (5.1)
International Avg.	38 (0.7)	31 (0.7)	54 (0.7)	57 (0.7)	61 (0.7)	76 (0.6)
Benchmarking Participants						
Basque Country, Spain	17 (4.3)	16 (3.8)	19 (3.7)	24 (4.6)	43 (5.1)	87 (3.5)
Indiana State, US	22 (5.7)	24 (4.9)	51 (5.6)	65 (6.1)	60 (7.2)	81 (4.7)
Ontario Province, Can.	21 (3.6)	17 (3.8)	38 (4.7)	43 (4.9)	47 (5.1)	59 (3.8)
Quebec Province, Can.	r 22 (4.3)	r 36 (4.6)	r 69 (5.1)	r 56 (4.9)	r 52 (5.3)	r 69 (4.1)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

Does not include students whose teachers report that they do not teach the topic.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

d Philippines: Data reported are for grade 8 biology teachers.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals 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 7.6: Teachers' Reports on Students Doing Science Investigations *(Continued...)*

SCIENCE Grade 8

Countries	Percentage of Students Whose Teachers Reported Students Doing the Activity About Half of the Lessons or More					
	Watch Me Demonstrate an Experiment or Investigation	Design or Plan Experiments or Investigations	Conduct Experiments or Investigations	Work Together in Small Groups on Experiments or Investigations	Write Explanations About What was Observed and Why It Happened	Relate What Students are Learning in Science to Their Daily Lives
Biology						
Armenia	r 14 (3.5)	r 15 (3.7)	r 23 (4.3)	r 15 (3.7)	r 14 (3.5)	r 87 (3.5)
Belgium (Flemish)	51 (3.9)	19 (3.3)	33 (3.9)	23 (3.2)	38 (3.7)	80 (2.9)
Bulgaria	r 42 (4.8)	r 4 (1.8)	r 5 (2.1)	r 16 (3.3)	r 12 (3.3)	r 87 (3.1)
Chinese Taipei	– –	– –	– –	– –	– –	– –
Cyprus	– –	– –	– –	– –	– –	– –
Estonia	12 (3.5)	9 (3.4)	9 (3.4)	5 (1.8)	9 (2.8)	91 (2.6)
Hungary	12 (2.7)	4 (1.5)	4 (1.3)	6 (2.0)	16 (3.4)	88 (3.1)
Indonesia	56 (4.6)	23 (4.0)	39 (3.9)	34 (3.7)	54 (4.1)	63 (4.4)
Latvia	19 (3.5)	8 (2.4)	14 (3.1)	26 (4.3)	36 (4.5)	84 (3.5)
Lithuania	11 (2.9)	14 (3.5)	12 (2.8)	13 (2.7)	32 (4.7)	82 (3.2)
Macedonia, Rep. of	43 (3.9)	25 (3.7)	28 (3.9)	40 (4.6)	43 (4.5)	76 (3.7)
[b] Morocco	99 (0.9)	85 (6.3)	91 (4.7)	85 (5.9)	98 (1.1)	99 (0.5)
Netherlands	r 1 (1.4)	r 2 (1.4)	r 7 (2.1)	r 11 (3.3)	r 5 (2.4)	r 63 (5.4)
Romania	41 (3.9)	17 (3.3)	32 (3.8)	36 (4.3)	49 (4.4)	86 (3.0)
Russian Federation	15 (2.6)	8 (2.0)	13 (2.6)	22 (3.1)	32 (3.5)	75 (3.4)
Serbia	18 (3.2)	16 (3.1)	12 (2.9)	15 (3.1)	26 (3.8)	83 (3.5)
Slovak Republic	18 (4.0)	8 (3.0)	8 (3.3)	16 (4.0)	27 (5.2)	81 (3.9)
Slovenia	15 (3.2)	7 (2.1)	3 (1.4)	8 (2.3)	16 (3.4)	93 (2.3)
International Avg.	29 (0.9)	16 (0.8)	21 (0.8)	23 (0.9)	32 (0.9)	82 (0.8)
Earth Science						
Armenia	s 11 (3.8)	s 8 (3.2)	s 13 (4.6)	s 20 (5.3)	s 21 (5.6)	s 79 (5.1)
Belgium (Flemish)	19 (2.6)	14 (2.6)	25 (3.3)	23 (3.3)	33 (3.5)	71 (3.6)
Bulgaria	r 39 (5.1)	r 8 (2.7)	r 4 (1.8)	r 13 (3.2)	r 21 (4.2)	r 80 (4.3)
Chinese Taipei	– –	– –	– –	– –	– –	– –
Cyprus	r 39 (2.1)	r 25 (2.3)	r 22 (2.3)	r 23 (2.3)	r 46 (2.8)	r 82 (1.8)
Estonia	4 (2.1)	5 (1.9)	3 (1.5)	3 (1.4)	12 (3.6)	87 (2.9)
Hungary	10 (2.5)	4 (1.7)	2 (1.2)	8 (2.4)	21 (3.6)	80 (3.2)
Indonesia	– –	– –	– –	– –	– –	– –
Latvia	– –	– –	– –	– –	– –	– –
Lithuania	r 5 (2.1)	r 8 (2.7)	r 8 (2.6)	r 9 (2.7)	r 19 (3.3)	r 71 (4.1)
Macedonia, Rep. of	40 (4.8)	21 (3.7)	20 (3.7)	38 (4.4)	37 (4.6)	71 (4.1)
[b] Morocco	– –	– –	– –	– –	– –	– –
Netherlands	r 1 (0.8)	4 (1.9)	r 3 (1.8)	r 7 (2.7)	r 5 (2.3)	62 (4.9)
Romania	35 (4.5)	21 (3.7)	23 (3.6)	30 (3.6)	42 (4.4)	82 (3.3)
Russian Federation	15 (2.8)	15 (4.6)	16 (4.4)	21 (3.0)	37 (3.9)	75 (3.2)
Serbia	16 (3.4)	11 (2.8)	10 (2.6)	16 (3.4)	24 (3.9)	73 (4.4)
Slovak Republic	10 (3.2)	11 (4.4)	8 (2.7)	18 (4.2)	22 (4.6)	81 (3.7)
Slovenia	– –	– –	– –	– –	– –	– –
International Avg.	19 (0.9)	12 (0.9)	12 (0.8)	18 (0.9)	26 (1.1)	77 (1.1)

Background data provided by teachers.

Does not include students whose teachers report that they do not teach the content area.

b Morocco: Data reported in biology panel are for grade 8 biology/earth science teachers.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals 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) 2003

Exhibit 7.6: Teachers' Reports on Students Doing Science Investigations *(...Continued)*

SCIENCE Grade 8

Countries	Percentage of Students Whose Teachers Reported Students Doing the Activity About Half of the Lessons or More					
	Watch Me Demonstrate an Experiment or Investigation	Design or Plan Experiments or Investigations	Conduct Experiments or Investigations	Work Together in Small Groups on Experiments or Investigations	Write Explanations About What was Observed and Why It Happened	Relate What Students are Learning in Science to Their Daily Lives
Chemistry						
Armenia	r 23 (4.4)	r 24 (3.8)	r 30 (4.8)	r 15 (3.6)	r 21 (4.0)	r 90 (2.5)
Belgium (Flemish)	– –	– –	– –	– –	– –	– –
Bulgaria	r 55 (4.6)	r 14 (3.5)	r 10 (2.8)	r 12 (3.1)	r 15 (3.4)	r 77 (4.4)
[a] Chinese Taipei	– –	– –	– –	– –	– –	– –
Cyprus	53 (1.7)	55 (2.2)	77 (1.9)	80 (1.9)	90 (1.5)	87 (1.7)
Estonia	46 (5.1)	12 (3.6)	21 (3.6)	16 (4.1)	23 (4.6)	85 (3.9)
Hungary	77 (3.9)	13 (2.9)	19 (3.2)	13 (2.8)	45 (4.2)	89 (2.6)
Indonesia	– –	– –	– –	– –	– –	– –
Latvia	r 39 (4.9)	r 12 (3.5)	r 17 (3.6)	s 18 (4.1)	s 27 (4.2)	r 72 (4.8)
Lithuania	39 (4.6)	14 (3.3)	16 (3.6)	14 (3.0)	37 (4.4)	78 (3.4)
Macedonia, Rep. of	42 (4.4)	20 (3.6)	25 (3.8)	42 (4.5)	46 (4.6)	81 (3.6)
[b] Morocco	– –	– –	– –	– –	– –	– –
[c] Netherlands	– –	– –	– –	– –	– –	– –
Romania	63 (4.2)	13 (2.7)	47 (4.2)	42 (4.2)	58 (3.9)	89 (2.4)
Russian Federation	52 (3.7)	11 (2.4)	22 (3.2)	23 (3.6)	34 (3.4)	68 (3.2)
Serbia	37 (3.8)	19 (3.8)	17 (3.4)	14 (2.8)	34 (4.3)	77 (3.7)
Slovak Republic	53 (4.8)	8 (2.6)	7 (2.3)	6 (2.1)	26 (4.3)	84 (3.4)
Slovenia	51 (4.2)	14 (3.1)	8 (2.3)	7 (2.1)	21 (3.5)	84 (3.4)
International Avg.	48 (1.2)	18 (0.9)	24 (0.9)	23 (0.9)	37 (1.1)	82 (0.9)
Physics						
Armenia	r 29 (3.7)	r 27 (4.4)	r 38 (4.2)	r 15 (2.9)	r 23 (3.5)	r 90 (2.5)
Belgium (Flemish)	54 (5.2)	33 (4.9)	52 (4.5)	45 (4.2)	39 (5.3)	68 (5.8)
Bulgaria	r 72 (4.4)	r 9 (2.4)	r 14 (3.0)	r 9 (2.5)	r 13 (3.1)	r 93 (2.4)
[a] Chinese Taipei	20 (3.0)	15 (2.8)	21 (3.6)	16 (2.9)	22 (3.5)	48 (4.0)
Cyprus	61 (2.5)	25 (2.6)	34 (3.1)	42 (2.9)	75 (2.7)	89 (2.1)
Estonia	58 (5.1)	27 (3.9)	33 (4.7)	17 (3.4)	29 (4.5)	87 (3.1)
Hungary	78 (3.1)	10 (2.3)	19 (3.0)	10 (2.2)	31 (3.7)	85 (2.9)
Indonesia	59 (4.7)	22 (3.9)	41 (4.5)	36 (4.3)	60 (4.2)	66 (4.3)
Latvia	49 (4.6)	r 12 (3.4)	r 18 (3.9)	r 13 (3.2)	21 (4.0)	r 80 (4.0)
Lithuania	56 (4.8)	24 (3.6)	19 (3.5)	15 (3.1)	39 (4.6)	87 (3.3)
Macedonia, Rep. of	41 (4.5)	22 (3.9)	36 (4.3)	50 (4.2)	51 (4.6)	75 (3.7)
[b] Morocco	95 (4.6)	75 (10.5)	88 (5.8)	81 (9.1)	95 (1.4)	90 (5.5)
[c] Netherlands	32 (5.1)	r 8 (3.1)	36 (5.4)	33 (4.7)	25 (4.7)	r 53 (5.3)
Romania	60 (3.9)	16 (3.2)	47 (4.1)	40 (4.4)	49 (4.6)	79 (3.1)
Russian Federation	67 (4.6)	16 (3.1)	16 (3.1)	24 (3.2)	22 (2.4)	74 (3.1)
Serbia	36 (4.2)	18 (3.0)	14 (2.8)	14 (2.6)	36 (4.2)	78 (3.4)
Slovak Republic	61 (4.9)	8 (3.5)	8 (2.4)	12 (2.3)	23 (4.0)	89 (2.7)
Slovenia	61 (4.4)	28 (3.7)	13 (2.9)	10 (2.2)	26 (3.6)	78 (3.7)
International Avg.	55 (1.0)	22 (1.0)	30 (0.9)	27 (0.9)	38 (0.9)	78 (0.9)

Background data provided by teachers.

Does not include students whose teachers report that they do not teach the content area.

a Chinese Taipei: Data reported in physics panel are for grade 8 physics/chemistry teachers.

b Morocco: Data reported in physics panel are for grade 8 physics/chemistry teachers.

c Netherlands: Data reported in physics panel are for grade 8 physics/chemistry teachers.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals 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) 2003

Exhibit 7.6: Teachers' Reports on Students Doing Science Investigations

Countries	Percentage of Students Whose Teachers Reported Students Doing the Activity About Half of the Lessons or More											
	Watch Me Do a Science Experiment		Design or Plan Experiments or Investigations		Do Experiments or Investigations		Work Together in Small Groups on Experiments or Investigations		Write Explanations About Something They are Studying		Relate What Students are Learning in Science to Their Daily Lives	
Armenia		x x		x x		x x		x x		x x		x x
Australia	r	12 (3.0)	r	27 (4.2)	r	40 (4.4)	r	46 (4.8)	r	58 (4.8)	r	52 (4.8)
Belgium (Flemish)		12 (2.6)		3 (1.3)		7 (1.8)		16 (2.7)		42 (3.6)		46 (3.7)
Chinese Taipei		42 (4.5)		53 (4.5)		81 (3.3)		76 (3.7)		70 (4.2)		68 (4.2)
Cyprus		33 (4.2)		63 (4.7)		90 (2.8)		96 (1.4)		95 (1.4)		97 (1.3)
England	r	13 (3.4)	r	51 (4.9)	r	61 (4.8)	r	64 (4.6)	r	78 (4.3)	r	75 (3.6)
Hong Kong, SAR		5 (2.0)		3 (2.1)	r	6 (2.4)		6 (2.5)		44 (5.0)		52 (4.9)
Hungary		15 (2.8)		2 (1.1)		5 (1.8)		6 (1.9)		83 (3.1)		84 (3.0)
Iran, Islamic Rep. of		83 (3.5)		76 (3.5)		74 (4.1)		74 (3.5)		85 (3.3)		78 (3.8)
Italy		18 (2.5)		25 (2.7)		30 (3.1)		24 (2.6)		79 (3.0)		44 (3.4)
Japan		37 (4.0)		64 (3.7)		85 (3.1)		85 (2.6)		76 (3.1)		55 (4.1)
Latvia		x x		x x		x x		x x		x x		x x
Lithuania		8 (2.1)		5 (1.6)		9 (2.2)		11 (2.4)		63 (3.6)		84 (2.6)
Moldova, Rep. of	r	25 (3.9)	r	21 (3.8)	r	22 (3.8)	r	55 (4.5)	r	70 (4.4)	r	91 (2.6)
Morocco		x x		x x		x x		x x		x x		x x
Netherlands		8 (2.5)		5 (1.7)		15 (3.4)		16 (3.6)		32 (4.6)		49 (4.9)
New Zealand	r	11 (2.3)	r	36 (3.6)	r	49 (3.4)	r	69 (3.2)	r	69 (3.5)	r	64 (3.3)
Norway		3 (1.5)		5 (2.0)		7 (2.5)		9 (2.2)		27 (3.5)		39 (3.8)
Philippines		27 (4.4)		39 (4.7)		49 (5.0)		61 (5.0)		72 (4.3)		77 (4.1)
Russian Federation		15 (3.1)		8 (1.9)		12 (2.7)		20 (3.1)		54 (3.7)		93 (2.0)
Scotland	s	15 (3.4)	s	23 (3.8)	s	40 (4.8)	s	43 (4.9)	s	59 (4.9)	s	54 (4.6)
Singapore		29 (3.9)		10 (2.1)		45 (4.2)		46 (4.0)		51 (4.7)		65 (4.1)
Slovenia		8 (2.2)		16 (3.1)		33 (4.2)		25 (3.6)		52 (4.1)		66 (4.6)
Tunisia		75 (4.2)	r	56 (4.3)	r	55 (4.4)		55 (4.3)		77 (3.8)		81 (3.3)
United States	r	12 (1.9)	r	22 (2.7)	r	44 (3.2)	r	57 (2.9)	r	63 (2.5)	r	71 (2.7)
International Avg.		23 (0.7)		28 (0.7)		39 (0.8)		44 (0.8)		64 (0.8)		67 (0.8)
Benchmarking Participants												
Indiana State, US		10 (3.5)		27 (4.9)		45 (5.5)		52 (6.5)		62 (5.7)		67 (5.3)
Ontario Province, Can.		20 (3.6)		13 (3.7)		43 (5.2)		48 (4.9)		64 (4.6)		68 (4.1)
Quebec Province, Can.		23 (3.6)		18 (3.4)		32 (4.4)		31 (4.3)		24 (3.4)		49 (4.0)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

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

What Instructional Strategies Are Used in Science Classes?

As shown in Exhibit 7.7, the textbook is often the foundation of science instruction at both the eighth and fourth grades. On average, internationally, more than half of the eighth- and fourth-grade students (56%) had teachers who reported using a textbook as the primary basis of their lessons. For another 39 percent of the eighth-grade students and 26 percent of the fourth-grade students, teachers reported using textbooks as a supplementary resource. Teaching science without the aid of a textbook was more common at fourth grade, particularly in Australia and New Zealand, where more than three-fourths (79% and 83%, respectively) of students were taught in this way.

Exhibit 7.8 presents a profile of the activities most commonly encountered in science classes around the world, as reported by science teachers. At the eighth grade, the three most predominant activities, accounting for 57 percent of class time, on average, internationally, were teacher lecture (24% of class time), teacher-guided student practice (19%), and students working on problems on their own (14%).

Exhibit 7.7

Exhibit 7.7: Texbook Use in Teaching Science

Countries		Percentage of Students Taught by Teachers Reporting Textbook Use		
		Do Not Use Textbook to Teach Science	Use Textbook to Teach Science	
			As Primary Basis for Lessons	As Supplementary Resource
Armenia	r	5 (1.1)	72 (2.6)	23 (2.5)
Australia	r	19 (3.1)	31 (4.4)	50 (3.8)
Bahrain		0 (0.0)	67 (2.6)	33 (2.6)
Belgium (Flemish)		14 (2.4)	43 (2.9)	43 (2.4)
Botswana		5 (2.0)	25 (4.0)	70 (4.2)
Bulgaria	r	2 (0.5)	75 (2.3)	23 (2.3)
Chile		6 (1.7)	21 (3.1)	74 (3.4)
Chinese Taipei		4 (1.7)	82 (3.4)	14 (3.2)
Cyprus		2 (0.5)	62 (1.1)	36 (1.0)
Egypt		1 (0.6)	67 (4.0)	33 (4.1)
Estonia		0 (0.2)	80 (2.3)	20 (2.2)
Ghana		8 (2.5)	34 (4.5)	58 (4.7)
Hong Kong, SAR		1 (0.9)	91 (2.8)	8 (2.6)
Hungary		0 (0.0)	66 (2.2)	34 (2.2)
Indonesia	s	54 (4.7)	21 (3.9)	24 (4.4)
Iran, Islamic Rep. of		8 (2.0)	81 (2.9)	12 (2.4)
Israel		5 (1.7)	45 (4.0)	50 (3.7)
Italy		1 (0.8)	63 (3.5)	36 (3.6)
Japan		2 (1.0)	62 (3.9)	37 (3.9)
Jordan		0 (0.0)	68 (3.9)	32 (3.9)
Korea, Rep. of	s	4 (1.4)	79 (2.9)	18 (2.8)
Latvia	r	1 (0.7)	43 (2.3)	56 (2.4)
Lebanon		5 (1.6)	49 (4.0)	46 (3.7)
Lithuania		0 (0.0)	100 (0.0)	0 (0.0)
Macedonia, Rep. of		5 (1.1)	63 (3.0)	32 (3.0)
Malaysia		13 (2.7)	44 (3.9)	43 (3.8)
Moldova, Rep. of	r	2 (0.8)	86 (2.0)	12 (2.0)
Morocco		0 (0.0)	12 (3.0)	88 (3.0)
Netherlands	r	1 (0.6)	92 (1.9)	7 (1.7)
New Zealand		15 (4.0)	11 (3.2)	74 (5.0)
Norway		0 (0.0)	87 (2.3)	13 (2.3)
Palestinian Nat'l Auth.		1 (0.0)	71 (3.8)	28 (3.7)
Philippines		8 (2.4)	52 (4.7)	41 (4.6)
Romania		0 (0.2)	71 (2.3)	29 (2.3)
Russian Federation		0 (0.2)	67 (3.2)	33 (3.2)
Saudi Arabia		1 (0.0)	79 (4.6)	20 (4.6)
Scotland	s	10 (2.0)	30 (4.3)	61 (4.1)
Serbia		1 (0.5)	64 (2.2)	34 (2.3)
Singapore		0 (0.0)	73 (2.4)	27 (2.4)
Slovak Republic		0 (0.3)	63 (2.6)	37 (2.7)
Slovenia		1 (0.4)	59 (3.3)	41 (3.3)
South Africa	r	8 (2.3)	36 (3.3)	56 (3.5)
Sweden		3 (1.2)	40 (3.2)	58 (3.2)
Tunisia		3 (1.4)	13 (2.8)	84 (3.1)
United States	r	7 (1.7)	39 (3.4)	54 (3.7)
‡ England	s	9 (2.7)	18 (3.9)	72 (4.3)
International Avg.		5 (0.2)	56 (0.5)	39 (0.5)
Benchmarking Participants				
Basque Country, Spain		5 (1.8)	74 (4.8)	21 (4.5)
Indiana State, US		2 (1.4)	48 (5.6)	50 (5.8)
Ontario Province, Can.		4 (2.1)	43 (4.4)	53 (4.7)
Quebec Province, Can.	r	11 (3.1)	38 (5.2)	51 (5.0)

Background data provided by teachers.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals 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) 2003

Exhibit 7.7: Texbook Use in Teaching Science

Countries		Percentage of Students Taught by Teachers Reporting Textbook Use		
		Do Not Use Textbook to Teach Science	Use Textbook to Teach Science	
			As Primary Basis for Lessons	As Supplementary Resource
Armenia		x x	x x	x x
Australia		79 (4.1)	8 (3.4)	13 (2.8)
Belgium (Flemish)		51 (4.0)	28 (3.4)	21 (3.3)
Chinese Taipei		3 (1.6)	86 (2.8)	11 (2.8)
Cyprus		0 (0.0)	77 (4.0)	23 (4.0)
England	r	37 (4.9)	6 (2.3)	58 (4.9)
Hong Kong, SAR	r	2 (1.1)	86 (3.7)	13 (3.7)
Hungary		0 (0.0)	81 (3.3)	19 (3.3)
Iran, Islamic Rep. of		5 (1.3)	67 (4.7)	28 (4.7)
Italy		7 (1.5)	32 (3.3)	61 (3.4)
Japan		1 (0.7)	76 (3.3)	23 (3.2)
Latvia		x x	x x	x x
Lithuania		0 (0.0)	100 (0.0)	0 (0.0)
Moldova, Rep. of	r	2 (1.3)	83 (4.1)	15 (4.0)
Morocco		x x	x x	x x
Netherlands	r	13 (3.0)	75 (4.3)	12 (3.3)
New Zealand	r	83 (2.6)	4 (1.5)	13 (2.1)
Norway		6 (2.2)	53 (4.7)	41 (4.5)
Philippines	r	2 (1.5)	71 (4.5)	27 (4.3)
Russian Federation		2 (1.3)	82 (3.1)	16 (2.7)
Scotland	s	26 (4.2)	40 (4.6)	35 (4.7)
Singapore		0 (0.0)	75 (4.0)	25 (4.0)
Slovenia		18 (3.4)	26 (3.5)	56 (4.2)
Tunisia	r	38 (4.2)	33 (4.3)	30 (4.1)
United States	r	24 (2.5)	46 (3.2)	30 (3.0)
International Avg.		18 (0.5)	56 (0.8)	26 (0.8)
Benchmarking Participants				
Indiana State, US		22 (5.9)	50 (6.3)	28 (5.1)
Ontario Province, Can.		23 (3.7)	33 (4.6)	44 (4.5)
Quebec Province, Can.		42 (4.7)	40 (4.4)	18 (3.5)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

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

Exhibit 7.8: Percentage of Time in Science Lessons Students Spend on Various Activities in a Typical Week

SCIENCE Grade 8

Countries	Reviewing Homework		Listening to Lecture-Style Presentations		Working Problems with Teacher's Guidance		Working Problems on Their Own Without Teacher's Guidance	
Armenia	s	10 (0.4)	s	18 (0.8)	s	18 (0.5)	s	14 (0.5)
Australia	r	7 (0.4)	r	19 (1.3)	r	20 (0.7)	r	17 (0.9)
Bahrain	r	13 (0.4)	r	27 (0.9)	r	13 (0.7)	r	10 (0.8)
Belgium (Flemish)	r	5 (0.3)	r	20 (1.2)	r	21 (0.9)	r	12 (0.6)
Botswana	r	10 (0.4)	r	21 (1.3)	r	20 (1.0)	r	13 (1.0)
Bulgaria	r	8 (0.5)	r	27 (1.3)	r	16 (0.7)	r	11 (0.5)
Chile		9 (0.4)		19 (0.9)		19 (0.9)		16 (0.8)
Chinese Taipei		9 (0.6)		50 (1.3)		10 (0.5)		5 (0.5)
Cyprus		13 (0.2)		19 (0.4)		20 (0.2)		12 (0.3)
Egypt		12 (0.5)		20 (1.0)		15 (0.7)		12 (0.5)
Estonia		11 (0.3)		18 (0.6)		19 (0.5)		21 (0.5)
Ghana		10 (0.4)		17 (1.0)		18 (0.9)	r	16 (0.7)
Hong Kong, SAR		8 (0.6)		35 (1.6)		17 (0.9)		9 (0.6)
Hungary		8 (0.3)		24 (0.7)		21 (0.5)		16 (0.4)
Indonesia		12 (0.4)		27 (1.1)		19 (0.7)		11 (0.7)
Iran, Islamic Rep. of		10 (0.5)		20 (1.1)		15 (0.7)		12 (0.8)
Israel		11 (0.4)		23 (1.0)		20 (0.8)		15 (0.8)
Italy		12 (0.6)		31 (0.9)		13 (0.6)		9 (0.4)
Japan		3 (0.3)		41 (1.6)		16 (1.2)		6 (0.7)
Jordan		13 (0.7)		27 (1.1)		16 (0.6)		11 (0.6)
Korea, Rep. of	s	5 (0.4)	s	47 (1.7)	s	11 (0.6)	s	10 (0.5)
Latvia	r	8 (0.3)	r	22 (1.0)	r	18 (0.5)	r	17 (0.7)
Lebanon	s	16 (0.9)	s	17 (1.0)	s	21 (0.9)	s	8 (0.7)
Lithuania		9 (0.3)		13 (0.6)		24 (0.6)		22 (0.5)
Macedonia, Rep. of	r	7 (0.4)	r	37 (1.2)	r	19 (0.8)	r	13 (0.7)
Malaysia		13 (0.7)		25 (1.2)		19 (0.8)		11 (0.7)
Moldova, Rep. of	s	13 (0.5)	s	17 (0.7)	s	19 (0.6)	s	16 (0.6)
Morocco	r	10 (0.5)	r	24 (1.7)	r	22 (1.7)	r	11 (0.6)
Netherlands	r	16 (0.5)	r	19 (0.6)	r	16 (0.8)	r	19 (1.1)
New Zealand		8 (0.5)		17 (1.0)		20 (0.8)		14 (1.0)
Norway		7 (0.5)		24 (1.0)		21 (1.1)		20 (1.2)
Palestinian Nat'l Auth.	r	12 (0.7)	r	23 (1.2)	r	15 (0.6)	r	12 (0.6)
Philippines	r	9 (0.4)	r	22 (1.3)	r	16 (0.8)	r	13 (0.8)
Romania		9 (0.3)		28 (0.6)		19 (0.5)		13 (0.4)
Russian Federation		13 (0.3)		28 (0.7)		15 (0.4)		14 (0.3)
Saudi Arabia	r	13 (0.9)	r	21 (1.3)	r	13 (1.0)	r	8 (0.6)
Scotland	s	6 (0.3)	s	16 (0.8)	s	34 (1.3)	s	18 (1.2)
Serbia	r	6 (0.3)	r	41 (0.9)	r	18 (0.7)	r	12 (0.4)
Singapore		12 (0.4)		36 (0.8)		14 (0.4)		11 (0.5)
Slovak Republic		7 (0.3)		25 (0.7)		20 (0.7)		15 (0.3)
Slovenia		7 (0.2)		29 (0.9)		24 (0.6)		16 (0.6)
South Africa	s	11 (0.5)	s	15 (0.9)	s	21 (0.9)	s	18 (1.1)
Sweden	r	6 (0.4)	r	20 (0.8)	r	34 (1.3)	r	16 (1.0)
Tunisia	r	11 (0.9)	r	15 (1.2)	r	22 (1.2)	r	20 (1.3)
United States	r	9 (0.4)	r	20 (1.0)	r	18 (0.6)	r	17 (0.8)
‡ England	s	7 (0.4)	s	15 (0.9)	s	32 (1.3)	s	19 (1.1)
International Avg.		10 (0.1)		24 (0.2)		19 (0.1)		14 (0.1)
Benchmarking Participants								
Basque Country, Spain		15 (0.6)		24 (1.4)		16 (1.0)		16 (0.9)
Indiana State, US		11 (0.9)		20 (1.5)		19 (1.4)		16 (1.0)
Ontario Province, Can.		10 (0.5)		26 (1.6)		19 (1.0)		16 (1.0)
Quebec Province, Can.	r	7 (0.4)	r	30 (1.7)	r	17 (1.1)	r	12 (0.9)

Background data provided by teachers.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals 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) 2003

Exhibit 7.8: Percentage of Time in Science Lessons Students Spend on Various Activities in a Typical Week

SCIENCE Grade 8

Countries	Listening to Teachers Re-teach and Clarify Content/Procedures		Taking Tests and Quizzes		Participating in Classroom Management Tasks Not Related to the Lesson's Content/Purpose		Other Student Activities	
Armenia	s	19 (0.6)	s	12 (0.4)	s	4 (0.2)	s	5 (0.3)
Australia	r	10 (0.4)	r	7 (0.3)	r	8 (0.5)	r	12 (1.1)
Bahrain	r	13 (0.6)	r	12 (0.5)	r	6 (0.2)	r	6 (0.3)
Belgium (Flemish)	r	26 (1.2)	r	10 (0.4)	r	5 (0.4)	r	3 (0.6)
Botswana	r	11 (0.6)	r	12 (0.8)	r	6 (0.6)	r	7 (1.0)
Bulgaria	r	23 (1.2)	r	9 (0.3)	r	3 (0.3)	r	3 (0.3)
Chile		15 (0.6)		11 (0.5)		7 (0.5)		4 (0.4)
Chinese Taipei		8 (0.4)		8 (0.4)		5 (0.5)		6 (0.6)
Cyprus		16 (0.2)		9 (0.2)		6 (0.1)	r	5 (0.2)
Egypt		14 (0.6)		13 (0.5)		7 (0.4)		8 (0.3)
Estonia		13 (0.4)	r	12 (0.4)		3 (0.2)	r	4 (0.4)
Ghana	r	13 (0.6)		13 (0.5)		7 (0.4)		7 (0.4)
Hong Kong, SAR		8 (0.5)		9 (1.1)		5 (0.4)		9 (1.1)
Hungary		10 (0.3)		11 (0.3)		4 (0.2)		7 (0.3)
Indonesia		12 (0.4)		13 (0.5)		3 (0.3)		3 (0.3)
Iran, Islamic Rep. of		16 (0.7)		13 (0.6)		7 (0.4)		7 (0.5)
Israel		12 (0.6)		8 (0.4)		6 (0.4)	r	5 (0.5)
Italy		15 (0.5)		11 (0.5)		4 (0.4)		4 (0.5)
Japan		16 (0.9)		6 (0.4)		2 (0.3)		11 (1.2)
Jordan		12 (0.5)		10 (0.4)		6 (0.3)		6 (0.4)
Korea, Rep. of	s	13 (0.8)	s	6 (0.3)	s	4 (0.3)	s	4 (0.5)
Latvia	r	12 (0.6)	r	14 (0.5)	r	3 (0.2)	r	8 (0.5)
Lebanon	s	14 (0.8)	s	14 (0.6)	s	5 (0.4)	s	5 (0.4)
Lithuania		14 (0.6)		13 (0.4)		3 (0.2)		3 (0.3)
Macedonia, Rep. of	r	8 (0.4)	r	7 (0.3)	r	4 (0.2)	r	5 (0.3)
Malaysia		12 (0.8)		10 (0.5)		5 (0.3)		5 (0.4)
Moldova, Rep. of	s	13 (0.5)	s	14 (0.4)	s	4 (0.3)	s	5 (0.5)
Morocco	r	10 (0.5)	r	13 (1.1)	r	4 (0.5)	r	7 (0.7)
Netherlands	r	9 (0.4)	r	8 (0.3)	r	6 (0.4)	r	8 (0.6)
New Zealand		10 (0.9)		7 (0.4)		8 (0.8)		16 (1.8)
Norway		10 (0.5)		6 (0.3)		4 (0.6)		9 (1.0)
Palestinian Nat'l Auth.	r	14 (0.9)	r	11 (0.5)	r	6 (0.4)	r	7 (0.7)
Philippines	r	14 (0.6)	r	13 (0.6)	r	8 (0.6)	r	5 (0.4)
Romania		11 (0.3)		10 (0.3)		4 (0.2)		5 (0.3)
Russian Federation		8 (0.2)		15 (0.4)		2 (0.1)		5 (0.3)
Saudi Arabia	r	20 (1.4)	r	11 (0.5)	r	7 (0.6)	r	7 (0.6)
Scotland	s	11 (0.4)	s	5 (0.3)	s	8 (0.5)	s	4 (0.4)
Serbia	r	9 (0.4)	r	8 (0.3)	r	3 (0.2)	r	4 (0.3)
Singapore		8 (0.4)		8 (0.3)		6 (0.5)		6 (0.5)
Slovak Republic		14 (0.4)		10 (0.3)		4 (0.2)		6 (0.3)
Slovenia		12 (0.4)		6 (0.2)		2 (0.2)		5 (0.4)
South Africa	s	12 (0.6)	s	11 (0.5)	s	8 (0.6)	s	6 (0.5)
Sweden	r	11 (0.5)	r	7 (0.3)	r	4 (0.2)	r	3 (0.4)
Tunisia	r	15 (1.2)	r	13 (0.6)	r	2 (0.3)	r	3 (0.4)
United States	r	11 (0.4)	r	8 (0.4)	r	7 (0.5)	r	10 (0.9)
‡ England	s	10 (0.5)	s	6 (0.7)	s	7 (0.6)	s	5 (0.6)
International Avg.		13 (0.1)		10 (0.1)		5 (0.1)		6 (0.1)
Benchmarking Participants								
Basque Country, Spain		10 (0.5)		9 (0.6)		5 (0.5)		5 (0.7)
Indiana State, US		12 (0.9)		8 (0.5)		7 (0.8)		7 (0.9)
Ontario Province, Can.		11 (0.7)		8 (0.4)		6 (0.5)	r	6 (0.9)
Quebec Province, Can.	r	10 (0.7)	r	8 (0.4)	r	7 (0.7)	r	10 (1.1)

Background data provided by teachers.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals 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) 2003

How Are Computers Used in Science Class?

Exhibit 7.9 shows the number of countries with national policies on computer use, the percentages of students whose teachers reported that computers were not available, and the percentages of students using computers for various activities in about half of the lessons or more. Across countries, 25 participants at the eighth grade and 12 at the fourth grade reported that their science curriculum contained statements about computer use and yet access to computers remains a challenge in many countries. Teachers reported that, on average, internationally, computers were not available for 62 percent of the eighth-grade students and 54 percent of the fourth-grade students. Beyond that, using computers as often as in half the lessons was extremely rare at either grade, even in countries with relatively high availability. Korea was the only country where a substantial percentage of students used a computer regularly for doing scientific procedures or experiments (32%) or studying natural phenomena through simulations (28%).

Exhibit 7.9: Computer Use in Science Class

Countries	National Curriculum Contains Policies / Statements About the Use of Computers	Percentage of Students Whose Teachers Reported That Computers Are Not Available	Percentage of Students Whose Teachers Reported on Computer Use About Half of the Lessons or More				
			Doing Scientific Procedures or Experiments	Studying Natural Phenomena Through Simulations	Practicing Skills and Procedures	Looking Up Ideas and Information	Processing and Analyzing Data
Armenia	○	s 77 (2.8)	s 2 (0.7)	s 2 (0.7)	s 3 (1.0)	s 5 (1.3)	s 3 (0.9)
Australia	●	r 26 (3.7)	r 1 (0.7)	r 0 (0.2)	r 3 (1.2)	r 6 (1.7)	r 4 (1.3)
Bahrain	●	44 (3.6)	3 (1.2)	3 (1.4)	10 (2.1)	22 (2.8)	7 (1.8)
Belgium (Flemish)	○	66 (3.4)	1 (0.5)	0 (0.3)	1 (0.4)	1 (0.4)	1 (0.4)
Botswana	○	95 (2.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.3)
Bulgaria	○	r 85 (2.2)	r 0 (0.2)	r 0 (0.1)	r 1 (0.5)	r 2 (0.5)	r 0 (0.0)
Chile	○	40 (3.5)	2 (0.6)	5 (2.0)	6 (1.3)	26 (2.9)	12 (2.4)
Chinese Taipei	●	56 (4.0)	1 (0.7)	1 (0.7)	2 (0.7)	1 (1.0)	1 (1.0)
Cyprus	●	81 (0.8)	1 (0.1)	0 (0.1)	1 (0.1)	3 (0.4)	2 (0.1)
Egypt	●	– –	– –	– –	– –	– –	– –
Estonia	●	56 (2.8)	2 (0.7)	1 (0.4)	1 (0.5)	4 (0.7)	2 (0.5)
Ghana	●	91 (2.9)	2 (1.3)	3 (1.5)	1 (0.0)	3 (1.5)	1 (1.0)
Hong Kong, SAR	●	44 (4.6)	5 (2.0)	3 (1.5)	4 (1.9)	5 (1.7)	3 (1.5)
Hungary	●	59 (2.9)	1 (0.4)	1 (0.4)	1 (0.5)	2 (0.8)	1 (0.5)
Indonesia	○	86 (2.5)	1 (0.8)	1 (0.8)	2 (1.0)	3 (1.1)	2 (1.1)
Iran, Islamic Rep. of	○	98 (0.8)	0 (0.0)	0 (0.0)	1 (0.5)	1 (0.5)	1 (0.5)
Israel	●	49 (4.1)	3 (1.4)	2 (1.1)	5 (1.4)	9 (1.9)	7 (1.9)
Italy	○	65 (3.7)	0 (0.0)	1 (0.8)	1 (0.7)	6 (1.6)	4 (1.4)
Japan	●	20 (3.4)	1 (0.9)	3 (1.3)	2 (0.6)	3 (1.4)	1 (0.9)
Jordan	●	82 (3.5)	1 (1.0)	3 (2.2)	3 (2.2)	4 (2.0)	2 (1.1)
Korea, Rep. of	●	r 14 (2.6)	r 32 (3.4)	r 28 (2.9)	r 11 (2.2)	r 16 (2.8)	r 12 (2.1)
Latvia	○	r 70 (2.6)	r 1 (0.6)	r 1 (0.7)	r 1 (0.6)	r 4 (1.3)	r 2 (0.9)
Lebanon	○	83 (2.4)	3 (1.0)	2 (0.9)	4 (1.4)	9 (1.9)	7 (1.6)
Lithuania	●	28 (2.7)	1 (0.3)	2 (0.7)	7 (1.4)	12 (1.3)	6 (1.1)
Macedonia, Rep. of	○	93 (1.6)	0 (0.2)	1 (0.3)	1 (0.4)	1 (0.4)	1 (0.4)
Malaysia	○	86 (3.0)	3 (1.4)	1 (0.9)	1 (0.7)	3 (1.3)	2 (1.3)
Moldova, Rep. of	○	s 69 (3.0)	r 8 (1.8)	r 8 (1.9)	r 13 (2.2)	r 12 (1.9)	r 12 (2.2)
Morocco	○	86 (2.4)	0 (0.0)	0 (0.0)	1 (0.9)	2 (1.4)	1 (0.9)
Netherlands	●	r 61 (2.9)	r 1 (0.5)	r 0 (0.0)	r 1 (0.6)	r 3 (1.1)	r 2 (0.9)
New Zealand	●	52 (5.7)	1 (0.7)	1 (0.0)	1 (0.9)	4 (1.8)	1 (0.8)
Norway	●	39 (3.9)	1 (1.0)	0 (0.0)	0 (0.0)	8 (2.5)	2 (1.2)
Palestinian Nat'l Auth.	●	69 (3.9)	5 (1.4)	3 (1.5)	4 (1.8)	7 (2.1)	1 (0.9)
Philippines	○	84 (3.2)	3 (1.6)	2 (1.3)	4 (1.8)	3 (1.7)	4 (1.9)
Romania	○	79 (2.5)	0 (0.0)	1 (0.5)	1 (0.5)	3 (0.8)	2 (0.7)
Russian Federation	○	89 (1.8)	0 (0.1)	0 (0.2)	0 (0.3)	1 (0.3)	1 (0.5)
Saudi Arabia	○	80 (3.2)	3 (2.5)	6 (3.9)	6 (4.0)	9 (1.9)	4 (2.6)
Scotland	●	s 32 (3.5)	s 1 (0.5)	s 0 (0.3)	s 2 (0.9)	s 6 (1.5)	s 1 (0.4)
Serbia	○	88 (1.7)	2 (0.6)	2 (0.6)	2 (0.7)	2 (0.6)	2 (0.7)
Singapore	●	21 (2.2)	2 (0.8)	1 (0.6)	1 (0.6)	11 (1.7)	4 (1.1)
Slovak Republic	○	67 (3.2)	0 (0.2)	0 (0.2)	2 (0.8)	2 (0.7)	1 (0.4)
Slovenia	●	50 (2.7)	1 (0.7)	1 (0.6)	1 (0.5)	4 (1.1)	3 (0.8)
South Africa	○	r 87 (2.4)	r 2 (1.0)	r 2 (1.2)	r 3 (1.4)	r 4 (1.5)	r 3 (1.3)
Sweden	○	36 (3.3)	1 (0.5)	0 (0.0)	1 (0.5)	9 (1.8)	5 (1.5)
Tunisia	○	65 (4.4)	4 (1.6)	5 (1.9)	7 (2.1)	9 (2.4)	7 (2.3)
United States	○	r 28 (2.9)	r 3 (0.9)	r 3 (1.1)	r 8 (1.7)	r 19 (2.3)	r 12 (1.5)
‡ England	●	s 30 (3.9)	s 1 (0.3)	s 2 (1.1)	s 1 (0.3)	s 7 (3.2)	s 0 (0.3)
International Avg.		62 (0.5)	2 (0.2)	2 (0.2)	3 (0.2)	6 (0.2)	3 (0.2)
Benchmarking Participants							
Basque Country, Spain	●	38 (4.7)	0 (0.0)	1 (0.0)	4 (2.2)	15 (4.5)	3 (1.9)
Indiana State, US	●	23 (5.2)	2 (2.3)	2 (2.3)	6 (3.0)	17 (5.0)	9 (3.8)
Ontario Province, Can.	●	52 (4.6)	4 (1.8)	1 (0.8)	1 (0.9)	5 (2.1)	2 (1.3)
Quebec Province, Can.	○	r 59 (5.1)	r 0 (0.2)	r 0 (0.2)	r 0 (0.2)	r 3 (1.5)	r 3 (2.0)

● Yes ○ No

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators and by teachers.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

Exhibit 7.9: Computer Use in Science Class

SCIENCE Grade 4

Countries	National Curriculum Contains Policies / Statements About the Use of Computers	Percentage of Students Whose Teachers Reported That Computers Are Not Available	Percentage of Students Whose Teachers Reported on Computer Use About Half of the Lessons or More			
			Doing Scientific Procedures or Experiments	Studying Natural Phenomena Through Simulations	Practicing Skills and Procedures	Looking Up Ideas and Information
Armenia	○	x x	x x	x x	x x	x x
Australia	●	16 (3.0)	4 (1.8)	5 (2.4)	6 (2.5)	23 (3.8)
Belgium (Flemish)	○	37 (3.7)	2 (0.9)	1 (0.7)	4 (1.4)	12 (2.3)
Chinese Taipei	●	65 (4.0)	3 (1.3)	3 (1.5)	4 (1.6)	8 (2.4)
Cyprus	○	26 (4.3)	2 (1.1)	4 (1.5)	3 (1.6)	11 (2.2)
England	●	r 12 (2.8)	r 4 (2.0)	r 3 (1.9)	r 4 (2.0)	r 15 (2.8)
Hong Kong, SAR	●	36 (4.8)	1 (0.8)	4 (1.9)	2 (1.4)	8 (2.2)
Hungary	○	76 (4.0)	1 (0.8)	1 (0.8)	1 (0.9)	1 (0.9)
Iran, Islamic Rep. of	○	96 (1.8)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.9)
Italy	○	81 (2.7)	0 (0.0)	0 (0.0)	0 (0.0)	2 (1.1)
Japan	●	11 (2.8)	1 (0.0)	9 (2.5)	1 (1.0)	8 (2.4)
Latvia	○	x x	x x	x x	x x	x x
Lithuania	●	91 (2.2)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.6)
Moldova, Rep. of	○	78 (4.0)	0 (0.0)	0 (0.0)	4 (1.8)	4 (1.8)
Morocco	○	x x	x x	x x	x x	x x
Netherlands	○	62 (4.9)	1 (0.0)	0 (0.0)	2 (1.4)	4 (2.0)
New Zealand	○	r 15 (2.6)	r 2 (1.2)	r 5 (1.4)	r 5 (1.7)	r 34 (3.3)
Norway	●	46 (4.2)	0 (0.0)	0 (0.0)	0 (0.0)	3 (2.2)
Philippines	○	94 (2.4)	1 (1.1)	2 (1.4)	3 (2.0)	3 (1.9)
Russian Federation	○	97 (1.3)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.5)
Scotland	●	s 21 (4.3)	s 1 (1.0)	s 0 (0.0)	s 4 (1.8)	s 19 (4.1)
Singapore	●	23 (3.5)	5 (1.8)	4 (1.7)	10 (2.7)	14 (2.9)
Slovenia	○	77 (3.9)	1 (0.9)	0 (0.0)	0 (0.0)	1 (0.5)
Tunisia	○	85 (3.4)	4 (1.7)	4 (1.7)	5 (2.0)	8 (2.5)
United States	○	32 (2.5)	3 (1.0)	2 (0.8)	6 (1.1)	19 (2.3)
International Avg.		54 (0.7)	2 (0.2)	2 (0.3)	3 (0.3)	9 (0.5)
Benchmarking Participants						
Indiana State, US	●	32 (4.7)	2 (1.4)	1 (0.0)	3 (1.1)	17 (3.9)
Ontario Province, Can.	●	38 (4.5)	5 (3.0)	3 (1.8)	3 (1.7)	10 (2.9)
Quebec Province, Can.	●	46 (4.5)	1 (1.3)	1 (0.6)	9 (2.6)	23 (4.2)

● Yes
○ No

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by National Research Coordinators and by teachers.

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

What Are the Roles of Homework and Assessment?

The amount of time students spend on homework assignments is an important consideration in examining their opportunity to learn science. Exhibit 7.10 presents the index of teachers' emphasis on science homework. Students in the high category had teachers who reported giving relatively long homework assignments (more than 30 minutes) on a relatively frequent basis (in about half the lessons or more). Those in the low category had teachers who gave short assignments (less than 30 minutes) relatively infrequently (in about half the lessons or less). The medium level includes all other possible combinations of responses.

The results show considerable variation across countries in the emphasis placed on homework. At the eighth grade, more than 40 percent of the students in Italy and Malaysia were in the high category. For the majority of countries, most students were in the medium (41%, on average) and low (44%, on average) categories. Seventy percent or more of the students were in the low category in Serbia, Tunisia, Bulgaria, Slovenia, Korea, Scotland, Japan, Belgium (Flemish), and the Slovak Republic. It can be noted, however, that students in Japan and perhaps Korea may be more likely to spend extra time in tutoring and special schools than doing homework.[1] At the fourth grade, teachers reported giving science homework much less frequently than at eighth grade. On average, internationally, only 6 percent of the fourth-grade students were in the high category. About one-fourth were in the medium category and almost 70 percent were in the low category. Students in the high category at both grade levels had the lowest science achievement, on average, suggesting that homework often was being used for remedial purposes.

Exhibit 7.11 presents eighth-grade teachers' reports about how they usually use homework in their science instruction. Internationally, the eighth-grade science teachers reported always or almost always monitoring whether homework was completed (for 76 percent of the students, on average). For more than half (62%) of the eighth-grade

1 Robitaille, D.F., (1997), *National Contexts for Mathematics and Science Education: An Encyclopedia of the Education Systems Participating in TIMSS,* Vancouver, BC: Pacific Educational Press.

students, on average, teachers reported always or almost always correcting assignments and giving feedback to students, but for about one-fourth, on average, the students corrected their own homework in class. One-fourth of the students, on average, had teachers that reported using homework as basis for class discussion and almost one-third to contribute toward grades or marks (31%).

As shown in Exhibit 7.12, eighth-grade teachers reported substantial variation across countries in the frequency of testing in science class. On average, internationally, about one-third of the students (32%) reported having a science test or examination every two weeks or more and another 43 percent reported such testing about once a month. Testing every two weeks or more for most students (80% or more) was reported by eighth-grade teachers in Bahrain, Chinese Taipei, Egypt, and the Philippines. Even though the international average was relatively low (25%) for infrequent testing, there were countries where teachers reported testing only a few times a year or more for half or more of the eighth-grade students, including Bulgaria, Hong Kong SAR, Israel, Japan, Norway, Serbia, Slovenia, and Sweden.

Exhibit 7.13 presents eighth-grade teachers' reports about the types of test formats they use for science tests in relation to average science achievement. On average, internationally, more than half the eighth-grade students (60%) had teachers who used constructed-response and multiple-choice formats for their tests or examinations in about equal proportions. More than one-fourth (28%) had teachers who used only or mostly constructed-response science tests. Very few students (13%, on average) had teachers who reported using only or mostly multiple-choice testing. These students had lower science achievement, on average, than did students whose teachers used some constructed-response and multiple-choice items or only constructed-response items.

Exhibit 7.10: Index of Teachers' Emphasis on Science Homework (ESH)

Index of Teachers' Emphasis on Science Homework

Index based on teachers' responses to two questions about how often they usually assign science homework and how many minutes of science homework they usually assign. High level indicates the assignment of more than 30 minutes of homework about half of the lessons or more. Low level indicates no assignment or the assignment of less than 30 minutes of homework about half of the lessons or less. Medium level includes all other possible combinations of responses.

Countries		High ESH		Medium ESH		Low ESH	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Italy		44 (4.1)	483 (4.7)	35 (3.8)	500 (5.6)	21 (3.0)	494 (6.3)
Malaysia		40 (4.0)	518 (5.3)	34 (3.9)	509 (7.3)	26 (3.8)	504 (6.8)
Ghana		29 (4.5)	233 (12.2)	41 (4.8)	255 (9.6)	29 (3.5)	267 (11.4)
Singapore		29 (2.6)	603 (6.5)	32 (2.5)	573 (8.4)	38 (2.2)	565 (7.6)
Moldova, Rep. of	r	29 (2.5)	466 (4.5)	59 (3.0)	474 (4.5)	12 (2.1)	460 (10.8)
Egypt		28 (3.3)	428 (7.3)	53 (4.1)	418 (6.0)	19 (3.6)	418 (10.9)
Russian Federation		28 (2.0)	514 (5.2)	69 (2.3)	513 (3.4)	2 (0.9)	~ ~
Iran, Islamic Rep. of		27 (3.8)	461 (5.2)	27 (3.6)	448 (5.6)	46 (4.4)	452 (4.3)
Indonesia		27 (3.3)	422 (7.4)	41 (3.1)	415 (5.1)	32 (2.9)	435 (7.1)
Lebanon		26 (3.2)	380 (7.7)	54 (3.8)	397 (6.9)	20 (3.1)	402 (10.7)
Armenia	r	26 (2.0)	468 (7.9)	52 (2.9)	464 (3.9)	22 (2.1)	454 (5.1)
Chinese Taipei		24 (3.6)	586 (6.9)	29 (3.8)	564 (6.5)	48 (4.3)	565 (4.6)
Morocco		21 (3.1)	398 (5.4)	50 (4.7)	402 (4.2)	29 (5.1)	394 (6.1)
Jordan		20 (3.5)	480 (9.2)	35 (4.1)	473 (4.7)	45 (4.4)	473 (6.6)
Philippines		19 (3.6)	367 (14.4)	62 (4.1)	379 (7.8)	18 (3.4)	389 (12.7)
Israel		18 (3.1)	495 (8.3)	50 (3.7)	490 (4.1)	33 (3.5)	484 (6.8)
Botswana		17 (2.3)	371 (5.5)	39 (4.5)	365 (7.0)	44 (4.7)	358 (4.7)
Chile		17 (3.0)	421 (8.9)	35 (3.3)	406 (4.7)	48 (3.9)	413 (4.1)
South Africa	r	17 (2.8)	210 (8.3)	40 (4.2)	238 (14.9)	43 (4.5)	266 (13.5)
Palestinian Nat'l Auth.		15 (3.1)	439 (7.1)	55 (4.2)	435 (5.1)	30 (4.1)	433 (5.9)
Norway		15 (2.9)	490 (5.4)	51 (4.5)	493 (3.5)	35 (4.4)	496 (3.9)
Hong Kong, SAR		12 (3.0)	560 (8.6)	40 (4.3)	565 (5.4)	48 (5.0)	548 (5.9)
Sweden		10 (2.3)	521 (9.0)	33 (2.8)	526 (4.0)	56 (2.9)	526 (3.2)
Romania		9 (1.6)	476 (13.1)	31 (1.8)	469 (6.4)	59 (2.0)	470 (4.7)
Lithuania		9 (1.3)	516 (4.6)	57 (2.3)	519 (2.6)	34 (2.6)	517 (2.7)
United States	r	8 (1.4)	510 (8.9)	34 (2.8)	532 (4.9)	58 (3.0)	533 (4.5)
Macedonia, Rep. of		7 (1.3)	423 (9.6)	28 (2.1)	453 (5.0)	65 (2.2)	451 (4.3)
Serbia		7 (1.2)	463 (5.9)	16 (1.7)	464 (5.2)	77 (2.0)	468 (2.7)
Cyprus		7 (0.9)	444 (5.1)	76 (1.1)	440 (2.2)	17 (0.7)	438 (3.2)
Latvia	r	7 (1.4)	504 (6.3)	58 (3.0)	516 (3.5)	35 (2.7)	511 (3.8)
Estonia		7 (1.0)	549 (5.8)	68 (2.4)	552 (3.0)	26 (2.5)	555 (3.6)
Tunisia		6 (2.0)	407 (8.3)	19 (3.7)	405 (6.0)	74 (3.9)	401 (2.4)
Netherlands	r	6 (1.7)	543 (10.2)	65 (2.9)	544 (3.5)	29 (3.0)	520 (5.4)
Bulgaria	r	6 (1.2)	480 (9.0)	24 (2.4)	479 (7.2)	70 (2.6)	478 (5.4)
Bahrain		5 (0.7)	449 (8.0)	72 (2.4)	439 (2.2)	23 (2.3)	431 (3.6)
Saudi Arabia		4 (1.7)	375 (13.7)	66 (3.8)	403 (5.1)	30 (3.6)	385 (6.1)
Slovenia		4 (1.0)	518 (3.8)	20 (1.6)	523 (3.4)	76 (1.8)	521 (2.0)
Korea, Rep. of	s	3 (1.2)	565 (6.8)	27 (3.5)	554 (3.8)	70 (3.5)	561 (2.3)
Hungary		3 (0.7)	530 (8.1)	45 (2.2)	546 (3.9)	52 (2.4)	538 (3.3)
Scotland	s	2 (1.2)	~ ~	14 (2.5)	507 (8.2)	84 (2.7)	517 (4.7)
Australia	r	2 (1.0)	~ ~	32 (3.6)	529 (6.8)	66 (3.5)	525 (5.2)
Japan		2 (1.2)	~ ~	18 (3.2)	554 (3.5)	80 (3.2)	552 (2.1)
Belgium (Flemish)		2 (0.9)	~ ~	15 (2.3)	524 (7.3)	83 (2.5)	516 (2.7)
New Zealand		1 (0.8)	~ ~	41 (4.9)	535 (6.9)	58 (4.9)	510 (5.4)
Slovak Republic		0 (0.2)	~ ~	17 (2.0)	521 (4.9)	83 (2.0)	516 (3.6)
‡ England	s	28 (4.2)	562 (9.8)	20 (2.9)	581 (11.4)	52 (4.0)	534 (7.5)
International Avg.		15 (0.4)	466 (1.4)	41 (0.5)	476 (0.9)	44 (0.5)	472 (1.0)
Benchmarking Participants							
Basque Country, Spain		7 (2.8)	481 (8.6)	47 (5.1)	493 (4.2)	46 (5.0)	487 (4.3)
Indiana State, US		11 (4.5)	540 (12.4)	35 (5.0)	539 (7.6)	54 (4.9)	524 (6.8)
Ontario Province, Can.		11 (2.9)	525 (7.5)	34 (4.6)	538 (4.0)	55 (5.0)	531 (4.1)
Quebec Province, Can.	r	5 (1.6)	518 (16.2)	26 (4.3)	541 (9.1)	69 (4.6)	532 (3.1)

Background data provided by teachers.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

A tilde (~) indicates insuffcient 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) 2003

Exhibit 7.10: **Index of Teachers' Emphasis on Science Homework (ESH)**

SCIENCE Grade 4

Countries		High ESH		Medium ESH		Low ESH	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Moldova, Rep. of	r	27 (4.2)	494 (9.5)	67 (4.3)	499 (5.8)	6 (2.0)	481 (13.4)
Italy		24 (3.1)	517 (7.8)	34 (2.9)	508 (6.7)	42 (3.7)	521 (5.1)
Russian Federation		16 (3.0)	539 (10.0)	80 (3.4)	524 (4.9)	4 (1.3)	482 (14.0)
Singapore		13 (2.9)	564 (9.4)	25 (3.3)	566 (9.6)	62 (4.2)	565 (7.6)
Iran, Islamic Rep. of		13 (3.2)	424 (10.3)	31 (4.8)	415 (9.0)	56 (5.0)	411 (5.3)
Philippines	r	12 (3.2)	317 (22.1)	60 (4.4)	312 (9.9)	28 (3.9)	339 (17.0)
Tunisia		11 (2.8)	320 (18.8)	30 (4.0)	321 (13.6)	59 (4.6)	304 (7.8)
Chinese Taipei		8 (2.4)	545 (9.0)	19 (3.2)	558 (4.2)	73 (3.4)	551 (2.0)
Slovenia		3 (1.6)	495 (5.2)	10 (2.8)	487 (5.8)	86 (3.2)	491 (3.0)
Norway		3 (1.4)	446 (11.0)	3 (1.4)	461 (19.1)	94 (2.0)	467 (2.7)
England	r	2 (1.4)	~ ~	13 (3.8)	531 (13.9)	85 (4.0)	541 (4.4)
Lithuania		2 (0.8)	~ ~	18 (2.3)	520 (4.2)	80 (2.6)	509 (2.8)
New Zealand	r	1 (0.6)	~ ~	3 (1.0)	535 (22.5)	95 (1.1)	522 (2.9)
Belgium (Flemish)		1 (0.9)	~ ~	4 (1.7)	523 (10.1)	95 (1.9)	518 (1.9)
United States	r	1 (0.7)	~ ~	12 (2.1)	542 (7.5)	86 (2.2)	536 (3.1)
Hong Kong, SAR	r	1 (0.9)	~ ~	35 (4.6)	538 (5.8)	64 (4.7)	544 (3.7)
Hungary		1 (0.7)	~ ~	63 (4.5)	530 (4.4)	36 (4.4)	523 (5.8)
Netherlands		0 (0.4)	~ ~	8 (2.9)	531 (10.8)	92 (2.9)	525 (2.1)
Australia	r	0 (0.4)	~ ~	5 (1.4)	525 (12.6)	95 (1.4)	524 (3.7)
Cyprus		0 (0.0)	~ ~	15 (2.9)	479 (4.7)	85 (2.9)	481 (2.5)
Japan		0 (0.0)	~ ~	8 (2.4)	546 (6.3)	92 (2.4)	543 (1.5)
Scotland	s	0 (0.0)	~ ~	4 (1.8)	494 (16.9)	96 (1.8)	508 (3.5)
Armenia		x x	x x	x x	x x	x x	x x
Latvia		x x	x x	x x	x x	x x	x x
Morocco		x x	x x	x x	x x	x x	x x
International Avg.		6 (0.4)	466 (4.0)	25 (0.7)	497 (2.4)	69 (0.7)	495 (1.5)
Benchmarking Participants							
Indiana State, US		1 (0.7)	~ ~	13 (4.3)	542 (9.0)	86 (4.4)	554 (4.0)
Ontario Province, Can.		3 (1.8)	515 (10.1)	12 (3.6)	556 (25.4)	85 (4.0)	539 (3.3)
Quebec Province, Can.		2 (1.2)	~ ~	7 (2.4)	504 (5.6)	91 (2.7)	501 (2.9)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

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

A tilde (~) indicates insuffcient 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 the students.

Exhibit 7.11: Use of Science Homework

Countries	Percentage of Students Whose Teachers Always or Almost Always									
	Monitor Whether or Not the Homework Was Completed		Correct Assignments and Then Give Feedback to Students		Have Students Correct Their Own Homework in Class		Use the Homework as a Basis for Class Discussion		Use the Homework to Contribute Toward Students' Grades/Marks	
Armenia	r	92 (1.2)	r	87 (1.7)	r	44 (2.2)	r	33 (2.6)	r	27 (2.2)
Australia	r	72 (3.4)	r	61 (3.9)	r	12 (2.8)	r	14 (2.7)	r	30 (3.9)
Bahrain		85 (3.1)		89 (2.7)		26 (2.7)		26 (3.2)		75 (3.1)
Belgium (Flemish)		62 (2.9)		56 (3.1)		15 (2.5)		12 (1.8)		31 (2.7)
Botswana		92 (2.7)		88 (3.2)		19 (3.4)		21 (3.5)		9 (2.6)
Bulgaria	r	85 (2.0)	r	61 (2.5)	r	9 (1.5)	r	17 (2.1)	r	7 (1.4)
Chile		85 (2.6)		83 (2.8)		57 (3.7)		50 (4.0)		35 (4.0)
Chinese Taipei		59 (4.1)		42 (4.4)		29 (3.6)		30 (3.9)		51 (4.5)
Cyprus		85 (0.8)		73 (1.2)		17 (0.7)		32 (1.2)		48 (1.3)
Egypt		87 (2.7)		85 (3.3)		24 (3.5)		48 (4.6)		27 (3.8)
Estonia		71 (2.2)		35 (2.2)		10 (1.5)		24 (2.3)		30 (2.6)
Ghana		95 (1.8)		93 (2.3)		35 (4.7)		36 (4.4)		63 (4.9)
Hong Kong, SAR		72 (4.1)		58 (4.2)		22 (3.9)		12 (2.7)		20 (3.2)
Hungary		88 (1.7)		40 (2.3)		54 (2.6)		8 (1.5)		8 (1.2)
Indonesia		93 (1.9)		87 (2.0)		16 (2.6)		22 (2.8)		49 (3.3)
Iran, Islamic Rep. of		52 (4.2)		35 (4.1)		32 (3.6)		18 (2.7)		41 (3.7)
Israel		78 (2.9)		67 (3.4)		58 (4.1)		38 (4.0)		60 (3.2)
Italy		77 (3.1)		35 (3.6)		37 (3.6)		42 (3.4)		13 (2.7)
Japan		48 (3.9)		22 (3.5)		22 (3.5)		9 (2.3)		28 (3.6)
Jordan		90 (2.5)		79 (3.8)		55 (4.2)		42 (4.6)		41 (4.2)
Korea, Rep. of	s	52 (4.0)	s	14 (2.7)	s	13 (2.3)	s	7 (1.9)	s	26 (2.8)
Latvia	r	71 (2.4)	r	53 (3.2)	r	13 (1.6)	r	11 (1.9)	r	14 (1.9)
Lebanon		80 (3.2)		87 (2.6)		52 (3.7)		40 (3.1)		13 (2.5)
Lithuania		64 (2.3)		57 (2.4)		14 (1.6)		8 (1.2)		15 (1.8)
Macedonia, Rep. of		65 (2.6)		59 (2.6)		24 (2.6)		19 (1.8)		25 (2.3)
Malaysia		92 (2.2)		87 (2.6)		5 (1.9)		29 (3.7)		6 (2.2)
Moldova, Rep. of	r	79 (2.8)	r	48 (3.2)	r	40 (3.1)	r	44 (2.6)	r	45 (2.7)
Morocco		61 (4.6)		75 (4.1)		58 (5.0)		22 (3.8)		42 (4.7)
Netherlands	r	41 (3.2)	r	42 (3.1)	r	55 (2.9)	r	7 (1.5)	r	11 (2.2)
New Zealand		80 (4.5)		60 (4.4)		15 (3.3)		9 (1.9)		19 (3.8)
Norway		22 (3.5)		7 (2.2)		7 (2.5)		18 (3.5)		27 (4.1)
Palestinian Nat'l Auth.		92 (2.3)		87 (3.0)		56 (4.7)		44 (4.4)		48 (4.2)
Philippines		87 (3.3)		81 (4.1)		26 (4.4)		52 (4.0)		57 (4.4)
Romania		81 (1.8)		60 (2.1)		15 (1.6)		26 (1.8)		10 (1.7)
Russian Federation		91 (1.1)		66 (2.3)		23 (1.5)		10 (0.9)		48 (1.9)
Saudi Arabia		91 (2.9)		85 (3.9)		45 (5.1)		24 (5.8)		72 (4.8)
Scotland	s	94 (1.5)	s	85 (2.1)	s	2 (0.9)	s	13 (2.0)	s	12 (2.3)
Serbia		60 (2.6)		45 (2.6)		19 (1.9)		20 (2.0)		10 (1.4)
Singapore		87 (1.8)		75 (2.0)		17 (1.9)		39 (2.6)		12 (1.5)
Slovak Republic		76 (2.2)		57 (2.5)		7 (1.5)		15 (1.8)		14 (1.6)
Slovenia		63 (2.6)		26 (2.7)		28 (2.3)		15 (2.0)		5 (1.3)
South Africa		88 (2.6)		83 (2.5)	r	26 (2.9)		32 (3.9)	r	33 (3.3)
Sweden		52 (3.1)		38 (3.0)		4 (1.4)		22 (2.6)		20 (2.7)
Tunisia		68 (3.7)		52 (3.7)		46 (3.7)		22 (3.4)		10 (2.4)
United States	r	87 (2.0)	r	59 (3.1)	r	22 (2.6)	r	39 (3.3)	r	72 (2.9)
‡ England	s	92 (2.5)	s	85 (2.4)	s	3 (1.6)	s	11 (2.8)	s	43 (4.7)
International Avg.		76 (0.4)		62 (0.4)		27 (0.4)		25 (0.4)		31 (0.5)
Benchmarking Participants										
Basque Country, Spain		86 (3.8)		60 (5.2)		72 (5.2)		26 (4.9)		70 (5.1)
Indiana State, US		90 (3.9)		63 (6.6)		20 (5.4)		36 (5.9)		75 (5.1)
Ontario Province, Can.		82 (3.8)		62 (4.7)		22 (3.9)		31 (4.0)		49 (4.9)
Quebec Province, Can.	r	64 (4.7)	r	67 (4.2)	r	41 (5.3)	r	16 (3.5)	r	12 (2.5)

Background data provided by teachers.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals 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) 2003

Exhibit 7.12: **Frequency of Science Tests**

Countries		Percentage of Students Whose Teachers Give a Science Test or Examination		
		Every Two Weeks or More	About Once a Month	A Few Times a Year or Less
Armenia	r	13 (1.4)	48 (2.4)	40 (2.4)
Australia	r	7 (1.9)	64 (3.6)	28 (3.1)
Bahrain		83 (2.2)	17 (2.2)	0 (0.0)
Belgium (Flemish)		43 (3.7)	49 (3.5)	8 (1.8)
Botswana		11 (2.8)	88 (3.0)	1 (0.0)
Bulgaria	r	8 (1.6)	40 (3.0)	51 (3.2)
Chile		45 (4.0)	47 (4.1)	7 (2.1)
Chinese Taipei		97 (1.4)	3 (1.4)	0 (0.0)
Cyprus		3 (0.6)	48 (1.3)	49 (1.4)
Egypt		89 (2.5)	11 (2.5)	0 (0.0)
Estonia		50 (2.6)	46 (2.4)	4 (0.9)
Ghana		74 (3.7)	24 (3.8)	2 (1.2)
Hong Kong, SAR		20 (3.1)	28 (4.0)	52 (3.8)
Hungary		38 (2.8)	51 (2.7)	11 (1.6)
Indonesia		36 (3.2)	52 (3.6)	12 (2.4)
Iran, Islamic Rep. of		48 (4.1)	45 (4.0)	7 (2.2)
Israel		9 (2.0)	27 (3.2)	64 (3.2)
Italy		17 (2.9)	52 (3.7)	30 (3.1)
Japan		11 (2.7)	35 (3.7)	54 (4.1)
Jordan		33 (4.3)	51 (4.5)	16 (3.8)
Korea, Rep. of	s	49 (4.3)	34 (4.1)	17 (3.3)
Latvia	r	43 (3.2)	54 (2.9)	3 (1.0)
Lebanon		x x	x x	x x
Lithuania		23 (2.0)	66 (2.2)	11 (1.6)
Macedonia, Rep. of		29 (2.2)	27 (2.4)	44 (2.8)
Malaysia		7 (2.0)	44 (4.1)	49 (3.9)
Moldova, Rep. of	r	43 (3.6)	43 (3.4)	14 (1.9)
Morocco		34 (5.1)	61 (5.7)	5 (2.1)
Netherlands	r	25 (2.6)	69 (2.7)	6 (1.5)
New Zealand		10 (2.9)	79 (4.5)	11 (3.7)
Norway		2 (1.4)	42 (4.8)	56 (4.9)
Palestinian Nat'l Auth.	r	29 (4.3)	33 (3.6)	38 (4.6)
Philippines		92 (2.6)	5 (2.1)	3 (1.5)
Romania		44 (2.5)	50 (2.5)	6 (1.1)
Russian Federation		60 (2.4)	30 (2.3)	9 (1.3)
Saudi Arabia		39 (5.1)	42 (5.6)	19 (3.4)
Scotland	s	3 (1.2)	58 (3.9)	38 (3.9)
Serbia		3 (0.7)	18 (1.5)	79 (1.8)
Singapore		25 (2.1)	61 (2.8)	15 (2.0)
Slovak Republic		24 (2.5)	38 (2.3)	38 (2.8)
Slovenia		0 (0.0)	7 (1.5)	93 (1.5)
South Africa	r	23 (3.6)	65 (4.2)	12 (2.2)
Sweden		2 (1.1)	36 (3.2)	62 (3.3)
Tunisia		9 (2.1)	73 (3.3)	18 (3.1)
United States	r	67 (3.4)	27 (3.3)	6 (1.5)
‡ England	s	15 (3.7)	57 (4.7)	28 (4.5)
International Avg.		32 (0.4)	43 (0.5)	25 (0.4)
Benchmarking Participants				
Basque Country, Spain		33 (4.8)	58 (4.8)	9 (2.8)
Indiana State, US		72 (4.7)	26 (4.9)	1 (1.0)
Ontario Province, Can.		32 (4.6)	53 (5.1)	15 (3.3)
Quebec Province, Can.	r	57 (5.4)	38 (5.2)	5 (1.7)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

Exhibit 7.13: Item Formats Used by Teachers in Science Tests or Examinations

SCIENCE Grade 8

Countries		Only or Mostly Constructed-Response		About Half Constructed-Response and Half Multiple-Choice		Only or Mostly Multiple-Choice	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	r	45 (2.3)	465 (4.9)	47 (2.4)	460 (4.4)	8 (1.4)	467 (8.3)
Australia	r	22 (3.1)	520 (9.9)	74 (3.4)	531 (4.4)	5 (1.9)	501 (15.0)
Bahrain		5 (1.7)	448 (8.4)	84 (2.3)	438 (2.0)	11 (1.7)	434 (6.4)
Belgium (Flemish)		34 (3.1)	520 (5.5)	42 (3.1)	513 (5.0)	24 (2.6)	521 (5.4)
Botswana		14 (3.4)	368 (11.0)	74 (4.4)	363 (4.2)	12 (3.0)	362 (5.4)
Bulgaria	r	16 (2.1)	467 (9.4)	70 (2.1)	483 (4.5)	14 (1.8)	466 (5.9)
Chile		13 (3.1)	409 (11.9)	71 (3.7)	409 (3.2)	16 (2.7)	433 (10.3)
Chinese Taipei		9 (2.4)	558 (10.3)	68 (4.0)	571 (4.5)	24 (3.5)	572 (6.0)
Cyprus		12 (0.6)	438 (3.2)	60 (1.2)	442 (2.2)	28 (1.1)	437 (3.6)
Egypt		2 (1.1)	~ ~	70 (4.2)	426 (5.1)	29 (4.1)	414 (7.8)
Estonia		14 (1.9)	556 (4.3)	65 (2.5)	554 (2.7)	20 (1.8)	548 (3.8)
Ghana		26 (3.8)	234 (10.1)	70 (4.3)	261 (7.4)	4 (1.9)	254 (14.8)
Hong Kong, SAR		39 (4.8)	556 (6.3)	60 (4.7)	558 (4.1)	1 (0.0)	~ ~
Hungary		47 (2.5)	545 (3.5)	50 (2.6)	537 (3.4)	3 (0.9)	562 (18.8)
Indonesia		36 (4.0)	416 (7.7)	56 (3.9)	428 (4.9)	8 (1.8)	425 (14.7)
Iran, Islamic Rep. of		24 (3.2)	455 (5.6)	72 (3.5)	455 (3.1)	4 (1.8)	443 (8.8)
Israel		7 (1.8)	477 (11.2)	69 (3.3)	488 (4.1)	24 (3.5)	497 (6.1)
Italy		33 (4.0)	498 (5.4)	61 (4.1)	488 (4.1)	6 (1.9)	488 (16.6)
Japan		26 (3.6)	552 (3.5)	67 (4.2)	550 (2.7)	7 (2.3)	562 (14.5)
Jordan		30 (3.7)	467 (7.0)	67 (3.7)	479 (4.9)	3 (1.3)	477 (21.7)
Korea, Rep. of	r	10 (2.3)	565 (5.6)	20 (3.2)	557 (4.2)	71 (3.6)	559 (2.3)
Latvia	r	37 (3.2)	514 (3.4)	57 (3.4)	512 (3.4)	6 (1.4)	518 (5.7)
Lebanon		19 (3.6)	412 (9.6)	65 (4.2)	386 (6.0)	15 (2.9)	399 (11.7)
Lithuania		29 (2.0)	518 (3.1)	65 (2.1)	519 (2.2)	6 (1.0)	512 (6.7)
Macedonia, Rep. of		35 (2.5)	430 (6.8)	58 (2.6)	461 (4.4)	7 (1.3)	450 (10.1)
Malaysia		1 (1.0)	~ ~	61 (4.4)	506 (4.8)	37 (4.4)	515 (6.1)
Moldova, Rep. of	r	20 (2.3)	466 (6.1)	67 (3.0)	471 (4.4)	13 (1.9)	468 (6.7)
Morocco		16 (3.8)	396 (10.7)	62 (4.7)	403 (4.3)	22 (3.8)	393 (6.0)
Netherlands	r	32 (3.0)	549 (5.6)	57 (3.4)	532 (3.7)	11 (2.1)	527 (10.2)
New Zealand		49 (4.3)	508 (5.2)	45 (4.2)	538 (7.1)	5 (1.8)	506 (11.0)
Norway		86 (3.1)	494 (2.5)	13 (3.0)	491 (7.2)	1 (0.9)	~ ~
Palestinian Nat'l Auth.		4 (1.7)	457 (9.6)	79 (3.8)	435 (4.6)	17 (3.5)	438 (8.4)
Philippines		8 (2.3)	364 (13.6)	84 (3.0)	374 (7.0)	8 (2.5)	386 (18.9)
Romania		11 (1.6)	482 (8.1)	77 (2.2)	469 (5.2)	13 (1.6)	467 (9.7)
Russian Federation		35 (2.8)	516 (4.3)	57 (3.5)	512 (3.5)	7 (1.1)	509 (5.9)
Saudi Arabia		4 (2.2)	406 (6.3)	63 (5.5)	395 (5.3)	33 (5.5)	397 (9.4)
Scotland	s	48 (4.4)	518 (6.0)	45 (4.3)	513 (6.9)	6 (2.4)	525 (18.2)
Serbia		41 (2.5)	464 (3.4)	45 (2.6)	468 (3.4)	14 (1.8)	475 (5.0)
Singapore		30 (2.4)	592 (8.6)	68 (2.4)	573 (5.3)	2 (0.5)	~ ~
Slovak Republic	r	62 (2.9)	515 (3.8)	32 (2.8)	521 (5.8)	6 (1.3)	513 (6.7)
Slovenia		28 (2.5)	524 (2.5)	71 (2.4)	520 (2.0)	1 (0.5)	~ ~
South Africa	r	16 (3.0)	219 (16.5)	72 (3.6)	254 (11.1)	11 (2.8)	221 (16.6)
Sweden		92 (1.9)	526 (2.8)	7 (1.9)	517 (9.1)	1 (0.6)	~ ~
Tunisia	r	23 (4.0)	402 (3.8)	73 (4.3)	406 (3.0)	4 (1.8)	368 (5.7)
United States	r	10 (2.1)	535 (8.7)	74 (3.0)	530 (4.2)	16 (2.2)	531 (7.2)
‡ England	s	72 (4.0)	560 (6.1)	27 (4.0)	534 (13.3)	2 (1.2)	~ ~
International Avg.		28 (0.4)	475 (1.1)	60 (0.5)	475 (0.9)	13 (0.3)	463 (1.7)
Benchmarking Participants							
Basque Country, Spain		32 (5.0)	491 (5.5)	51 (5.4)	490 (3.8)	17 (3.9)	485 (7.4)
Indiana State, US		11 (4.2)	503 (17.1)	69 (6.4)	537 (5.7)	20 (4.6)	526 (7.2)
Ontario Province, Can.	r	21 (4.1)	541 (4.5)	76 (4.2)	533 (3.7)	3 (1.6)	537 (12.1)
Quebec Province, Can.		x x	x x	x x	x x	x x	x x

Background data provided by teachers.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

A tilde (~) indicates insuffcient 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 the students.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Chapter 8

School Contexts for Learning and Instruction

Chapter 8 presents findings about the school contexts for learning and instruction in science, including school characteristics, policies, and practices. Information is presented about the economic status of the student body, the extent of school resources in each country, the school climate, attendance problems, and school safety.

What Are the Schools' Demographic Characteristics?

Exhibit 8.1 presents principals' reports about the economic background of the students in their schools. Internationally, about one-fifth of the eighth grade students (22%), on average, attended schools with few students (less than 10 percent) from economically disadvantaged homes, 26 percent attended schools with 11 to 25 percent disadvantaged students, 21 percent attended schools with 26 to 50 percent economically disadvantaged students, and 31 percent attended schools with more than 50 percent economically disadvantaged students. There was considerable variation across countries, however. In some countries more than half the students (52 to 85%) attended schools where the majority of the students came from disadvantaged homes, including Chile, Ghana, Indonesia, Lebanon, Malaysia, Morocco, the Palestinian National Authority, the Philippines, South Africa, and Tunisia.

At the fourth grade across the participating countries, 34 percent of the students, on average, attended schools with few students (less 10 percent) from economically disadvantaged homes, 25 percent attended schools with 11 to 25 percent disadvantaged students, 18 percent attended schools with 26 to 50 percent economically disadvantaged students, and 24 percent attended schools with more than 50 percent economically disadvantaged students. Among the countries participating at the fourth grade, 75 percent of the students in Morocco attended schools where the majority of the students came from disadvantaged homes, but it was the only one where more than half the students attended such schools.

At the eighth grade, on average, internationally, science achievement for students in schools with few students from economically disadvantaged homes was 51 scale-score points greater than that for students attending schools with more than half their student population from disadvantaged homes (500 vs. 449). At the fourth grade, this difference also was substantial – 43 points (505 vs. 462).

Exhibit 8.1: Principals' Reports on the Percentages of Students in Their Schools Coming from Economically Disadvantaged Homes

Countries	Schools with Few (0-10%) Economically Disadvantaged Students		Schools with 11-25% Economically Disadvantaged Students		Schools with 26-50% Economically Disadvantaged Students		Schools with More than 50% Economically Disadvantaged Students	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia r	3 (1.6)	435 (27.9)	21 (3.6)	459 (7.0)	29 (4.3)	465 (7.7)	47 (4.8)	459 (5.0)
Australia	32 (4.6)	544 (7.0)	35 (4.2)	539 (7.2)	23 (3.3)	508 (8.4)	9 (2.3)	497 (9.2)
Bahrain	16 (0.1)	454 (3.3)	20 (0.1)	434 (3.6)	33 (0.2)	444 (2.7)	31 (0.2)	424 (3.9)
Belgium (Flemish)	53 (3.7)	533 (3.4)	36 (3.9)	508 (4.6)	7 (2.2)	485 (22.4)	4 (1.7)	401 (25.5)
Botswana	15 (3.6)	385 (14.1)	22 (3.6)	373 (7.3)	25 (3.9)	362 (4.7)	38 (4.6)	351 (3.5)
Bulgaria	20 (3.3)	497 (13.5)	25 (4.2)	473 (13.3)	25 (3.6)	471 (9.8)	30 (3.9)	485 (7.8)
Chile	19 (2.7)	467 (9.3)	12 (2.2)	429 (8.1)	17 (3.1)	417 (6.9)	52 (3.7)	386 (3.7)
Chinese Taipei	67 (3.5)	579 (3.9)	25 (3.5)	565 (6.1)	5 (1.8)	561 (10.3)	3 (1.5)	483 (13.3)
Cyprus	38 (0.3)	453 (3.3)	35 (0.3)	439 (3.3)	15 (0.2)	427 (4.6)	11 (0.3)	431 (4.9)
Egypt	11 (2.5)	457 (13.4)	24 (3.7)	428 (8.9)	23 (3.5)	405 (7.4)	42 (3.8)	408 (6.4)
Estonia	13 (3.1)	572 (8.6)	45 (4.5)	554 (3.9)	25 (3.7)	545 (4.9)	18 (2.7)	538 (5.9)
Ghana	4 (1.6)	272 (24.7)	8 (2.5)	293 (19.1)	18 (3.5)	268 (12.2)	71 (4.3)	242 (7.4)
Hong Kong, SAR	14 (3.5)	576 (6.3)	27 (4.0)	552 (10.0)	24 (3.9)	555 (7.7)	35 (4.6)	544 (7.3)
Hungary	15 (3.0)	570 (7.6)	23 (3.3)	555 (5.8)	35 (4.3)	540 (4.5)	27 (3.9)	518 (6.8)
Indonesia	5 (1.9)	496 (23.1)	17 (3.5)	432 (9.0)	24 (3.5)	428 (8.4)	54 (4.1)	407 (6.2)
Iran, Islamic Rep. of	15 (2.6)	491 (5.3)	12 (2.2)	467 (7.1)	25 (3.5)	449 (5.4)	49 (4.1)	439 (3.3)
Israel	15 (3.1)	524 (5.8)	35 (3.8)	503 (6.1)	26 (4.1)	479 (8.1)	25 (3.3)	464 (6.0)
Italy	45 (3.4)	504 (3.2)	33 (3.8)	487 (6.8)	13 (2.4)	476 (9.2)	10 (2.2)	465 (9.0)
Japan	72 (3.6)	556 (2.1)	23 (3.3)	545 (3.4)	4 (1.7)	538 (7.4)	1 (0.0)	~ ~
Jordan	14 (3.2)	499 (12.5)	22 (4.2)	474 (7.8)	24 (3.5)	476 (5.8)	40 (4.5)	468 (6.4)
Korea, Rep. of	34 (3.7)	570 (2.7)	40 (4.1)	558 (2.5)	16 (3.0)	546 (3.1)	10 (2.5)	539 (4.6)
Latvia	22 (4.1)	526 (4.2)	44 (4.6)	515 (4.0)	18 (3.3)	498 (5.4)	16 (3.5)	497 (7.4)
Lebanon	8 (2.6)	374 (20.9)	17 (3.2)	422 (11.5)	15 (2.7)	417 (10.7)	61 (4.0)	383 (6.4)
Lithuania r	20 (4.1)	538 (6.8)	41 (4.9)	521 (3.7)	31 (4.4)	508 (3.6)	8 (2.5)	502 (11.0)
Macedonia, Rep. of	11 (2.6)	477 (14.3)	19 (3.5)	465 (14.2)	35 (4.6)	448 (6.4)	36 (4.5)	431 (8.0)
Malaysia	8 (2.3)	538 (16.7)	12 (2.8)	515 (12.8)	17 (3.3)	515 (10.3)	64 (4.0)	505 (4.0)
Moldova, Rep. of r	7 (2.4)	461 (14.2)	16 (3.7)	466 (7.9)	35 (4.4)	481 (5.4)	42 (4.8)	468 (8.2)
Morocco s	0 (0.0)	~ ~	5 (2.2)	387 (9.4)	16 (4.1)	393 (6.5)	79 (4.6)	397 (3.3)
Netherlands	60 (4.6)	556 (4.8)	26 (4.0)	515 (6.3)	10 (2.6)	499 (9.4)	5 (2.3)	465 (18.9)
New Zealand	36 (4.2)	547 (7.7)	30 (5.6)	525 (7.1)	16 (3.2)	496 (14.8)	18 (2.3)	480 (10.8)
Norway	– –	– –	– –	– –	– –	– –	– –	– –
Palestinian Nat'l Auth.	6 (2.0)	457 (18.7)	11 (2.6)	437 (11.4)	28 (3.8)	444 (5.1)	55 (3.7)	428 (5.5)
Philippines	9 (2.7)	378 (24.3)	16 (2.6)	411 (16.2)	22 (3.9)	385 (10.9)	53 (4.4)	360 (8.1)
Romania	11 (2.9)	505 (13.6)	18 (3.2)	489 (11.6)	21 (3.0)	459 (9.1)	50 (4.2)	460 (6.7)
Russian Federation	19 (2.9)	529 (8.2)	36 (3.0)	513 (4.1)	24 (2.8)	511 (7.0)	20 (2.9)	503 (5.6)
Saudi Arabia	19 (3.7)	406 (6.3)	28 (4.3)	403 (7.2)	29 (5.3)	392 (7.8)	24 (3.9)	386 (10.1)
Scotland s	28 (4.7)	539 (8.2)	44 (5.6)	526 (7.1)	23 (4.7)	487 (10.2)	6 (2.7)	468 (12.1)
Serbia	10 (2.2)	486 (9.3)	28 (4.0)	469 (5.0)	23 (4.0)	460 (6.7)	39 (4.2)	464 (4.1)
Singapore	57 (0.0)	592 (5.8)	28 (0.0)	568 (8.9)	10 (0.0)	530 (19.0)	5 (0.0)	545 (18.5)
Slovak Republic	16 (2.9)	539 (8.6)	43 (4.8)	518 (4.9)	25 (3.3)	505 (5.4)	16 (3.6)	501 (8.6)
Slovenia	23 (4.0)	524 (4.6)	43 (4.6)	523 (2.7)	23 (4.1)	517 (3.7)	11 (2.7)	512 (5.3)
South Africa	3 (1.3)	479 (51.8)	2 (1.0)	~ ~	9 (2.4)	342 (30.2)	85 (2.8)	211 (4.8)
Sweden r	47 (4.0)	540 (4.3)	32 (4.1)	519 (5.4)	19 (3.8)	507 (6.7)	2 (1.1)	~ ~
Tunisia	10 (2.6)	429 (8.2)	15 (2.7)	418 (3.9)	17 (2.9)	400 (4.0)	59 (4.2)	395 (2.2)
United States r	28 (2.9)	563 (5.8)	23 (3.1)	550 (6.1)	25 (3.1)	522 (4.6)	24 (2.8)	482 (5.1)
‡ England s	32 (5.3)	576 (12.4)	33 (6.0)	551 (10.3)	22 (6.2)	535 (14.6)	13 (4.2)	505 (6.4)
International Avg.	22 (0.5)	500 (2.2)	26 (0.5)	484 (1.3)	21 (0.5)	469 (1.5)	31 (0.5)	449 (1.4)
Benchmarking Participants								
Basque Country, Spain	65 (4.9)	493 (3.4)	20 (3.8)	490 (6.5)	9 (3.1)	472 (12.3)	7 (2.4)	480 (8.4)
Indiana State, US	9 (4.3)	562 (11.6)	38 (7.5)	559 (6.2)	36 (6.7)	510 (7.5)	17 (4.9)	499 (11.6)
Ontario Province, Can.	41 (4.7)	542 (2.9)	29 (4.5)	529 (4.7)	14 (3.5)	532 (7.3)	16 (3.3)	513 (9.6)
Quebec Province, Can.	44 (4.7)	545 (5.7)	30 (4.9)	529 (5.6)	15 (3.0)	519 (7.3)	11 (2.5)	505 (10.0)

Background data provided by schools.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

A dash (–) indicates comparable data are not available. A tilde (~) indicates insuffcient 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) 2003

Exhibit 8.1: Principals' Reports on the Percentages of Students in Their Schools Coming from Economically Disadvantaged Homes

Countries	Schools with Few (0-10%) Economically Disadvantaged Students		Schools with 11-25% Economically Disadvantaged Students		Schools with 26-50% Economically Disadvantaged Students		Schools with More than 50% Economically Disadvantaged Students	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia r	4 (1.7)	432 (30.7)	21 (3.5)	433 (9.1)	28 (4.1)	433 (9.9)	48 (4.6)	435 (7.2)
Australia	34 (4.4)	542 (5.3)	30 (4.0)	520 (5.5)	21 (3.6)	510 (6.2)	15 (4.0)	473 (17.7)
Belgium (Flemish)	59 (4.4)	525 (2.2)	27 (4.0)	518 (2.7)	7 (2.1)	497 (5.4)	7 (2.7)	487 (12.6)
Chinese Taipei	80 (3.4)	555 (2.1)	15 (3.0)	545 (3.8)	4 (1.5)	510 (13.1)	2 (0.9)	~ ~
Cyprus	58 (4.5)	486 (2.9)	30 (4.4)	476 (4.8)	6 (2.2)	481 (8.2)	5 (1.1)	455 (10.0)
England r	38 (4.4)	565 (6.7)	25 (4.5)	537 (6.9)	11 (3.0)	540 (12.3)	25 (4.2)	500 (9.1)
Hong Kong, SAR	23 (4.4)	553 (6.8)	26 (3.5)	543 (5.5)	25 (4.9)	545 (5.5)	25 (4.4)	530 (4.9)
Hungary	15 (3.3)	554 (5.5)	24 (4.2)	540 (5.5)	31 (4.0)	529 (5.9)	30 (3.6)	505 (5.9)
Iran, Islamic Rep. of	17 (3.5)	461 (13.3)	11 (3.2)	434 (9.4)	22 (4.3)	417 (8.3)	50 (4.7)	393 (5.3)
Italy	46 (4.1)	525 (4.1)	37 (3.8)	513 (6.5)	10 (2.4)	490 (10.1)	8 (1.6)	505 (18.6)
Japan	74 (3.9)	546 (1.8)	22 (3.6)	535 (2.8)	4 (1.5)	537 (7.1)	0 (0.0)	~ ~
Latvia	23 (3.7)	547 (5.4)	42 (4.8)	540 (4.9)	22 (4.0)	516 (7.6)	14 (3.3)	504 (6.2)
Lithuania	26 (3.8)	530 (4.4)	33 (4.5)	513 (4.5)	31 (3.8)	499 (4.3)	11 (2.9)	501 (7.9)
Moldova, Rep. of r	10 (3.0)	482 (25.7)	17 (3.1)	499 (7.7)	31 (4.7)	502 (11.9)	43 (5.2)	490 (6.6)
Morocco r	3 (1.2)	301 (38.9)	4 (1.5)	305 (16.0)	18 (3.5)	284 (16.5)	75 (3.8)	312 (7.6)
Netherlands	64 (4.0)	534 (2.2)	17 (3.5)	526 (4.1)	8 (2.5)	508 (8.0)	10 (2.0)	488 (8.4)
New Zealand	44 (3.2)	550 (3.8)	22 (3.5)	521 (6.1)	12 (2.3)	504 (9.2)	22 (2.5)	473 (6.6)
Norway	– –	– –	– –	– –	– –	– –	– –	– –
Philippines	12 (2.7)	350 (31.8)	14 (3.5)	368 (30.1)	25 (3.9)	303 (12.5)	48 (4.8)	315 (9.8)
Russian Federation	18 (2.5)	542 (10.6)	33 (3.6)	525 (8.3)	26 (3.0)	528 (8.0)	23 (3.6)	511 (9.1)
Scotland r	36 (4.5)	521 (4.4)	31 (4.6)	502 (4.7)	17 (4.3)	482 (4.5)	15 (3.4)	468 (9.2)
Singapore	64 (3.7)	580 (7.0)	25 (3.2)	540 (9.3)	6 (1.7)	524 (22.2)	4 (1.6)	535 (17.7)
Slovenia	24 (4.0)	498 (5.4)	43 (4.6)	490 (3.3)	22 (4.0)	480 (7.2)	11 (2.7)	499 (8.9)
Tunisia	20 (3.1)	371 (12.7)	16 (2.9)	312 (14.8)	15 (3.0)	310 (14.5)	49 (3.6)	289 (8.9)
United States	19 (2.8)	579 (4.0)	23 (2.6)	567 (4.5)	20 (2.9)	539 (5.0)	38 (2.6)	498 (3.9)
International Avg.	34 (0.7)	505 (2.9)	25 (0.8)	492 (2.0)	18 (0.7)	478 (2.1)	24 (0.7)	462 (2.2)
Benchmarking Participants								
Indiana State, US	19 (4.5)	584 (6.2)	27 (6.2)	571 (7.0)	28 (6.6)	550 (5.9)	26 (3.9)	516 (7.7)
Ontario Province, Can.	48 (5.5)	549 (4.1)	20 (4.1)	553 (12.6)	15 (3.8)	535 (8.2)	17 (4.1)	507 (6.1)
Quebec Province, Can.	41 (4.4)	506 (3.9)	30 (3.7)	495 (4.1)	13 (3.2)	494 (5.6)	17 (3.3)	496 (7.3)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by schools.

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

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

An "r" indicates data are available for at least 70 but less than 85% of the students.

What Is the Level of School-Home Involvement?

To measure the extent to which schools expected parents to participate in school-related events, TIMSS asked about five activities: attending special events, raising funds for the school, volunteering for school projects, ensuring their child completes his/her homework, and serving on school committees. The results are presented in Exhibit 8.2. At both the eighth and fourth grades, the common activities across countries were attending special events (89% and 91 %, respectively) and ensuring that homework was completed (87% and 91%, respectively). Also at both grades, expecting parents to volunteer for school projects was the next activity schools expected on a relatively frequent basis (71% and 82%, respectively), followed by serving on committees (62% and 68%) and raising funds for the school (57% and 64%).

Exhibit 8.2: Schools' Expectations for Parents' Involvement

Countries	Percentages of Students Whose Schools Reported That They Expect Parents to Be Involved in the School-Related Activity									
	Attend Special Events (e.g., Science Fair, Concert, Sporting Events)		Raise Funds for the School		Volunteer for School Projects, Programs, and Trips		Ensure That Their Child Completes His/Her Homework		Serve on School Committees (e.g., Select School Personnel, Review School Finances)	
Armenia	r	94 (2.5)	r	57 (4.7)	r	73 (4.0)	r	92 (2.5)	r	87 (3.1)
Australia		96 (1.0)		71 (4.1)		64 (4.4)		98 (1.0)		90 (3.0)
Bahrain		81 (0.2)		29 (0.2)		39 (0.2)		75 (0.2)		14 (0.1)
Belgium (Flemish)		65 (4.4)		18 (3.5)		44 (4.2)		89 (2.5)		7 (2.3)
Botswana		93 (2.6)		99 (1.0)		88 (3.0)		97 (1.4)		88 (3.1)
Bulgaria		93 (2.2)		71 (4.1)		65 (4.1)		84 (3.2)		71 (4.0)
Chile		93 (2.1)		61 (3.6)		86 (2.5)		96 (1.7)		21 (3.4)
Chinese Taipei		99 (0.7)		75 (3.1)		97 (1.5)		98 (1.0)		86 (2.8)
Cyprus		100 (0.0)		97 (0.1)		62 (0.3)		100 (0.0)		53 (0.3)
Egypt		78 (3.4)		37 (4.3)		61 (4.1)		70 (4.1)		55 (3.9)
Estonia		98 (1.1)		27 (4.0)		87 (2.8)		95 (1.9)		86 (3.4)
Ghana		93 (2.5)		93 (2.7)		82 (4.0)		91 (2.7)		84 (3.8)
Hong Kong, SAR		93 (2.5)		81 (3.6)		89 (3.1)		94 (2.5)		47 (4.8)
Hungary		85 (3.1)		53 (4.6)		87 (2.4)		91 (2.2)		48 (4.1)
Indonesia		89 (2.6)		94 (2.3)		72 (3.8)		99 (0.9)		66 (3.7)
Iran, Islamic Rep. of		91 (2.2)		83 (3.0)		82 (3.1)		91 (2.2)		76 (3.6)
Israel		96 (1.8)		46 (3.9)		81 (3.1)		83 (3.5)		68 (4.0)
Italy		97 (1.3)		38 (3.7)		58 (4.1)		97 (1.3)		67 (3.6)
Japan		95 (1.7)		15 (2.7)		81 (3.3)		74 (3.7)		30 (3.9)
Jordan		89 (3.0)		21 (3.5)		42 (4.6)		73 (3.9)		25 (3.5)
Korea, Rep. of		83 (3.5)		36 (4.0)		49 (4.1)		83 (2.9)		82 (2.9)
Latvia		91 (2.7)		55 (4.4)		73 (4.0)		82 (3.7)		84 (3.6)
Lebanon		68 (4.0)		40 (4.2)		42 (4.7)		79 (3.0)		64 (4.5)
Lithuania		99 (0.7)		70 (3.6)		90 (2.6)		92 (2.3)		93 (2.2)
Macedonia, Rep. of		93 (2.2)		68 (4.0)		77 (3.7)		90 (2.8)		98 (1.2)
Malaysia		93 (2.0)		83 (3.5)		87 (2.8)		96 (1.8)		23 (3.5)
Moldova, Rep. of	r	74 (4.6)	r	79 (3.5)	r	61 (4.5)	r	64 (4.8)	r	75 (4.4)
Morocco	s	87 (3.8)	s	80 (4.7)	s	81 (4.3)	s	70 (5.5)	s	50 (6.1)
Netherlands		58 (4.8)		9 (2.3)		29 (4.7)		95 (1.8)		43 (5.3)
New Zealand		88 (3.8)		53 (4.0)		67 (4.8)		95 (2.2)		72 (5.5)
Norway		89 (2.4)		12 (2.3)		77 (3.8)		94 (2.1)		92 (2.6)
Palestinian Nat'l Auth.		95 (1.9)		52 (4.1)		62 (4.3)		70 (4.1)		12 (3.0)
Philippines		91 (2.6)		85 (2.7)		86 (3.1)		89 (3.1)		53 (4.5)
Romania		80 (3.8)		80 (3.2)		60 (4.0)		80 (3.7)		49 (3.8)
Russian Federation		94 (1.8)		64 (4.3)		89 (2.1)		84 (2.5)		83 (2.4)
Saudi Arabia		87 (2.1)		13 (3.3)		41 (5.1)		58 (3.9)		44 (5.0)
Scotland	s	98 (1.4)	s	82 (4.6)	s	58 (4.7)	s	92 (3.2)	s	79 (4.2)
Serbia		96 (1.7)		73 (3.5)		89 (2.6)		87 (3.0)		79 (4.2)
Singapore		88 (0.0)		65 (0.0)		81 (0.0)		98 (0.0)		64 (0.0)
Slovak Republic		83 (3.2)		80 (3.6)		92 (2.2)		95 (2.2)		85 (3.1)
Slovenia		97 (1.4)		49 (5.0)		69 (3.7)		94 (1.9)		60 (4.7)
South Africa		95 (1.5)		91 (2.2)		91 (2.0)		94 (2.1)		100 (0.3)
Sweden		85 (2.7)		9 (2.5)		65 (4.1)		98 (1.1)		63 (4.1)
Tunisia		60 (4.4)		19 (3.2)		32 (3.9)		40 (4.4)		9 (2.4)
United States		98 (0.9)		63 (3.1)		90 (2.1)		98 (1.0)		74 (3.5)
‡ England		– –		– –		– –		– –		– –
International Avg.		89 (0.4)		57 (0.5)		71 (0.5)		87 (0.4)		62 (0.5)
Benchmarking Participants										
Basque Country, Spain		83 (3.5)		36 (5.3)		74 (4.5)		88 (3.4)		89 (3.6)
Indiana State, US		98 (2.2)		63 (7.6)		88 (4.9)		97 (2.3)		86 (5.4)
Ontario Province, Can.		96 (1.9)		86 (3.2)		94 (2.3)		100 (0.0)		74 (4.5)
Quebec Province, Can.		92 (2.9)		70 (4.8)		62 (4.6)		98 (1.0)		66 (4.8)

Background data provided by schools.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals 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) 2003

Exhibit 8.2: Schools' Expectations for Parents' Involvement

Countries	Percentages of Students Whose Schools Reported That They Expect Parents to Be Involved in the School-Related Activity				
	Attend Special Events (e.g., Science Fair, Concert, Sporting Events)	Raise Funds for the School	Volunteer for School Projects, Programs, and Trips	Ensure That Their Child Completes His/Her Homework	Serve on School Committees (e.g., Select School Personnel, Review School Finances)
Armenia	r 95 (1.9)	r 55 (4.3)	r 72 (4.2)	r 94 (2.2)	r 88 (2.7)
Australia	97 (1.6)	95 (2.2)	91 (2.8)	97 (1.9)	92 (2.6)
Belgium (Flemish)	60 (4.6)	42 (4.6)	84 (3.4)	98 (1.2)	4 (1.5)
Chinese Taipei	100 (0.0)	73 (3.6)	99 (0.6)	100 (0.0)	90 (2.1)
Cyprus	95 (2.2)	90 (3.0)	52 (4.9)	99 (0.8)	77 (4.5)
England	– –	– –	– –	– –	– –
Hong Kong, SAR	98 (1.2)	79 (4.2)	99 (0.9)	99 (0.8)	52 (4.5)
Hungary	84 (3.0)	60 (4.4)	91 (2.2)	94 (2.2)	50 (3.4)
Iran, Islamic Rep. of	88 (2.2)	88 (2.7)	83 (3.5)	98 (1.2)	75 (4.3)
Italy	100 (0.0)	37 (3.7)	63 (3.6)	97 (1.4)	63 (3.1)
Japan	97 (1.5)	8 (2.5)	94 (1.9)	80 (3.5)	20 (3.4)
Latvia	94 (2.0)	59 (4.5)	78 (3.7)	84 (3.3)	86 (3.1)
Lithuania	100 (0.0)	70 (3.9)	84 (3.4)	94 (1.9)	91 (2.6)
Moldova, Rep. of	r 71 (4.1)	r 71 (4.5)	r 53 (4.5)	r 65 (4.4)	r 69 (4.1)
Morocco	r 81 (3.0)	r 68 (4.1)	r 67 (3.8)	r 69 (4.4)	r 56 (4.5)
Netherlands	77 (4.7)	42 (4.5)	96 (1.6)	93 (2.6)	85 (3.5)
New Zealand	97 (1.3)	90 (2.0)	99 (0.7)	97 (1.0)	88 (2.4)
Norway	97 (1.6)	17 (3.4)	89 (3.0)	98 (1.2)	91 (2.7)
Philippines	93 (2.1)	86 (2.7)	83 (3.5)	91 (2.9)	65 (4.1)
Russian Federation	98 (0.9)	64 (4.0)	92 (1.8)	95 (1.8)	83 (3.0)
Scotland	100 (0.0)	98 (1.2)	94 (1.8)	99 (1.0)	85 (3.5)
Singapore	96 (1.6)	75 (3.5)	96 (1.5)	99 (0.7)	57 (4.3)
Slovenia	97 (1.3)	50 (4.8)	69 (3.8)	96 (1.3)	59 (4.8)
Tunisia	73 (3.6)	41 (4.0)	52 (3.7)	53 (3.8)	28 (3.4)
United States	96 (1.4)	85 (2.3)	97 (1.2)	99 (0.7)	82 (3.1)
International Avg.	91 (0.5)	64 (0.7)	82 (0.6)	91 (0.5)	68 (0.7)
Benchmarking Participants					
Indiana State, US	97 (2.3)	89 (4.5)	99 (1.2)	100 (0.0)	73 (5.5)
Ontario Province, Can.	96 (2.0)	91 (2.3)	97 (1.9)	100 (0.0)	76 (4.5)
Quebec Province, Can.	96 (1.8)	92 (2.7)	96 (1.7)	100 (0.0)	67 (4.6)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by schools.

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

What School Resources Are Available to Support Science Learning?

Some school resources are specific to science, but many are general resources that improve learning opportunities across the curriculum. All the available resources, however, can work together to support science learning and instruction.

To measure the extent of school resources in each of the participating countries, TIMSS created an index of availability of school resources for science instruction. As described in Exhibit 8.3, the index is based on schools' average response to five questions about shortages that affect general capacity to provide instruction and six questions about shortages that affect science instruction in particular. Students were placed in the high category if principals reported that shortages, both general and for science in particular, had no or little effect on instructional capacity. The medium level indicates that one type of shortage affects instruction some or a lot, and the low level, that both shortages affect it some or a lot.

Since TIMSS results in 1995 and 1999 showed that students in schools that reported being generally unaffected by a lack of resources had higher average science achievement than those in schools where across-the-board shortages affected instructional capacity some or a lot, TIMSS 2003 reported information on trends in school resources. Exhibit 8.3 shows changes in the percentages of eighth-grade students in the high, medium, and low categories for 1995, 1999, and 2003, and for the fourth-grade students for 1995 to 2003. At the eighth grade, the trend suggests similarity between 1995 and 2003 with a dip in available resources in 1999. Consistent with this overall pattern across countries, the results at the eighth grade show 13 countries having significantly more students in the high category in 2003 than in 1999. At the fourth grade, the results for the participating countries were even more positive. Eleven of the countries showed significant increases in the high category and none showed a decrease.

Exhibit 8.3

Exhibit 8.3: Trends in Index of Availability of School Resources for Science Instruction (ASRSI)

SCIENCE Grade 8

Index of Availability of School Resources for Science Instruction

Index based on principals' average response to five questions about shortages that affect general capacity to provide instruction: instructional materials (e.g., textbook); budget for supplies (e.g., paper, pencils); school buildings and grounds; heating/cooling and lighting systems; and instructional space (e.g., classrooms); and the average response to six questions about shortages that affect science instruction: science laboratory equipment and materials; computers for science instruction; computer software for science instruction; calculators for science instruction; library materials relevant to science instruction; and audio-visual resources for science instruction. Average is computed based on a 4-point scale: 1 = none; 2 = a little; 3 = some; 4 = a lot. High level indicates that both shortages are on average lower than 2. Low level indicates that both shortages are on average greater than or equal to 3. Medium level includes all other possible combinations of responses.

▲ 2003 significantly higher

▼ 2003 significantly lower

Countries		High ASRSI			Medium ASRSI		
		2003 Percent of Students	1999 Percent of Students	1995 Percent of Students	2003 Percent of Students	1999 Percent of Students	1995 Percent of Students
Singapore		92 (0.0)	56 (3.9) ▲	62 (4.8) ▲	7 (0.0)	40 (4.1) ▼	37 (4.7) ▼
Hong Kong, SAR		66 (3.6)	19 (3.3) ▲	23 (5.4) ▲	32 (3.6)	73 (3.5) ▼	72 (5.7) ▼
Netherlands	r	59 (4.7)	37 (6.4) ▲	50 (7.5)	40 (4.8)	62 (6.4) ▼	50 (7.5)
Belgium (Flemish)		57 (4.9)	60 (4.5)	52 (5.8)	41 (4.8)	40 (4.5)	48 (5.8)
Israel		55 (4.1)	36 (4.1) ▲	– –	44 (4.1)	59 (4.1) ▼	– –
Australia	r	55 (3.8)	– –	42 (5.2) ▲	43 (3.8)	– –	52 (5.4)
United States	r	49 (3.8)	34 (3.3) ▲	16 (3.3) ▲	48 (3.8)	59 (3.2) ▼	77 (3.5) ▼
Japan		49 (4.0)	31 (3.8) ▲	25 (3.4) ▲	49 (4.0)	64 (4.1) ▼	67 (3.8) ▼
Slovenia	r	48 (3.8)	– –	7 (2.5) ▲	50 (3.8)	– –	74 (4.2) ▼
New Zealand		45 (4.8)	37 (4.1)	19 (3.3) ▲	52 (5.1)	62 (4.1)	74 (4.0) ▼
Sweden		38 (4.0)	✧ ✧	33 (4.8)	60 (3.9)	✧ ✧	57 (5.2)
Scotland		36 (5.3)	✧ ✧	– –	62 (5.4)	✧ ✧	– –
Lebanon		34 (3.6)	✧ ✧	✧ ✧	58 (3.7)	✧ ✧	✧ ✧
Egypt		34 (4.4)	✧ ✧	✧ ✧	49 (4.3)	✧ ✧	✧ ✧
Italy		31 (3.4)	22 (3.1)	– –	68 (3.5)	71 (3.8)	– –
Korea, Rep. of		30 (4.0)	7 (2.2) ▲	2 (1.2) ▲	67 (3.9)	76 (3.7)	81 (3.0) ▼
Hungary		26 (3.9)	24 (3.6)	22 (3.3)	72 (3.9)	69 (3.9)	77 (3.4)
Chinese Taipei		26 (3.9)	5 (2.1) ▲	✧ ✧	68 (4.0)	78 (3.4)	✧ ✧
Estonia		24 (3.6)	✧ ✧	✧ ✧	71 (3.9)	✧ ✧	✧ ✧
Norway	r	23 (4.0)	✧ ✧	30 (4.0)	72 (4.3)	✧ ✧	66 (4.2)
Chile		19 (2.7)	20 (3.0)	✧ ✧	67 (3.3)	70 (3.3)	✧ ✧
Malaysia		18 (3.3)	23 (3.7)	✧ ✧	69 (3.7)	70 (4.1)	✧ ✧
Bahrain		18 (0.2)	✧ ✧	✧ ✧	67 (0.2)	✧ ✧	✧ ✧
Saudi Arabia		18 (5.6)	✧ ✧	✧ ✧	67 (6.2)	✧ ✧	✧ ✧
Jordan		17 (3.6)	5 (1.9) ▲	✧ ✧	69 (3.9)	58 (4.5)	✧ ✧
Cyprus	r	16 (0.2)	15 (0.1) ▲	23 (0.5) ▼	66 (0.3)	80 (0.2) ▼	69 (0.6) ▼
Latvia		13 (3.0)	– –	– –	77 (4.1)	– –	– –
Tunisia		13 (2.8)	5 (1.9) ▲	✧ ✧	71 (3.9)	66 (4.3)	✧ ✧
Philippines		12 (2.6)	11 (2.6)	✧ ✧	53 (4.5)	54 (4.1)	✧ ✧
Palestinian Nat'l Auth.		12 (3.0)	✧ ✧	✧ ✧	73 (4.0)	✧ ✧	✧ ✧
Slovak Republic		11 (2.6)	5 (2.0)	11 (2.5)	71 (4.0)	87 (3.1) ▼	86 (2.8) ▼
Ghana		11 (2.9)	✧ ✧	✧ ✧	75 (4.3)	✧ ✧	✧ ✧
Lithuania		10 (2.9)	6 (2.1)	2 (1.4) ▲	80 (3.9)	71 (3.7)	78 (3.7)
Iran, Islamic Rep. of		10 (2.4)	5 (1.9)	2 (1.0) ▲	67 (3.4)	71 (3.9)	67 (4.9)
Morocco	s	10 (3.4)	– –	✧ ✧	63 (6.4)	– –	✧ ✧
South Africa		9 (2.0)	7 (1.9)	– –	52 (3.5)	45 (4.0)	– –
Indonesia		9 (2.5)	21 (3.8) ▼	✧ ✧	85 (3.1)	67 (4.7) ▲	✧ ✧
Botswana		7 (2.5)	✧ ✧	✧ ✧	77 (3.9)	✧ ✧	✧ ✧
Macedonia, Rep. of		6 (1.9)	2 (1.2)	✧ ✧	69 (4.1)	59 (3.7)	✧ ✧
Romania		6 (2.1)	2 (1.1)	3 (1.1)	82 (2.9)	72 (3.7) ▲	73 (3.8)
Armenia	r	5 (2.0)	✧ ✧	✧ ✧	69 (4.6)	✧ ✧	✧ ✧
Serbia		4 (1.9)	✧ ✧	✧ ✧	70 (4.0)	✧ ✧	✧ ✧
Russian Federation		3 (1.2)	1 (0.9)	1 (0.0) ▲	69 (3.7)	46 (4.6) ▲	46 (4.3) ▲
Moldova, Rep. of	r	3 (1.6)	0 (0.0) ▲	✧ ✧	73 (4.7)	29 (3.9) ▲	✧ ✧
Bulgaria		3 (1.4)	0 (0.0) ▲	– –	86 (2.6)	65 (4.4) ▲	– –
‡ England	s	34 (6.5)	26 (4.2)	24 (4.8)	59 (6.5)	69 (4.5)	72 (5.0)
International Avg.		26 (0.5)	19 (0.6) ▲	22 (0.9) ▲	63 (0.6)	63 (0.7)	66 (1.0) ▼
Benchmarking Participants							
Basque Country, Spain		61 (4.9)	✧ ✧	✧ ✧	38 (4.9)	✧ ✧	✧ ✧
Indiana State, US		43 (6.5)	39 (7.9)	✧ ✧	53 (6.9)	58 (7.8)	✧ ✧
Ontario Province, Can.		25 (4.2)	17 (3.3)	15 (3.8)	67 (4.7)	74 (4.2)	80 (4.1) ▼
Quebec Province, Can.	r	56 (4.4)	57 (6.1)	41 (6.5)	41 (4.4)	43 (6.1)	59 (6.5) ▼

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by schools.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

Trend notes: Because of differences in population coverage, 1999 data are not shown for Australia, Latvia, Morocco, and Slovenia, and 1995 data are not shown for Israel, Italy, Latvia, and South Africa. Korea tested later in 2003 than in 1999 and 1995, at the beginning of the next school year. Similarly, Lithuania tested later in 1999 than in 2003 and 1995.

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

A diamond (✧) indicates the country did not participate in the assessment.

Exhibit 8.3: Trends in Index of Availability of School Resources for Science Instruction (ASRSI)

Countries		Low ASRSI		
		2003 Percent of Students	1999 Percent of Students	1995 Percent of Students
Singapore		1 (0.0)	4 (1.4)	1 (0.8)
Hong Kong, SAR		2 (1.3)	8 (2.3) ▼	5 (2.6)
Netherlands	r	1 (1.0)	1 (0.8)	0 (0.0)
Belgium (Flemish)		2 (1.2)	0 (0.0)	1 (0.8)
Israel		1 (0.9)	5 (1.7)	– –
Australia	r	2 (1.3)	– –	6 (2.3)
United States	r	3 (1.2)	6 (2.4)	7 (0.9) ▼
Japan		2 (1.0)	5 (1.9)	8 (2.5) ▼
Slovenia	r	2 (1.3)	– –	19 (3.6) ▼
New Zealand		3 (1.7)	1 (1.0)	7 (2.4)
Sweden		1 (1.0)	✧ ✧	10 (3.3) ▼
Scotland		2 (1.3)	✧ ✧	– –
Lebanon		8 (2.1)	✧ ✧	✧ ✧
Egypt		17 (3.2)	✧ ✧	✧ ✧
Italy		1 (0.9)	7 (2.0) ▼	– –
Korea, Rep. of		2 (1.0)	17 (3.2) ▼	17 (2.9) ▼
Hungary		1 (1.0)	7 (2.3) ▼	1 (1.0)
Chinese Taipei		6 (1.9)	17 (2.9) ▼	✧ ✧
Estonia		4 (1.8)	✧ ✧	✧ ✧
Norway	r	5 (1.9)	✧ ✧	4 (1.8)
Chile		14 (2.4)	10 (2.2)	✧ ✧
Malaysia		13 (2.7)	7 (2.0)	✧ ✧
Bahrain		15 (0.2)	✧ ✧	✧ ✧
Saudi Arabia		15 (2.9)	✧ ✧	✧ ✧
Jordan		14 (2.8)	38 (4.4) ▼	✧ ✧
Cyprus	r	18 (0.3)	5 (0.2) ▲	8 (0.4) ▲
Latvia		10 (3.2)	– –	– –
Tunisia		16 (2.9)	30 (3.8) ▼	✧ ✧
Philippines		35 (4.0)	35 (4.0)	✧ ✧
Palestinian Nat'l Auth.		15 (3.3)	✧ ✧	✧ ✧
Slovak Republic		17 (3.1)	8 (2.4) ▲	3 (1.6) ▲
Ghana		14 (3.3)	✧ ✧	✧ ✧
Lithuania		9 (2.7)	23 (3.6) ▼	20 (3.5) ▼
Iran, Islamic Rep. of		23 (3.1)	23 (3.6)	31 (4.9)
Morocco	s	28 (5.9)	– –	✧ ✧
South Africa		39 (3.5)	48 (4.1)	– –
Indonesia		6 (2.1)	12 (3.1)	✧ ✧
Botswana		15 (3.2)	✧ ✧	✧ ✧
Macedonia, Rep. of		25 (3.9)	39 (3.9) ▼	✧ ✧
Romania		12 (2.6)	27 (3.5) ▼	24 (3.9) ▼
Armenia		26 (4.5)	✧ ✧	✧ ✧
Serbia		26 (3.7)	✧ ✧	✧ ✧
Russian Federation		27 (3.8)	53 (4.6) ▼	54 (4.4) ▼
Moldova, Rep. of	r	23 (4.5)	71 (3.9) ▼	✧ ✧
Bulgaria		11 (2.7)	35 (4.4) ▼	– –
‡ England	s	7 (3.3)	5 (2.1)	5 (1.7)
International Avg.		12 (0.4)	20 (0.6) ▼	12 (0.6)
Benchmarking Participants				
Basque Country, Spain		0 (0.5)	✧ ✧	✧ ✧
Indiana State, US		4 (2.6)	3 (2.3)	✧ ✧
Ontario Province, Can.		8 (2.6)	9 (2.6)	5 (1.7)
Quebec Province, Can.	r	3 (1.7)	0 (0.0)	0 (0.0)

Background data provided by schools.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

Trend notes: Because of differences in population coverage, 1999 data are not shown for Australia, Latvia, Morocco, and Slovenia, and 1995 data are not shown for Israel, Italy, Latvia, and South Africa. Korea tested later in 2003 than in 1999 and 1995, at the beginning of the next school year. Similarly, Lithuania tested later in 1999 than in 2003 and 1995.

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

A diamond (✧) indicates the country did not participate in the assessment.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 8.3: Trends in Index of Availability of School Resources for Science Instruction (ASRSI)

Countries	High ASRMI		Medium ASRMI		Low ASRMI	
	2003 Percent of Students	1995 Percent of Students	2003 Percent of Students	1995 Percent of Students	2003 Percent of Students	1995 Percent of Students
Singapore	85 (2.8)	47 (4.1) ▲	15 (2.8)	53 (4.1) ▼	1 (0.5)	0 (0.0)
Scotland	51 (4.7)	– –	47 (4.9)	– –	1 (1.1)	– –
Slovenia r	49 (4.1)	7 (2.6) ▲	49 (4.3)	73 (4.6) ▼	2 (1.4)	21 (4.2) ▼
Japan	48 (3.8)	25 (3.6) ▲	49 (3.9)	70 (3.8) ▼	3 (1.3)	5 (2.0)
England r	45 (4.9)	26 (4.5) ▲	55 (4.9)	66 (4.6)	0 (0.0)	8 (2.9) ▼
New Zealand	40 (3.3)	20 (3.8) ▲	59 (3.3)	72 (4.3) ▼	1 (0.8)	7 (2.5) ▼
Australia	38 (3.9)	24 (4.6) ▲	59 (4.0)	74 (4.5) ▼	3 (1.3)	2 (1.2)
United States r	36 (3.4)	24 (3.2) ▲	57 (3.5)	72 (2.7) ▼	6 (1.7)	4 (1.5)
Belgium (Flemish)	36 (3.9)	✧ ✧	62 (4.2)	✧ ✧	3 (1.4)	✧ ✧
Hong Kong, SAR	35 (4.5)	21 (4.3) ▲	65 (4.5)	75 (4.5)	0 (0.0)	3 (1.6)
Hungary	34 (4.0)	22 (3.7) ▲	66 (4.0)	76 (3.8)	1 (0.5)	2 (1.1)
Netherlands	29 (4.3)	28 (4.5)	67 (4.1)	69 (4.8)	3 (1.7)	3 (1.6)
Norway r	27 (4.3)	16 (3.2) ▲	66 (4.6)	82 (3.4) ▼	7 (2.2)	1 (1.1) ▲
Italy	25 (3.3)	– –	72 (3.5)	– –	3 (1.3)	– –
Latvia	21 (3.9)	– –	73 (4.6)	– –	7 (2.5)	– –
Chinese Taipei	20 (3.1)	✧ ✧	75 (3.5)	✧ ✧	5 (1.6)	✧ ✧
Cyprus r	14 (3.0)	15 (3.3)	70 (4.8)	83 (3.4) ▼	16 (4.0)	3 (1.2) ▲
Iran, Islamic Rep. of	12 (3.4)	4 (1.9) ▲	65 (5.2)	68 (4.6)	23 (4.5)	27 (4.5)
Philippines	11 (3.0)	✧ ✧	66 (4.6)	✧ ✧	23 (4.0)	✧ ✧
Lithuania	11 (2.2)	✧ ✧	78 (3.2)	✧ ✧	11 (2.8)	✧ ✧
Tunisia	7 (2.2)	✧ ✧	69 (3.9)	✧ ✧	24 (3.8)	✧ ✧
Morocco	7 (2.7)	✧ ✧	54 (4.8)	✧ ✧	40 (4.3)	✧ ✧
Armenia	6 (2.7)	✧ ✧	70 (4.6)	✧ ✧	24 (4.3)	✧ ✧
Russian Federation	4 (1.4)	✧ ✧	73 (3.2)	✧ ✧	23 (3.1)	✧ ✧
Moldova, Rep. of	2 (1.2)	✧ ✧	75 (4.8)	✧ ✧	23 (4.6)	✧ ✧
International Avg.	28 (0.7)	22 (1.0) ▲	62 (0.8)	72 (1.1) ▼	11 (0.6)	7 (0.6) ▲
Benchmarking Participants						
Indiana State, US	40 (6.7)	✧ ✧	60 (6.7)	✧ ✧	0 (0.0)	✧ ✧
Ontario Province, Can.	25 (4.6)	13 (3.5)	66 (4.9)	83 (4.0) ▼	9 (3.0)	4 (1.9)
Quebec Province, Can.	36 (4.5)	48 (10.3)	62 (4.2)	52 (10.3)	3 (1.3)	0 (0.0) ▲

▲ 2003 significantly higher

▼ 2003 significantly lower

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by schools.

Trend notes: Because of differences between 1995 and 2003 in population coverage, 1995 data are not shown for Italy and Latvia. 1995 data for New Zealand in this exhibit include students in English medium instruction only (>98% of the estimated population).

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

A diamond (✧) indicates the country did not participate in the assessment.

What Are the Perceptions of School Climate?

The school environment establishes the climate for learning. To measure the extent to which schools offer a positive school climate, TIMSS created two new indices in 2003 – one measuring the views of principals and the other the views of teachers. The results for the Index of Principals' Perception of School Climate are presented in Exhibit 8.4. On a scale from very high to very low, the index was based on principals' characterizations of the following:

- teachers' job satisfaction;
- teachers' understanding of the school's curricular goals;
- teachers' degree of success in implementing the school's curricula;
- teachers' expectations for students' achievement;
- parental support for student's achievement;
- parental involvement in schools' activities;
- students' regard for school property;
- students' desire to do well in school.

Students in the high category attended schools where the principals averaged high or very high reports for each aspect of school climate. Students whose principals characterized school climate as medium were placed in the medium category, and whose principals characterized the school climate as low or very low were placed in the low category.

At both grades, internationally, on average, two-thirds of the students were in the medium category. At the eighth grade, 15 percent were in the high category, and 18 percent were in the low category. Morocco, Tunisia, and Botswana had from 59 to 69 percent of their students in the low category. At the fourth grade, 23 percent were in the high category, and 11 percent in the low category. In both grades,

Exhibit 8.4: Index of Principals' Perception of School Climate (PPSC)

Index of Principals' Perception of School Climate

Index based on principals' responses to eight questions about their schools: teachers' job satisfaction; 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; parental involvement in school activities; students' regard for school property; and students' desire to do well in school. Average is computed based on a 5-point scale: 1 =very high; 2 = high; 3 = medium; 4 = low; 5 = very low. High level indicates average is less than or equal to 2. Medium level indicates that average is greater than 2 and less or equal to 3. Low level indicates average is greater than 3.

Countries	High PPSC		Medium PPSC		Low PPSC	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
United States	43 (3.2)	560 (4.7)	49 (3.3)	512 (5.1)	8 (1.9)	492 (6.4)
Scotland s	42 (4.3)	539 (6.7)	52 (4.7)	505 (7.1)	6 (2.6)	473 (30.2)
Chinese Taipei	37 (3.8)	582 (5.1)	60 (4.0)	566 (4.0)	3 (1.0)	532 (27.2)
Philippines	35 (4.1)	397 (9.1)	59 (4.1)	368 (8.2)	6 (2.2)	365 (20.4)
New Zealand	34 (4.7)	547 (7.8)	58 (4.7)	509 (7.5)	8 (3.2)	504 (11.7)
Australia	31 (4.3)	541 (7.0)	61 (4.8)	529 (5.3)	8 (2.7)	476 (19.9)
Singapore	30 (0.0)	628 (6.0)	65 (0.0)	559 (6.4)	5 (0.0)	520 (22.1)
Japan	29 (3.4)	563 (3.8)	69 (3.4)	548 (2.1)	3 (1.3)	533 (4.8)
Israel	28 (4.0)	506 (6.6)	69 (4.1)	484 (4.2)	2 (1.0)	~ ~
Egypt	26 (3.3)	430 (7.8)	62 (4.2)	418 (5.1)	12 (3.0)	415 (13.0)
Sweden	21 (3.2)	536 (4.9)	72 (3.8)	523 (3.7)	7 (2.2)	516 (12.4)
Cyprus	20 (0.2)	460 (4.3)	76 (0.2)	435 (2.2)	4 (0.1)	456 (6.1)
Indonesia	19 (3.2)	433 (11.8)	71 (3.8)	421 (4.7)	11 (2.8)	391 (17.0)
Jordan	18 (3.2)	502 (9.7)	71 (4.2)	472 (4.4)	11 (2.7)	452 (11.9)
Lebanon	18 (3.5)	421 (10.6)	63 (4.6)	402 (6.3)	19 (2.9)	347 (8.9)
Malaysia	17 (3.3)	535 (10.0)	70 (4.1)	507 (4.5)	13 (3.1)	499 (9.2)
Korea, Rep. of	16 (3.3)	573 (4.7)	68 (3.8)	558 (2.2)	15 (3.0)	549 (3.4)
Belgium (Flemish)	16 (2.7)	539 (6.5)	74 (3.8)	518 (3.5)	10 (2.6)	463 (19.3)
Chile	14 (2.8)	436 (10.9)	67 (3.6)	414 (3.8)	19 (3.2)	395 (5.6)
Palestinian Nat'l Auth.	14 (3.1)	456 (10.5)	77 (3.5)	434 (4.1)	8 (2.5)	410 (10.4)
Saudi Arabia	14 (4.5)	380 (11.5)	68 (5.1)	400 (3.8)	18 (3.8)	402 (8.4)
Macedonia, Rep. of	14 (3.0)	481 (13.0)	74 (3.7)	449 (4.4)	12 (2.8)	426 (16.2)
Ghana	13 (3.4)	296 (25.0)	68 (4.4)	248 (7.2)	18 (3.3)	237 (12.5)
Norway	13 (2.6)	509 (4.3)	82 (3.4)	492 (2.2)	5 (2.2)	494 (21.8)
Italy	12 (2.7)	511 (8.3)	75 (3.6)	491 (3.7)	13 (2.3)	470 (8.5)
Hong Kong, SAR	12 (2.7)	576 (11.1)	70 (4.1)	556 (3.4)	18 (3.4)	533 (9.7)
Bahrain	11 (0.1)	453 (2.9)	74 (0.2)	436 (2.2)	15 (0.2)	429 (5.4)
Iran, Islamic Rep. of	10 (2.2)	488 (8.6)	69 (3.7)	453 (2.9)	21 (3.0)	437 (4.8)
Slovenia	9 (2.2)	525 (4.9)	83 (2.8)	521 (2.1)	8 (2.4)	513 (8.0)
Lithuania	8 (2.4)	533 (12.2)	88 (3.0)	519 (2.3)	4 (1.9)	509 (7.6)
Romania	7 (2.2)	526 (13.7)	69 (4.1)	475 (5.5)	24 (3.7)	439 (8.8)
South Africa	7 (2.1)	330 (49.4)	45 (4.1)	256 (13.3)	48 (3.9)	220 (7.4)
Hungary	7 (2.1)	574 (12.3)	84 (3.3)	542 (3.4)	10 (2.6)	531 (11.5)
Netherlands	5 (2.1)	572 (10.5)	81 (3.7)	538 (3.4)	13 (3.2)	510 (13.9)
Bulgaria	4 (1.4)	507 (12.8)	72 (3.4)	483 (6.6)	23 (3.1)	466 (9.5)
Morocco s	3 (1.7)	393 (17.5)	37 (5.6)	399 (6.0)	59 (5.7)	395 (3.9)
Slovak Republic	3 (1.6)	588 (24.2)	78 (3.9)	519 (2.8)	19 (3.9)	495 (6.9)
Serbia	3 (1.4)	494 (25.3)	71 (4.1)	466 (3.3)	26 (3.8)	469 (4.7)
Armenia r	3 (1.5)	486 (39.8)	79 (4.1)	462 (4.1)	18 (4.0)	439 (7.6)
Estonia	1 (1.1)	~ ~	79 (3.1)	553 (3.2)	20 (2.9)	547 (4.2)
Tunisia	1 (1.0)	~ ~	30 (3.7)	412 (3.6)	69 (3.7)	399 (2.5)
Botswana	1 (1.0)	~ ~	31 (4.2)	366 (6.1)	68 (4.3)	358 (3.1)
Moldova, Rep. of r	1 (0.0)	~ ~	50 (5.1)	481 (4.1)	49 (5.1)	465 (7.0)
Russian Federation	1 (0.5)	~ ~	70 (2.9)	516 (4.5)	29 (2.9)	507 (5.3)
Latvia	0 (0.0)	~ ~	84 (3.8)	514 (3.0)	16 (3.8)	508 (6.4)
‡ England s	33 (5.8)	568 (11.0)	63 (6.2)	539 (8.2)	5 (3.1)	503 (11.9)
International Avg.	15 (0.4)	499 (2.4)	67 (0.6)	473 (0.8)	18 (0.4)	455 (1.9)
Benchmarking Participants						
Basque Country, Spain	12 (3.3)	498 (9.0)	79 (3.8)	490 (2.9)	9 (2.4)	470 (7.4)
Indiana State, US	29 (6.4)	554 (7.7)	67 (6.7)	527 (5.0)	5 (2.2)	458 (13.4)
Ontario Province, Can.	42 (4.3)	543 (3.2)	52 (4.7)	525 (3.6)	5 (2.1)	534 (10.7)
Quebec Province, Can.	14 (2.2)	562 (7.2)	78 (3.1)	529 (3.7)	8 (2.2)	512 (9.6)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by schools.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

A tilde (~) indicates insuffcient 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 8.4: Index of Principals' Perception of School Climate (PPSC)

Countries	High PPSC		Medium PPSC		Low PPSC	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Chinese Taipei	57 (3.8)	556 (2.3)	41 (3.8)	547 (3.1)	2 (0.9)	~ ~
Scotland	51 (5.0)	513 (4.2)	45 (4.9)	497 (4.5)	4 (1.8)	451 (14.3)
New Zealand	48 (3.3)	543 (3.1)	48 (3.3)	505 (4.6)	4 (1.5)	477 (14.4)
United States	48 (3.5)	564 (3.4)	45 (3.5)	521 (4.1)	7 (1.6)	475 (9.0)
Australia	38 (4.6)	538 (4.5)	55 (5.1)	514 (4.4)	7 (3.6)	468 (36.6)
England r	34 (4.7)	556 (7.3)	64 (4.9)	533 (5.9)	2 (1.3)	~ ~
Singapore	32 (4.1)	583 (7.7)	63 (4.1)	558 (7.0)	5 (1.6)	519 (15.1)
Hong Kong, SAR	30 (4.6)	551 (5.2)	65 (4.8)	540 (3.4)	5 (2.1)	529 (5.8)
Cyprus	28 (4.0)	483 (5.6)	66 (4.3)	480 (2.8)	6 (2.3)	479 (5.1)
Philippines	27 (3.9)	359 (17.7)	66 (4.2)	312 (8.5)	7 (2.2)	306 (26.1)
Norway	26 (3.9)	472 (4.6)	72 (4.0)	464 (3.0)	2 (1.0)	~ ~
Lithuania	25 (3.5)	517 (5.3)	72 (3.7)	510 (2.9)	3 (1.4)	489 (9.9)
Iran, Islamic Rep. of	25 (4.0)	438 (10.8)	67 (4.3)	411 (4.9)	8 (2.6)	366 (13.2)
Belgium (Flemish)	21 (3.3)	527 (3.0)	77 (3.2)	518 (1.9)	3 (1.4)	479 (32.8)
Netherlands	20 (3.8)	528 (3.7)	79 (4.0)	526 (2.5)	2 (1.2)	~ ~
Japan	18 (3.1)	554 (3.7)	77 (3.3)	542 (1.8)	5 (1.8)	526 (6.4)
Italy	15 (2.8)	525 (9.0)	76 (3.4)	515 (4.4)	10 (2.4)	507 (12.7)
Tunisia	9 (2.4)	367 (19.2)	49 (3.9)	331 (7.8)	42 (3.9)	281 (8.2)
Slovenia	8 (2.1)	499 (4.3)	85 (2.7)	492 (3.0)	7 (2.0)	469 (7.0)
Hungary	8 (2.2)	559 (8.6)	85 (3.0)	526 (3.4)	7 (2.3)	532 (16.7)
Latvia	6 (2.2)	543 (11.6)	83 (3.6)	532 (3.1)	11 (2.9)	521 (7.9)
Russian Federation	4 (1.3)	545 (19.4)	84 (2.6)	526 (5.7)	12 (2.4)	524 (12.5)
Morocco r	3 (1.4)	399 (11.6)	41 (4.7)	299 (9.0)	57 (4.7)	308 (9.9)
Armenia r	2 (1.3)	~ ~	80 (3.7)	439 (4.9)	18 (3.5)	408 (12.4)
Moldova, Rep. of r	0 (0.0)	~ ~	55 (5.0)	503 (6.3)	45 (5.0)	485 (8.8)
International Avg.	23 (0.7)	510 (2.0)	66 (0.8)	486 (1.1)	11 (0.5)	457 (3.5)
Benchmarking Participants						
Indiana State, US	55 (7.2)	568 (5.3)	42 (7.1)	539 (6.1)	3 (0.3)	480 (5.7)
Ontario Province, Can.	43 (4.5)	557 (6.2)	52 (4.6)	530 (4.1)	5 (2.4)	519 (12.6)
Quebec Province, Can.	25 (3.6)	510 (3.6)	70 (3.9)	498 (2.9)	5 (2.1)	483 (8.7)

Background data provided by schools.

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

A tilde (~) indicates insuffcient 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) 2003

Exhibit 8.5: Index of Science Teachers' Perception of School Climate (TPSC)

Index of Teachers' Perception of School Climate

Index based on teachers' responses to eight questions about their schools: teachers' job satisfaction; 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; parental involvement in school activities; students' regard for school property; and students' desire to do well in school. Average is computed based on a 5-point scale: 1 = very high; 2 = high; 3 = medium; 4 = low; 5 = very low. High level indicates average is less than or equal to 2. Medium level indicates that average is greater than 2 and less or equal to 3. Low level indicates average is greater than 3.

Countries	High TPSC		Medium TPSC		Low TPSC	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Philippines	32 (4.5)	402 (10.4)	59 (4.9)	372 (7.7)	9 (1.9)	358 (11.1)
Israel	25 (3.0)	514 (7.1)	61 (3.6)	487 (3.8)	14 (2.4)	452 (8.1)
United States	24 (2.6)	564 (5.5)	52 (3.0)	531 (4.0)	24 (2.6)	499 (5.8)
New Zealand	22 (4.3)	534 (6.6)	60 (5.3)	523 (6.6)	18 (4.1)	503 (12.0)
Lebanon	20 (2.8)	415 (7.3)	55 (3.6)	402 (6.3)	25 (3.2)	360 (7.6)
Egypt	20 (3.0)	441 (8.7)	60 (4.1)	419 (4.4)	20 (3.2)	406 (11.5)
Chinese Taipei	19 (3.5)	587 (8.0)	66 (4.2)	569 (4.0)	15 (3.1)	551 (6.7)
Malaysia	15 (3.1)	531 (11.9)	71 (4.0)	510 (4.3)	14 (3.3)	494 (8.4)
Indonesia	15 (1.8)	450 (8.7)	69 (3.1)	419 (4.9)	16 (2.6)	413 (8.6)
Ghana	14 (3.3)	307 (21.5)	61 (4.6)	247 (7.5)	25 (4.0)	241 (10.2)
Australia r	13 (2.1)	559 (7.2)	57 (3.9)	534 (5.5)	30 (3.9)	499 (6.6)
Macedonia, Rep. of	13 (2.0)	453 (11.0)	70 (2.6)	455 (4.1)	16 (2.0)	427 (9.1)
Scotland s	12 (1.8)	536 (10.0)	60 (3.0)	522 (4.9)	28 (2.9)	493 (6.8)
South Africa	12 (2.3)	317 (33.7)	44 (4.1)	244 (12.4)	44 (4.2)	226 (8.6)
Cyprus	12 (0.7)	453 (3.5)	59 (1.0)	439 (2.4)	29 (1.1)	437 (3.0)
Bahrain	11 (2.1)	459 (4.8)	50 (3.5)	440 (2.6)	39 (3.5)	430 (3.0)
Armenia r	11 (1.5)	475 (9.2)	65 (2.1)	464 (3.8)	24 (2.2)	455 (5.1)
Romania	10 (1.6)	507 (8.2)	61 (2.7)	472 (5.6)	29 (2.8)	452 (6.1)
Palestinian Nat'l Auth.	10 (2.8)	452 (11.3)	67 (3.9)	435 (4.0)	23 (3.6)	428 (7.8)
Chile	10 (1.7)	448 (10.7)	53 (3.5)	420 (4.1)	37 (3.4)	393 (4.3)
Iran, Islamic Rep. of	9 (2.3)	489 (8.3)	43 (4.0)	456 (4.5)	48 (3.8)	445 (3.0)
Singapore	9 (1.5)	625 (16.2)	71 (2.6)	583 (5.3)	20 (2.0)	542 (9.4)
Japan	9 (2.2)	573 (13.4)	62 (4.0)	554 (2.7)	30 (3.7)	542 (3.2)
Serbia	7 (1.1)	468 (6.8)	63 (2.1)	470 (3.0)	30 (2.2)	461 (3.8)
Norway	7 (2.1)	501 (13.1)	85 (3.1)	494 (2.2)	8 (2.2)	486 (6.7)
Jordan	7 (2.0)	513 (13.2)	54 (4.3)	481 (4.9)	39 (3.9)	460 (6.9)
Belgium (Flemish)	7 (1.5)	551 (8.1)	68 (3.0)	525 (3.0)	25 (2.8)	482 (8.2)
Hong Kong, SAR	7 (2.3)	589 (15.0)	66 (4.7)	561 (4.1)	28 (4.5)	537 (7.4)
Lithuania	6 (1.1)	527 (7.0)	84 (1.7)	520 (2.2)	10 (1.4)	505 (4.0)
Sweden	6 (1.7)	540 (4.8)	65 (3.2)	529 (3.1)	29 (2.8)	513 (4.7)
Tunisia	6 (2.0)	408 (9.3)	54 (4.2)	404 (2.8)	40 (3.8)	401 (3.0)
Korea, Rep. of r	6 (1.6)	560 (6.0)	70 (3.1)	561 (2.3)	25 (3.0)	556 (4.2)
Saudi Arabia	5 (1.7)	395 (13.9)	52 (5.9)	406 (5.0)	43 (5.9)	387 (6.0)
Hungary	5 (1.0)	570 (9.5)	79 (2.1)	545 (2.7)	17 (2.0)	518 (5.4)
Slovenia	4 (1.3)	540 (9.4)	77 (2.8)	520 (2.0)	19 (2.6)	523 (3.0)
Italy	4 (1.8)	499 (33.3)	49 (4.2)	497 (4.3)	48 (3.9)	484 (4.4)
Bulgaria r	4 (1.2)	487 (17.3)	54 (3.0)	486 (5.4)	43 (3.2)	469 (6.4)
Slovak Republic	2 (1.2)	~ ~	58 (3.0)	519 (3.4)	40 (3.1)	509 (3.7)
Morocco	1 (1.1)	~ ~	30 (4.9)	407 (7.0)	68 (5.1)	396 (3.6)
Latvia	1 (0.6)	~ ~	68 (3.2)	515 (3.1)	31 (3.2)	508 (4.0)
Russian Federation	1 (0.6)	~ ~	52 (2.5)	521 (3.8)	47 (2.6)	504 (4.4)
Moldova, Rep. of	1 (0.4)	~ ~	46 (2.9)	476 (4.2)	53 (2.9)	467 (4.9)
Botswana	1 (1.0)	~ ~	31 (4.2)	373 (4.9)	68 (4.3)	357 (3.3)
Netherlands r	1 (0.7)	~ ~	60 (3.1)	546 (4.3)	39 (3.0)	521 (4.9)
Estonia	1 (0.3)	~ ~	61 (3.0)	556 (2.6)	38 (3.0)	547 (3.6)
‡ England s	12 (2.2)	606 (14.6)	70 (4.5)	546 (7.9)	19 (4.3)	537 (10.4)
International Avg.	10 (0.3)	496 (2.1)	60 (0.5)	477 (0.8)	30 (0.5)	460 (1.1)
Benchmarking Participants						
Basque Country, Spain	6 (2.6)	507 (7.1)	68 (4.8)	491 (3.0)	26 (4.2)	481 (5.7)
Indiana State, US	19 (4.1)	557 (12.3)	56 (6.5)	531 (5.1)	24 (5.8)	509 (10.6)
Ontario Province, Can.	19 (3.8)	540 (4.4)	62 (4.6)	535 (3.2)	20 (4.1)	525 (6.8)
Quebec Province, Can.	8 (2.8)	562 (8.2)	66 (4.4)	534 (4.3)	25 (3.4)	518 (4.2)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

A tilde (~) indicates insuffcient 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 8.5: Index of Science Teachers' Perception of School Climate (TPSC)

Countries	High TPSC		Medium TPSC		Low TPSC	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
United States	42 (2.8)	557 (3.3)	47 (2.8)	531 (3.4)	12 (1.5)	486 (6.5)
Scotland r	41 (5.1)	518 (4.9)	58 (5.0)	500 (4.2)	2 (1.1)	~ ~
New Zealand	37 (2.9)	533 (5.1)	57 (3.1)	516 (3.5)	5 (1.2)	461 (9.5)
Philippines	34 (4.5)	359 (22.3)	57 (4.7)	320 (10.5)	9 (2.8)	306 (20.4)
Lithuania	34 (3.4)	517 (4.1)	65 (3.4)	508 (2.9)	0 (0.0)	~ ~
Chinese Taipei	34 (4.4)	557 (3.1)	63 (4.6)	550 (2.5)	3 (1.3)	539 (23.4)
Australia	31 (3.6)	532 (7.3)	59 (3.7)	526 (3.3)	11 (2.5)	466 (25.7)
England r	29 (4.4)	552 (6.6)	63 (4.9)	533 (5.2)	8 (2.4)	539 (15.4)
Iran, Islamic Rep. of	25 (4.0)	437 (10.0)	60 (4.6)	408 (5.7)	15 (3.5)	402 (8.6)
Cyprus	23 (3.4)	486 (5.0)	68 (3.8)	481 (2.7)	9 (2.1)	460 (6.6)
Singapore	20 (3.5)	596 (9.5)	71 (3.9)	558 (6.5)	9 (2.1)	534 (20.7)
Belgium (Flemish)	19 (2.6)	518 (3.6)	75 (3.2)	521 (1.7)	6 (1.9)	490 (13.4)
Norway	18 (3.6)	477 (5.9)	76 (3.7)	464 (3.2)	6 (1.9)	459 (10.7)
Armenia s	18 (4.0)	452 (12.1)	60 (5.6)	451 (7.8)	23 (5.5)	431 (11.4)
Slovenia	16 (3.6)	490 (7.0)	80 (4.0)	491 (3.2)	4 (1.8)	490 (2.1)
Hungary	15 (2.8)	535 (7.9)	79 (3.2)	531 (3.1)	7 (2.1)	492 (15.8)
Japan	13 (2.8)	557 (4.6)	75 (3.5)	543 (1.8)	12 (2.8)	532 (3.3)
Hong Kong, SAR	11 (2.8)	555 (6.9)	76 (4.2)	540 (3.4)	13 (3.3)	544 (7.6)
Italy	8 (2.2)	522 (13.4)	73 (3.3)	520 (4.4)	19 (2.7)	495 (8.5)
Netherlands	8 (2.6)	538 (5.1)	84 (3.6)	527 (2.4)	8 (2.5)	504 (8.6)
Morocco s	6 (2.3)	377 (31.1)	28 (5.1)	303 (15.2)	66 (5.1)	302 (8.1)
Tunisia r	6 (2.2)	367 (17.4)	58 (3.8)	325 (8.5)	36 (3.7)	287 (10.8)
Russian Federation	5 (1.8)	562 (18.4)	80 (3.4)	528 (5.6)	15 (3.1)	504 (9.1)
Latvia	5 (2.0)	547 (7.3)	87 (2.8)	532 (2.9)	8 (2.0)	514 (10.4)
Moldova, Rep. of	2 (0.7)	~ ~	63 (4.1)	497 (6.9)	35 (4.1)	494 (6.3)
International Avg.	20 (0.7)	506 (2.4)	66 (0.8)	488 (1.2)	14 (0.6)	467 (2.7)
Benchmarking Participants						
Indiana State, US	35 (5.5)	571 (6.2)	59 (4.9)	544 (4.1)	7 (2.8)	542 (23.9)
Ontario Province, Can.	36 (4.1)	555 (7.7)	55 (4.4)	534 (3.2)	9 (3.2)	518 (14.6)
Quebec Province, Can.	14 (2.7)	516 (6.8)	73 (3.8)	499 (3.0)	13 (3.1)	493 (6.0)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

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

A tilde (~) indicates insuffcient 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.

there was a strong positive relationship between the principals' perception of school climate and average science achievement.

The Index of Science Teachers' Perception of School Climate is presented in Exhibit 8.5. It is based on the teachers' characterizations of the same aspects of school climate as were characterized by the principals (see list above). As can be seen from the results, fourth-grade teachers were in considerable agreement with principals, also placing two-thirds of the fourth-grade students in the medium category. According to their teachers, internationally, on average, 20 percent of the students attended schools in the high category and 14 percent attended schools in the low category. At the eighth grade, teachers had a somewhat more gloomy view of the climate in schools than did the principals. According to their teachers, on average, only 10 percent of the eighth-grade students were attending schools in the high category. Sixty percent were attending schools in the medium category and 30 percent in the low category. Similar to the results for the principals, at both grades, there was a positive relationship between higher reports from teachers and higher average science achievement.

How Serious Are School Attendance Problems?

In some countries, schools are confronted with high rates of absenteeism, which can influence instructional continuity and reduce the time for learning. In general, research has shown that greater truancy is related to less serious attitudes towards school and lower academic achievement. To examine this issue, TIMSS developed an index of good school and class attendance based on schools' responses to three questions about the seriousness of students' absenteeism, arriving late at school, and skipping class. The high index level indicates schools reported that all three behaviors are not a problem. The low level indicates that two or more are a serious problem, or two are minor problems and the third a serious problem. The medium category includes all other possible combinations of responses.

The results of the index for TIMSS 2003 are presented in Exhibit 8.6, which also contains trends between 1999 and 2003 at the eighth grade. At the eighth grade, the results show very little change, on average, in attendance problems. Considering the two assessments, the high category did show a small (statistically significant) increase from 21 percent in 1999 to 23 percent in 2003. Nevertheless, the overwhelming majority of the students – 58 to 59 percent – were in the medium category in both years, and about one-fifth (19-20%) were in the low category. Student attendance problems remain a serious problem in many countries, decreasing in five countries but increasing in four others during the same four-year period. At the fourth grade in 2003, 47 percent of students, on average, internationally, were in the high category, where principals had judged their schools to have few if any attendance problems. Another 47 percent of the students were in schools at the medium level of the index where principals reported moderate attendance problems. Only 5 percent were in schools at the low index level.

Exhibit 8.6: Trends in Index of Good School and Class Attendance (GSCA)

SCIENCE Grade 8

Index of Good School and Class Attendance

Index based on principals' responses to three questions about the seriousness of attendance problems in the school: arriving late at school; absenteeism (i.e., unjustified absences); and skipping class. High level indicates that all three behaviors either never occur or are reported not to be a problem. Low level indicates that two or more behaviors are reported to be a serious problem, or two behaviors are reported to be minor problems and the third a serious problem. Medium level includes all other possible combinations of responses.

▲ 2003 significantly higher

▼ 2003 significantly lower

Countries	High GSCA		Medium GSCA		Low GSCA	
	2003 Percent of Students	1999 Percent of Students	2003 Percent of Students	1999 Percent of Students	2003 Percent of Students	1999 Percent of Students
Lebanon	66 (4.2)	✧ ✧	31 (4.1)	✧ ✧	2 (1.1)	✧ ✧
Italy	56 (3.5)	35 (3.2) ▲	39 (3.6)	57 (3.3) ▼	5 (1.5)	9 (2.2)
Korea, Rep. of	51 (3.8)	31 (3.7) ▲	48 (3.8)	62 (3.9) ▼	1 (0.7)	7 (2.2) ▼
Chinese Taipei	51 (3.9)	28 (3.7) ▲	45 (4.0)	62 (3.6) ▼	4 (1.6)	10 (2.6) ▼
Belgium (Flemish)	47 (4.5)	51 (4.4)	47 (4.4)	46 (4.4)	6 (2.0)	3 (1.0)
Egypt	47 (4.4)	✧ ✧	37 (4.2)	✧ ✧	16 (2.6)	✧ ✧
Singapore	41 (0.0)	32 (4.1) ▲	55 (0.0)	64 (4.0) ▼	4 (0.0)	3 (1.6)
Iran, Islamic Rep. of	36 (3.9)	39 (4.7)	56 (3.8)	58 (4.8)	8 (2.0)	2 (1.2) ▲
Jordan	34 (4.2)	40 (4.3)	52 (4.5)	56 (4.4)	14 (3.1)	4 (1.8) ▲
Saudi Arabia	34 (3.8)	✧ ✧	56 (4.3)	✧ ✧	10 (2.3)	✧ ✧
Slovak Republic	31 (3.8)	32 (4.2)	54 (3.8)	56 (4.4)	16 (3.6)	12 (3.2)
Slovenia	30 (4.0)	– –	55 (4.3)	– –	15 (2.5)	– –
Hungary	30 (3.9)	22 (3.6)	55 (4.3)	62 (4.1)	16 (2.7)	16 (2.9)
Palestinian Nat'l Auth.	29 (3.6)	✧ ✧	53 (4.0)	✧ ✧	18 (3.3)	✧ ✧
Hong Kong, SAR	27 (4.1)	25 (3.9)	69 (4.1)	68 (4.3)	4 (1.8)	7 (2.5)
Morocco	26 (5.5)	– –	56 (6.0)	– –	18 (4.7)	– –
Australia	26 (4.5)	– –	61 (4.4)	– –	13 (2.6)	– –
Bahrain	25 (0.2)	✧ ✧	58 (0.2)	✧ ✧	16 (0.2)	✧ ✧
Macedonia, Rep. of	24 (3.7)	32 (4.4)	54 (4.3)	49 (4.5)	22 (3.3)	19 (3.1)
Chile	22 (3.5)	18 (3.1)	64 (3.8)	69 (3.8)	15 (2.4)	13 (2.7)
Romania	22 (3.7)	15 (3.3)	56 (4.4)	55 (4.3)	22 (3.2)	30 (4.1)
Cyprus r	22 (0.2)	19 (0.1) ▲	65 (0.3)	54 (0.2) ▲	14 (0.3)	27 (0.2) ▼
Armenia r	21 (3.6)	✧ ✧	64 (4.8)	✧ ✧	15 (3.8)	✧ ✧
Norway	20 (4.1)	✧ ✧	71 (4.5)	✧ ✧	8 (2.5)	✧ ✧
United States r	18 (2.7)	19 (3.0)	72 (3.3)	68 (3.5)	10 (2.0)	13 (2.5)
Malaysia	18 (3.5)	6 (2.4) ▲	68 (4.2)	69 (4.1)	14 (3.1)	25 (3.8) ▼
Netherlands r	17 (4.1)	30 (7.3)	64 (4.7)	46 (7.3) ▲	19 (3.5)	24 (7.5)
Tunisia	17 (3.2)	16 (3.1)	60 (4.3)	59 (3.8)	23 (3.4)	25 (3.6)
Serbia	16 (3.2)	✧ ✧	57 (4.5)	✧ ✧	27 (3.7)	✧ ✧
Moldova, Rep. of r	15 (3.5)	1 (1.0) ▲	60 (4.6)	63 (3.8)	26 (4.1)	35 (3.8)
Scotland s	14 (3.7)	✧ ✧	69 (5.3)	✧ ✧	16 (4.0)	✧ ✧
Israel r	13 (3.0)	7 (2.3)	72 (3.6)	58 (4.7) ▲	16 (3.1)	36 (4.5) ▼
Japan	12 (2.3)	9 (2.1)	45 (4.4)	50 (4.0)	44 (4.2)	41 (3.7)
New Zealand	11 (3.3)	15 (2.9)	64 (5.0)	69 (3.7)	26 (4.1)	16 (2.5) ▲
Russian Federation	9 (2.5)	10 (1.7)	70 (3.6)	70 (3.8)	21 (2.9)	20 (3.4)
Indonesia	9 (2.4)	10 (2.6)	58 (4.6)	59 (4.6)	33 (4.3)	32 (4.1)
Latvia	8 (2.2)	– –	56 (4.1)	– –	36 (3.8)	– –
Ghana	8 (2.4)	✧ ✧	69 (3.6)	✧ ✧	23 (3.2)	✧ ✧
Estonia	8 (2.3)	✧ ✧	48 (3.9)	✧ ✧	45 (4.0)	✧ ✧
Sweden	7 (2.2)	✧ ✧	58 (4.1)	✧ ✧	35 (4.1)	✧ ✧
Philippines	7 (2.2)	8 (2.4)	69 (4.1)	72 (3.9)	24 (3.5)	20 (3.4)
South Africa	6 (1.9)	3 (1.3)	50 (3.8)	44 (3.9)	44 (3.6)	53 (4.0)
Lithuania	6 (2.1)	12 (2.6)	52 (4.4)	56 (4.2)	43 (4.4)	32 (3.7)
Botswana	5 (1.9)	✧ ✧	62 (4.7)	✧ ✧	33 (4.6)	✧ ✧
Bulgaria	4 (1.5)	24 (5.6) ▼	59 (4.0)	60 (5.4)	37 (4.1)	16 (3.1) ▲
‡ England	16 (4.2)	– –	72 (5.6)	– –	12 (4.6)	– –
International Avg.	23 (0.5)	21 (0.7) ▲	58 (0.6)	59 (0.8)	19 (0.5)	20 (0.6)
Benchmarking Participants						
Basque Country, Spain	25 (4.4)	✧ ✧	65 (5.1)	✧ ✧	10 (3.2)	✧ ✧
Indiana State, US	14 (5.3)	27 (7.8)	78 (6.4)	66 (8.4)	8 (3.7)	7 (3.7)
Ontario Province, Can.	23 (3.5)	24 (4.1)	71 (4.0)	72 (4.5)	6 (2.2)	4 (2.1)
Quebec Province, Can.	16 (3.2)	7 (3.7) ▲	68 (4.6)	79 (5.8)	15 (3.4)	14 (4.4)

Background data provided by schools.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9)

Trend notes: Because of differences in population coverage, 1999 data are not shown for Australia, Latvia, Morocco, and Slovenia. Korea tested later in 2003 than in 1999, at the beginning of the next school year. Similarly, Lithuania tested later in 1999 than in 2003.

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

A diamond (✧) indicates the country did not participate in the assessment.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 8.6: Index of Good School and Class Attendance (GSCA)

Countries	High GSCA	Medium GSCA	Low GSCA
	2003 Percent of Students	2003 Percent of Students	2003 Percent of Students
Slovenia	81 (3.8)	18 (3.7)	2 (1.1)
Chinese Taipei	79 (3.5)	21 (3.5)	0 (0.0)
Italy	72 (3.4)	26 (3.3)	2 (1.1)
Netherlands	69 (4.1)	31 (4.1)	0 (0.0)
Singapore	65 (4.3)	33 (4.3)	1 (0.6)
Hong Kong, SAR	64 (5.1)	36 (5.1)	0 (0.0)
Belgium (Flemish)	54 (3.9)	45 (4.0)	1 (0.8)
Scotland	53 (5.4)	43 (5.4)	4 (1.6)
Japan	52 (3.7)	41 (4.0)	7 (1.6)
Norway	51 (4.3)	48 (4.2)	0 (0.0)
Cyprus	49 (5.0)	51 (5.0)	0 (0.0)
Tunisia	46 (3.6)	45 (3.9)	9 (2.2)
Hungary	46 (4.0)	51 (4.0)	3 (1.3)
Lithuania	46 (4.2)	53 (4.2)	2 (1.0)
Iran, Islamic Rep. of	45 (4.7)	53 (4.9)	2 (1.3)
Australia	41 (4.4)	55 (4.6)	4 (2.0)
Latvia	41 (4.3)	52 (4.8)	7 (2.4)
Morocco r	39 (4.8)	41 (5.3)	20 (3.9)
England r	38 (4.9)	58 (5.1)	4 (1.4)
New Zealand	35 (3.1)	63 (3.3)	2 (0.9)
Armenia r	33 (4.1)	55 (4.6)	11 (3.4)
Russian Federation	28 (3.5)	68 (3.7)	4 (1.4)
Moldova, Rep. of r	26 (4.0)	56 (4.6)	19 (3.7)
United States	21 (2.8)	71 (2.8)	8 (1.8)
Philippines	11 (2.7)	74 (3.9)	15 (3.3)
International Avg.	47 (0.8)	47 (0.9)	5 (0.4)
Benchmarking Participants			
Indiana State, US	29 (5.9)	68 (5.8)	3 (2.3)
Ontario Province, Can.	35 (4.4)	61 (4.4)	3 (2.2)
Quebec Province, Can.	43 (3.9)	53 (4.1)	4 (2.1)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by schools.

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

How Safe and Orderly Are Schools?

Since school safety is central for providing an environment conducive to learning, TIMSS asked both teachers and students to characterize their perceptions of safety in their schools. More specifically, teachers were asked how much they agreed with three statements:

- This school is located in a safe neighborhood;
- I feel safe at this school;
- This school's security policies and practices are sufficient.

TIMSS used the teachers' responses to create an index, called the Index of Science Teachers' Perceptions of Safety in the Schools. If their teachers agreed or agreed a lot to all three statements, then the students were placed in the high category. If their teachers disagreed or disagreed a lot to all three statements, then students were placed in the low category. All other combinations (some agreements and some disagreements) were placed in the medium category.

Exhibit 8.7 contains the results for the Index of Science Teachers' Perception of Safety in the Schools. On the positive side of things, across countries, about three-fourths of students in both grades were in the high category (70 percent of the eighth-grade students and 76 percent of the fourth-grade students). More than one-fifth were in the medium category (24 to 20 percent, respectively), and only 6 to 4 percent were in the low category. At both grades, there was a positive relationship between teachers' reports of school safety and science achievement.

TIMSS asked the students to answer "yes" or "no" to whether each of the following five things had happened during the last month:

- Something of mine was stolen;
- I was hit or hurt by other students;
- I was made to do things that I didn't want to do by other students;

- I was made fun of or called names;
- I was left out of activities by other students.

TIMSS used students' responses to create the Index of Students' Perception of Being Safe in the Schools. Students who reported being in a safe environment, answering "no" to all five statements, were placed in the high category. Students who reported being in a much riskier school environment by answering "yes" to all five statements were placed in the low category. Students who answered "yes" to some statements and "no" to others were placed in the medium category.

Exhibit 8.8 presents the results for the Index of Students' Perception of Being Safe in the Schools. Internationally, on average, eighth-grade students reported a greater sense of security than did fourth-grade students. Nearly half of the eighth-grade students (48%) were in the high category, 37 percent were in the medium category, and 15 percent were in the low category. It should be emphasized, however, that the feeling of safety was not universal. In several countries, more than one-third of the eighth-grade students were in the low category, including Jordan, the Philippines, Ghana, and South Africa. There was a positive relationship between eighth-grade students' reporting being in safer schools and science achievement.

At the fourth grade, across the participating countries, 35 percent of the students, on average, were in the high category, 42 percent were in the medium category, and 23 percent were in the low category. The two countries with more than one-third of the fourth-grade students in the low category were Chinese Taipei and the Philippines. Similar to the eighth grade, there was a direct relationship at the fourth grade between students' reporting being in safer schools and having higher science achievement.

Exhibit 8.7: Index of Science Teachers' Perception of Safety in the Schools (TPSS)

SCIENCE Grade 8

Index of Teachers' Perception of Safety in the Schools

Index based on teachers' responses to three statements about their schools: this school is located in a safe neighborhood; I feel safe at this school; this school's security policies and practices are sufficient. High level indicates that the teacher agrees a lot or agrees to all three statements. Low level indicates that teacher disagrees or disagrees a lot to all three statements. Medium level includes all other combinations of responses.

Countries	High TPSS		Medium TPSS		Low TPSS	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Singapore	91 (1.5)	578 (4.8)	8 (1.5)	574 (16.2)	1 (0.6)	~ ~
Hong Kong, SAR	88 (2.9)	559 (3.1)	12 (2.9)	535 (16.6)	0 (0.0)	~ ~
Egypt	85 (2.7)	424 (4.3)	13 (2.7)	408 (10.8)	2 (1.1)	~ ~
Indonesia	85 (2.5)	423 (4.4)	12 (2.2)	425 (7.7)	3 (1.3)	408 (26.3)
Hungary	84 (2.2)	543 (3.1)	14 (2.0)	538 (4.7)	2 (0.7)	~ ~
Israel	82 (2.8)	491 (3.3)	15 (2.5)	482 (11.2)	3 (1.1)	481 (11.1)
Saudi Arabia	82 (3.5)	398 (4.7)	15 (3.4)	395 (4.4)	4 (1.5)	390 (10.0)
Slovak Republic	81 (2.2)	518 (3.5)	17 (2.0)	511 (5.4)	2 (0.8)	~ ~
Lebanon	81 (2.6)	405 (5.0)	17 (2.6)	351 (8.4)	2 (0.8)	~ ~
Norway	81 (2.9)	495 (2.2)	19 (2.9)	489 (6.3)	0 (0.0)	~ ~
United States	80 (2.3)	538 (3.3)	18 (2.3)	506 (8.3)	2 (0.8)	~ ~
Belgium (Flemish)	80 (3.0)	517 (3.1)	18 (2.7)	512 (7.6)	2 (1.2)	~ ~
Netherlands r	79 (2.4)	539 (3.4)	18 (2.1)	535 (8.0)	2 (1.2)	~ ~
Lithuania	79 (2.6)	520 (2.3)	19 (2.5)	512 (4.1)	2 (0.7)	~ ~
New Zealand	78 (5.2)	522 (5.7)	18 (4.6)	523 (11.4)	3 (2.8)	515 (7.4)
Sweden	78 (2.7)	528 (2.7)	21 (2.6)	515 (5.2)	1 (0.7)	~ ~
Romania	78 (2.4)	471 (5.3)	19 (2.3)	466 (8.2)	3 (0.8)	445 (23.9)
Serbia	75 (2.6)	467 (2.6)	17 (2.2)	470 (5.6)	8 (1.4)	459 (4.8)
Philippines	75 (4.0)	384 (7.1)	20 (3.7)	365 (12.6)	5 (2.0)	377 (22.6)
Tunisia	75 (3.4)	406 (2.3)	21 (3.2)	396 (4.1)	4 (1.7)	401 (11.6)
Cyprus	74 (1.3)	440 (2.4)	22 (1.3)	444 (3.8)	4 (0.2)	429 (4.6)
Bahrain	74 (2.0)	441 (2.2)	21 (1.9)	431 (3.9)	5 (1.6)	429 (7.1)
Iran, Islamic Rep. of	73 (3.4)	455 (3.2)	23 (3.4)	453 (3.6)	3 (1.4)	435 (13.7)
Malaysia	73 (4.1)	515 (4.3)	21 (3.6)	504 (8.0)	6 (2.3)	493 (11.0)
Slovenia	73 (2.6)	522 (2.0)	21 (2.2)	521 (2.6)	6 (1.4)	516 (5.3)
Jordan	72 (3.6)	477 (4.8)	25 (3.6)	469 (8.5)	3 (1.4)	463 (21.5)
Macedonia, Rep. of	71 (2.9)	450 (4.0)	25 (2.5)	450 (7.0)	4 (1.1)	448 (10.6)
Australia r	70 (3.6)	527 (4.5)	26 (3.5)	529 (9.0)	3 (1.3)	501 (14.0)
Bulgaria r	69 (3.4)	482 (5.3)	24 (3.0)	473 (6.1)	7 (1.7)	468 (15.6)
Estonia	69 (2.5)	551 (2.7)	29 (2.3)	556 (3.5)	2 (0.5)	~ ~
Italy	68 (3.3)	499 (3.3)	23 (3.0)	473 (5.8)	9 (2.2)	480 (11.8)
Armenia r	66 (3.0)	463 (4.1)	30 (2.6)	464 (5.5)	5 (1.2)	460 (8.3)
Latvia	63 (2.9)	511 (3.1)	31 (2.6)	517 (3.5)	6 (1.3)	511 (8.9)
Chinese Taipei	63 (4.3)	578 (4.0)	32 (4.0)	559 (6.0)	4 (1.7)	543 (8.5)
Scotland s	61 (3.1)	523 (5.0)	35 (3.0)	509 (6.1)	4 (1.4)	461 (27.1)
Russian Federation	60 (2.3)	514 (4.0)	34 (2.3)	511 (4.7)	6 (1.3)	515 (12.0)
Morocco	59 (4.3)	404 (4.1)	25 (4.2)	395 (5.5)	16 (4.1)	386 (5.6)
Chile	58 (3.9)	424 (4.6)	35 (3.7)	397 (4.4)	7 (1.5)	393 (7.5)
Japan	55 (3.9)	555 (2.7)	35 (3.5)	551 (3.1)	10 (2.3)	539 (6.0)
Palestinian Nat'l Auth.	54 (4.1)	434 (4.8)	26 (3.9)	438 (6.5)	20 (3.6)	435 (9.7)
Moldova, Rep. of	51 (2.6)	477 (3.6)	37 (2.4)	465 (5.1)	12 (1.8)	467 (8.5)
Korea, Rep. of r	49 (3.5)	560 (2.8)	42 (3.4)	557 (2.9)	8 (2.1)	566 (7.3)
Ghana	43 (4.7)	254 (11.0)	43 (4.8)	253 (9.0)	14 (3.3)	256 (16.0)
Botswana	36 (4.6)	367 (7.5)	43 (4.3)	366 (4.4)	20 (3.8)	353 (5.3)
South Africa	29 (3.6)	302 (19.9)	35 (3.9)	220 (12.4)	36 (4.1)	221 (7.9)
‡ England s	62 (5.0)	563 (7.4)	34 (5.0)	536 (9.2)	4 (1.7)	494 (11.0)
International Avg.	70 (0.5)	479 (0.8)	24 (0.5)	468 (1.2)	6 (0.3)	447 (2.4)
Benchmarking Participants						
Basque Country, Spain	69 (5.1)	492 (3.2)	29 (5.2)	488 (6.1)	2 (1.1)	~ ~
Indiana State, US	82 (4.2)	534 (5.1)	15 (4.1)	525 (10.0)	3 (0.5)	470 (41.7)
Ontario Province, Can.	90 (2.5)	535 (2.7)	8 (2.4)	525 (11.1)	2 (1.4)	~ ~
Quebec Province, Can.	81 (3.3)	533 (3.3)	18 (3.3)	530 (7.3)	0 (0.3)	~ ~

Background data provided by teachers.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

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

An "r" indicates 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) 2003

Exhibit 8.7: Index of Science Teachers' Perception of Safety in the Schools (TPSS)

Countries	High TPSS		Medium TPSS		Low TPSS	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Norway	91 (2.8)	466 (2.7)	9 (2.7)	467 (12.4)	1 (0.7)	~ ~
Singapore	88 (2.5)	568 (5.6)	12 (2.5)	542 (17.4)	0 (0.0)	~ ~
Hungary	88 (3.0)	528 (3.2)	11 (2.8)	538 (12.6)	1 (1.0)	~ ~
New Zealand r	88 (1.9)	524 (2.8)	12 (1.9)	484 (9.4)	0 (0.3)	~ ~
Netherlands	85 (2.2)	531 (2.0)	13 (2.1)	497 (7.7)	2 (1.5)	~ ~
United States	83 (2.1)	545 (2.5)	14 (1.9)	499 (7.6)	2 (0.7)	~ ~
Hong Kong, SAR	83 (3.8)	542 (3.5)	15 (3.6)	547 (6.1)	2 (1.3)	~ ~
Armenia s	82 (4.7)	449 (6.2)	15 (4.5)	424 (14.2)	3 (1.6)	506 (28.8)
Iran, Islamic Rep. of	81 (4.3)	416 (4.8)	16 (4.1)	406 (11.3)	2 (1.5)	~ ~
Lithuania	81 (3.1)	513 (2.7)	17 (2.8)	502 (5.4)	3 (1.1)	505 (9.7)
Tunisia r	79 (3.8)	319 (6.7)	11 (2.6)	290 (25.4)	10 (2.8)	299 (18.0)
Australia	79 (3.5)	529 (3.9)	20 (3.5)	494 (15.6)	1 (0.7)	~ ~
Philippines	78 (3.7)	340 (11.8)	17 (3.3)	307 (13.9)	5 (2.1)	288 (24.0)
Scotland r	77 (3.2)	513 (3.8)	22 (3.1)	486 (5.8)	1 (0.0)	~ ~
Chinese Taipei	76 (3.4)	553 (2.1)	22 (3.4)	550 (4.2)	2 (1.4)	~ ~
Cyprus	76 (3.4)	482 (2.7)	22 (3.4)	473 (4.1)	2 (0.8)	~ ~
Slovenia	73 (4.1)	487 (3.3)	23 (4.0)	504 (5.0)	4 (1.7)	502 (10.6)
Russian Federation	72 (3.2)	528 (5.8)	26 (3.2)	524 (8.4)	1 (0.7)	~ ~
England r	70 (4.0)	548 (4.4)	28 (4.0)	518 (7.6)	2 (1.2)	~ ~
Belgium (Flemish)	69 (2.9)	518 (1.8)	30 (2.8)	519 (3.7)	1 (0.4)	~ ~
Latvia	66 (3.6)	531 (3.5)	31 (3.6)	532 (5.8)	3 (1.4)	530 (17.1)
Italy	65 (3.5)	520 (4.5)	24 (3.0)	505 (8.3)	12 (2.2)	513 (12.5)
Moldova, Rep. of	63 (4.3)	493 (6.8)	32 (4.1)	504 (7.4)	4 (1.6)	481 (13.4)
Japan	57 (4.0)	548 (2.0)	36 (4.1)	538 (2.6)	7 (2.3)	539 (3.8)
Morocco s	51 (4.7)	314 (11.8)	30 (5.0)	298 (9.5)	20 (4.0)	299 (17.9)
International Avg.	76 (0.7)	492 (1.1)	20 (0.7)	478 (2.2)	4 (0.3)	446 (5.4)
Benchmarking Participants						
Indiana State, US	87 (3.3)	555 (3.9)	11 (2.8)	547 (9.9)	2 (1.2)	~ ~
Ontario Province, Can.	90 (3.1)	542 (3.9)	10 (3.0)	520 (9.2)	0 (0.3)	~ ~
Quebec Province, Can.	80 (3.6)	503 (2.5)	18 (3.4)	495 (7.9)	2 (1.3)	~ ~

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by teachers.

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

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

An "r" indicates 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 8.8: Index of Students' Perception of Being Safe in the Schools (SPBSS)

Index of Students' Perception of Being Safe in the Schools

Index based on students' responses to five statements about things that happened in their schools in the last month (1 = yes, 2 = no): something of mine was stolen; I was hit or hurt by other student(s) (e.g., shoving, hitting, kicking); I was made to do things that I didn't want to do by other students; I was made fun of or called names; I was left out of activities by other students. High level indicates that the student answered NO to all five statements. Low level indicates that the student answered YES to three or more statements. Medium level includes all other possible combinations of responses.

Countries	High SPBSS		Medium SPBSS		Low SPBSS	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Sweden	78 (1.0)	524 (2.7)	20 (0.8)	533 (4.1)	3 (0.3)	524 (9.0)
Armenia	72 (1.0)	468 (3.7)	23 (0.8)	460 (4.7)	6 (0.6)	445 (7.4)
Bulgaria	69 (1.1)	483 (5.8)	25 (0.9)	477 (6.1)	6 (0.5)	464 (9.3)
Serbia	67 (1.2)	471 (2.6)	27 (1.0)	469 (3.6)	5 (0.5)	454 (7.8)
Netherlands	66 (1.4)	538 (3.2)	29 (1.1)	535 (4.1)	5 (0.5)	523 (8.5)
Belgium (Flemish)	64 (1.1)	520 (2.6)	31 (1.0)	513 (3.0)	5 (0.4)	494 (7.1)
Estonia	64 (1.2)	555 (2.6)	30 (1.0)	552 (3.3)	6 (0.5)	544 (5.5)
Norway	63 (1.1)	498 (2.1)	30 (0.8)	493 (3.0)	6 (0.5)	479 (5.6)
Korea, Rep. of	62 (1.1)	558 (1.7)	32 (0.8)	560 (2.4)	6 (0.5)	557 (4.9)
Hungary	61 (1.2)	545 (3.1)	32 (1.0)	543 (3.5)	7 (0.5)	537 (6.0)
Japan	61 (1.0)	552 (2.0)	31 (0.8)	555 (2.5)	8 (0.5)	542 (5.0)
Lithuania	60 (1.1)	520 (2.5)	34 (0.8)	519 (2.9)	7 (0.5)	515 (6.0)
Russian Federation	60 (0.9)	518 (3.8)	35 (0.9)	512 (4.2)	6 (0.4)	513 (5.2)
Scotland	59 (1.2)	511 (3.4)	33 (1.0)	516 (4.2)	8 (0.6)	509 (8.5)
Italy	56 (1.1)	496 (3.3)	35 (0.9)	489 (3.3)	9 (0.6)	473 (5.3)
Latvia	56 (1.4)	520 (2.4)	36 (1.3)	508 (3.4)	7 (0.6)	500 (5.9)
Macedonia, Rep. of	56 (1.2)	467 (3.9)	33 (0.9)	450 (4.5)	11 (0.8)	411 (7.0)
Saudi Arabia	55 (1.9)	403 (4.2)	35 (1.4)	402 (4.4)	11 (0.8)	384 (6.5)
Israel	53 (1.2)	494 (3.5)	35 (1.2)	495 (3.7)	11 (0.6)	462 (6.1)
Slovenia	53 (1.3)	520 (2.0)	38 (1.3)	526 (2.8)	10 (0.6)	509 (4.1)
Malaysia	51 (1.1)	514 (4.2)	41 (1.0)	508 (3.5)	8 (0.5)	500 (5.9)
Slovak Republic	50 (1.2)	522 (3.8)	38 (0.9)	513 (3.6)	12 (0.7)	509 (4.4)
Iran, Islamic Rep. of	49 (1.5)	460 (2.7)	39 (1.1)	449 (2.7)	11 (0.7)	442 (5.0)
Romania	48 (1.4)	480 (5.5)	38 (1.0)	467 (4.6)	14 (0.9)	454 (8.2)
Moldova, Rep. of	48 (1.2)	483 (4.1)	38 (1.0)	470 (3.6)	14 (0.8)	456 (5.3)
Chinese Taipei	47 (0.9)	577 (3.8)	36 (0.7)	569 (3.6)	17 (0.6)	560 (4.4)
Tunisia	47 (1.0)	405 (2.3)	40 (0.9)	402 (2.4)	13 (0.6)	410 (3.9)
Hong Kong, SAR	46 (1.3)	557 (3.1)	42 (1.0)	558 (3.7)	12 (0.7)	548 (4.7)
Singapore	44 (0.7)	589 (4.1)	43 (0.6)	576 (4.5)	13 (0.5)	548 (6.6)
Australia	43 (1.2)	530 (4.2)	40 (1.0)	529 (4.1)	18 (0.9)	524 (4.3)
Egypt	42 (1.3)	463 (3.3)	40 (1.0)	417 (4.3)	18 (0.9)	364 (6.1)
Bahrain	41 (1.0)	449 (2.3)	42 (0.9)	440 (2.3)	17 (0.8)	417 (3.6)
Cyprus	41 (0.9)	456 (2.9)	42 (0.8)	444 (2.1)	17 (0.8)	419 (4.0)
Palestinian Nat'l Auth.	41 (1.3)	455 (2.8)	42 (0.9)	432 (3.7)	17 (0.9)	407 (4.9)
New Zealand	40 (1.5)	529 (5.3)	41 (1.3)	518 (5.4)	19 (1.2)	512 (6.4)
Indonesia	39 (1.2)	429 (3.9)	45 (1.1)	422 (4.3)	16 (0.8)	409 (5.8)
Lebanon	36 (1.8)	431 (6.0)	37 (0.9)	396 (4.5)	26 (1.8)	348 (5.6)
Morocco	35 (1.2)	401 (3.7)	48 (1.1)	400 (3.8)	17 (0.8)	393 (4.4)
Chile	31 (1.0)	420 (3.7)	51 (0.7)	413 (3.5)	18 (0.8)	400 (3.8)
Jordan	17 (2.3)	494 (8.8)	22 (1.6)	461 (5.8)	61 (3.2)	482 (3.5)
Philippines	15 (0.9)	422 (7.8)	47 (0.9)	384 (5.8)	38 (1.1)	354 (6.0)
Ghana	13 (1.0)	300 (8.3)	49 (1.0)	273 (6.0)	38 (1.3)	231 (6.7)
South Africa	13 (0.9)	339 (16.3)	47 (0.9)	257 (6.5)	40 (1.2)	200 (5.2)
Botswana	12 (0.6)	389 (5.9)	56 (0.8)	372 (3.6)	32 (0.9)	351 (3.1)
United States	– –	– –	– –	– –	– –	– –
‡ England	51 (1.4)	545 (5.2)	37 (1.0)	551 (4.6)	12 (1.0)	542 (7.0)
International Avg.	48 (0.2)	484 (0.8)	37 (0.1)	474 (0.7)	15 (0.1)	458 (1.0)
Benchmarking Participants						
Basque Country, Spain	62 (2.0)	494 (2.9)	32 (1.6)	487 (3.8)	6 (0.7)	456 (5.8)
Indiana State, US	– –	– –	– –	– –	– –	– –
Ontario Province, Can.	45 (1.4)	532 (3.3)	40 (1.1)	536 (2.7)	15 (1.1)	530 (5.0)
Quebec Province, Can.	55 (1.2)	532 (3.4)	36 (1.0)	532 (3.6)	9 (0.6)	528 (5.7)

Background data provided by students.

‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit 8.8: Index of Students' Perception of Being Safe in the Schools (SPBSS)

Countries	High SPBSS		Medium SPBSS		Low SPBSS	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia r	58 (1.4)	454 (5.4)	37 (1.4)	430 (4.8)	5 (0.4)	406 (8.5)
Norway	53 (1.2)	480 (2.5)	34 (1.0)	470 (3.6)	13 (0.7)	440 (5.5)
Japan	45 (1.2)	549 (1.9)	39 (0.9)	546 (1.9)	17 (0.8)	527 (3.5)
Lithuania	44 (1.2)	523 (2.6)	43 (1.1)	508 (3.4)	13 (0.7)	500 (5.5)
Netherlands	44 (1.5)	533 (2.3)	40 (1.1)	524 (2.4)	17 (1.0)	513 (3.8)
Latvia	41 (1.3)	544 (2.5)	45 (1.0)	531 (2.8)	14 (0.8)	504 (5.6)
Russian Federation	40 (1.3)	539 (5.8)	46 (1.0)	524 (5.3)	14 (0.8)	508 (7.1)
Hong Kong, SAR	40 (1.5)	552 (3.3)	40 (0.9)	540 (3.2)	21 (1.1)	529 (4.0)
Slovenia	40 (1.4)	501 (2.8)	40 (1.1)	491 (3.2)	20 (1.2)	474 (4.4)
Hungary	37 (1.2)	542 (3.2)	43 (1.0)	531 (3.5)	20 (0.8)	514 (4.7)
Moldova, Rep. of	37 (2.0)	518 (5.8)	43 (1.4)	492 (5.0)	20 (1.3)	474 (7.3)
Belgium (Flemish)	35 (1.2)	527 (2.0)	41 (0.8)	517 (2.4)	24 (0.9)	510 (2.8)
Iran, Islamic Rep. of	33 (2.2)	423 (5.9)	44 (1.4)	413 (5.1)	23 (1.6)	412 (6.0)
Italy	33 (1.1)	524 (5.5)	42 (0.9)	518 (4.0)	25 (1.0)	507 (4.7)
Scotland	33 (1.4)	517 (3.9)	40 (1.0)	503 (3.2)	27 (1.2)	485 (4.0)
England	32 (1.2)	558 (4.0)	42 (0.9)	545 (4.0)	26 (1.2)	514 (4.0)
Australia	29 (1.0)	535 (3.9)	39 (1.0)	525 (4.9)	32 (1.4)	508 (4.8)
Chinese Taipei	28 (1.0)	562 (2.6)	37 (0.8)	555 (1.8)	35 (1.0)	539 (2.3)
Cyprus	27 (1.0)	497 (3.1)	47 (0.8)	484 (2.8)	25 (1.0)	462 (3.2)
New Zealand	26 (0.8)	542 (2.8)	42 (1.0)	523 (3.0)	32 (0.9)	503 (3.6)
Singapore	25 (0.9)	585 (5.1)	47 (0.7)	568 (5.6)	28 (0.9)	545 (6.7)
Morocco r	25 (2.1)	324 (12.2)	52 (1.7)	307 (6.7)	23 (1.4)	301 (10.2)
Tunisia	23 (1.8)	342 (10.6)	50 (1.2)	323 (6.0)	27 (1.4)	307 (7.1)
Philippines	7 (0.8)	370 (28.7)	43 (1.1)	336 (10.2)	50 (1.5)	327 (8.0)
United States	– –	– –	– –	– –	– –	– –
International Avg.	35 (0.3)	502 (1.7)	42 (0.2)	488 (1.0)	23 (0.2)	471 (1.3)
Benchmarking Participants						
Indiana State, US	– –	– –	– –	– –	– –	– –
Ontario Province, Can.	30 (1.1)	555 (5.4)	40 (1.0)	541 (3.8)	29 (1.1)	528 (3.8)
Quebec Province, Can.	34 (1.1)	511 (3.2)	42 (0.8)	501 (2.8)	24 (1.1)	488 (4.0)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background data provided by students.

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

Appendix A

Overview of TIMSS Procedures for Assessing Science

History

TIMSS 2003 is the latest in a long series of studies conducted by the International Association for the Evaluation of Educational Achievement (IEA). Since its inception in 1959, the IEA has conducted almost 20 studies of cross-national achievement in the curricular areas of mathematics, science, language, civics, and reading.

In particular, TIMSS 2003 continues a rich tradition of studies designed to improve teaching and learning in mathematics and science. IEA conducted the pioneering First International Science Study (FISS) in 1970-71 and the Second International Science Study (SISS) in 1983-84. The First and Second International Mathematics Studies (FIMS and SIMS) were conducted in 1964 and 1980-82, respectively. The Third International Mathematics and Science Study (TIMSS) in 1994-1995 was the largest and most complex IEA study ever conducted, including both mathematics and science at third and fourth grades, seventh and eighth grades, and the final year of secondary school.

In 1999, TIMSS (now renamed the Trends in International Mathematics and Science Study) again assessed eighth-grade students

in both mathematics and science to measure trends in student achievement since 1995. Also, 1999 represented four years since the first TIMSS, and the population of students originally assessed as fourth-graders had advanced to the eighth grade. Thus, TIMSS 1999 also provided information about whether the relative performance of these students had changed in the intervening years.

TIMSS 2003, the third data collection in the TIMSS cycle of studies, was administered at the eighth and fourth grades. For countries that participated in previous assessments, TIMSS 2003 provides three-cycle trends at the eighth grade (1995, 1999, 2003) and data over two points in time at the fourth grade (1995 and 2003). In countries new to the study, the 2003 results can help policy makers and practitioners assess their comparative standing and gauge the rigor and effectiveness of their mathematics and science programs. TIMSS 2007 will again assess mathematics and science achievement at fourth and eighth grades, providing previously participating countries an opportunity to extend their trend lines and new countries an opportunity to join a valuable and exciting endeavor.

Participants in TIMSS

Exhibit A.1 lists all the countries that have participated in TIMSS in 1995, 1999, or 2003 at fourth or eighth grade. In all, 67 countries have participated in TIMSS at one time or another. Of the 49 countries that participated in TIMSS 2003, 48 participated at the eighth grade and 26 at the fourth grade. Yemen participated at the fourth but not the eighth grade. The exhibit shows that at the eighth grade 23 countries also participated in TIMSS 1995 and TIMSS 1999. For these participants, trend data across three points in time are available. Eleven countries participated in TIMSS 2003 and TIMSS 1999 only, while three countries participated in TIMSS 2003 and TIMSS 1995. These countries have trend data for two points in time. Of the 12 new countries participating in the study, 11 participated at eighth grade and 2 at the fourth grade.

Of the 26 countries participating in TIMSS 2003 at the fourth grade, 16 also participated in 1995, providing data at two points in time.

Inspired by the very successful TIMSS 1999 benchmarking initiative in the United States,[1] in which 13 states and 14 school districts or district consortia administered the TIMSS assessment and compared their students' achievement to student achievement world wide, TIMSS 2003 provided an international benchmarking program, whereby regions or localities of countries could participate in the study to compare to international standards. TIMSS 2003 included four benchmarking participants at the eighth grade: the Basque Country of Spain, the U.S. state of Indiana, and the Canadian provinces of Ontario and Quebec. Indiana, Ontario, and Quebec participated also at the fourth grade. Having also participated in 1999, Indiana has data at two points in time at eighth grade. Ontario and Quebec participated also in 1995 and 1999, and so have trend data across three points in time at both grade levels.

1 Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., O'Connor, K.M., Chrostowski, S.J., Gregory, K.D., Garden, R.A., and Smith, T.A. (2001), *Mathematics Benchmarking Report TIMSS 1999 – Eighth Grade: Achievement for U.S. States and Districts in an International Context*. Chestnut Hill, MA: Boston College.

Exhibit A.1: **Countries Participating in TIMSS 2003, 1999, and 1995**

Countries	Grade 8			Grade 4	
	2003	1999	1995	2003	1995
[1] Argentina	●	●			
Armenia	●			●	
Australia	●	●	●	●	●
Austria			●		●
Bahrain	●				
Belgium (Flemish)	●	●	●	●	
Belgium (French)			●		
Botswana	●				
Bulgaria	●	●	●		
Canada		●	●		●
Chile	●	●			
Chinese Taipei	●	●		●	
Colombia			●		
Cyprus	●	●	●	●	●
Czech Republic		●	●		●
Denmark			●		
Egypt	●				
England	●	●	●	●	●
Estonia	●				
Finland		●			
France			●		
Germany			●		
Ghana	●				
Greece			●		●
Hong Kong, SAR	●	●	●	●	●
Hungary	●	●	●	●	●
Iceland			●		●
Indonesia	●	●			
Iran, Islamic Rep. of	●	●	●	●	●
Ireland			●		●
Israel	●	●	●		●
Italy	●	●	●	●	●
Japan	●	●	●	●	●
Jordan	●	●			
Korea, Rep. of	●	●	●		●
Kuwait			●		●
Latvia	●	●	●	●	●
Lebanon	●				
Lithuania	●	●	●	●	
Macedonia, Rep. of	●	●			
Malaysia	●	●			
Moldova, Rep. of	●	●		●	
Morocco	●	●		●	
Netherlands	●	●	●	●	●
New Zealand	●	●	●	●	●
Norway	●		●	●	●
Palestinian Nat'l Auth.	●				
Philippines	●	●		●	
Portugal			●		●

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

1 Argentina administered the TIMSS 2003 data collection one year late, and did not score and process its data in time for inclusion in this report.

Exhibit A.1: Countries Participating in TIMSS 2003, 1999, and 1995

Countries	Grade 8			Grade 4	
	2003	1999	1995	2003	1995
Romania	●	●	●		
Russian Federation	●	●	●	●	
Saudi Arabia	●				
Scotland	●		●	●	●
Serbia	●				
Singapore	●	●	●	●	●
Slovak Republic	●	●	●		
Slovenia	●	●	●	●	●
South Africa	●	●	●		
Spain			●		
Sweden	●		●		
Switzerland			●		
[2] Syrian Arab Republic	●				
Thailand		●	●		●
Tunisia	●	●		●	
Turkey		●			
United States	●	●	●	●	●
[2] Yemen				●	
Benchmarking Participants					
[2] Basque Country, Spain	●				
Indiana State, US	●	●		●	
[3] Ontario Province, Can.	●	●	●	●	●
[3] Quebec Province, Can.	●	●	●	●	●

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

2 Because the characteristics of their samples are not completely known, achievement data for Syrian Arab Republic and Yemen are presented in Appendix F of this report.

3 Ontario and Quebec participated in TIMSS 1999 and 1995 as part of Canada.

Developing the TIMSS 2003 Science Assessment

The development of the TIMSS 2003 science assessment was a collaborative process spanning a two-and-a-half-year period and involving science educators and development specialists from all over the world.[2] Central to this effort was a major updating and revision of the existing TIMSS assessment frameworks to address changes during the last decade in curricula and the way science is taught. The resulting publication, entitled *TIMSS Assessment Frameworks and Specifications 2003*, serves as the basis of TIMSS 2003 and beyond.[3]

As shown in Exhibit A.2, the science assessment framework for TIMSS 2003 is framed by two organizing dimensions or aspects, a content domain and a cognitive domain. The content domains – life science, chemistry, physics, earth science, and environmental science at the eighth grade and life science, physical science, and earth science at the fourth grade – define the specific science subject matter covered by the assessment. The three cognitive domains – factual knowledge, conceptual understanding, and reasoning and analysis – define the sets of behaviors expected of students as they engage with the science content.

Developing the TIMSS assessments for 2003 was a cooperative venture involving all of the National Research Coordinators (NRCs) during the entire process. Although about half of the items in the 1999 eighth-grade assessment had been kept secure and were available for use in 2003 to measure trends from 1995 and 1999, the ambitious goals for curriculum coverage and innovative problem solving tasks specified in the *Frameworks and Specifications* necessitated a tremendous item development effort.

To maximize the effectiveness of the contributions from national centers, the TIMSS & PIRLS International Study Center developed a detailed item-writing manual and conducted a workshop for countries that wished to provide items for the international item pool. At this workshop, an item development "Task Force" consisting of the science coordinator and two experienced science item writers reviewed general

2 For a full discussion of the TIMSS 2003 test development effort, please see Smith Neidorf, T.A. and Garden, R.A. (2004), "Developing the TIMSS 2003 Mathematics and Science Assessment and Scoring Guides" in M.O. Martin, I.V.S. Mullis and S.J. Chrostowski (eds.), *TIMSS 2003 Technical Report*, Chestnut Hill, MA: Boston College.

3 Mullis, I.V.S., Martin, M.O., Smith, T.A., Garden, R.A., Gregory, K.D., Gonzalez, E.J., Chrostowski, S.J, and O'Connor, K.M. (2003), *TIMSS Assessment Frameworks and Specifications 2003 (2nd Edition)*, Chestnut Hill, MA: Boston College.

For the TIMSS frameworks used in 1995 and 1999, see Robitaillle, D.F., McKnight, C.C., Schmidt, W.H., Britton, E.D., Raisen, S.A., and Nicol, C. (1993), *TIMSS Monograph No. 1: Curriculum Frameworks for Mathematics and Science*, Vancouver, BC: Pacific Educational Press.

Exhibit A.2: **The Content and the Cognitive Domains of the Science Framework**

Content Domain

Grade 8

- Life Science
- Chemistry
- Physics
- Earth Science
- Environmental Science

Grade 4

- Life Science
- Physical Science
- Earth Science

Cognitive Domain

- Factual Knowledge
- Conceptual Understanding
- Reasoning and Analysis

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

item-writing guidelines for multiple-choice and constructed-response items and provided specific training in writing science items in accordance with the *TIMSS Assessment Frameworks and Specifications 2003*. In the weeks that followed, more than 2,000 items and scoring guides were drafted and reviewed by the task force. The items were further reviewed by the Science and Mathematics Item Review Committee, a group of internationally prominent mathematics and science educators nominated by participating countries to advise on subject-matter issues in the assessment. Committee members also contributed enormously to the quality of the assessment by helping to develop tasks and items to assess problem solving and scientific inquiry.

Participating countries field-tested the items with representative samples of students, and all of the potential new items were again reviewed by the Science and Mathematics Item Review Committee. The NRCs had several opportunities to review the items and scoring criteria. The resulting TIMSS 2003 science tests contained 189 items at the eighth grade and 152 items at the fourth grade.

Exhibit A.3 presents the number and percentage of items, the number of multiple-choice and constructed-response items, and the number of score points in each of the science content domains for eighth and fourth grades. Comparable information is presented for the three cognitive domains. About two-fifths of the items at each grade level were in constructed-response format, requiring students to generate and write their own answers. Some constructed-response questions asked for short answers while others required extended responses with students showing their work or providing explanations for their answers. The remaining questions used a multiple-choice format. In scoring the items, correct answers to most questions were worth one point. However, responses to some constructed-response questions (particularly those requiring extended responses) were evaluated for partial credit, with a fully correct answer being awarded two points (see later section on scoring). The total number of score points available for analysis thus somewhat exceeds the number of items (211 and 168

score points for eighth- and fourth-grades, respectively). Less than half of the students' testing time (48% at eighth grade and 46% at fourth grade) was allocated to constructed-response items.

To ensure reliable measurement of trends over time, the TIMSS 2003 assessment included items that had been used in the 1995 and 1999 assessments as well as items developed for the first time in 2003. Exhibit A.4 shows the distribution of score points across content domains for both trend items and items used for the first time. Of the 211 score points available in the entire 2003 science assessment, 24 came from items used also in 1995, 52 from items used also in 1999, and 135 from items used for the first time in 2003. At fourth grade, 33 score points came from 1995 items, and the remaining 135 from new 2003 items.

Every effort was made to ensure that the tests represented the curricula of the participating countries and that the items exhibited no bias toward or against particular countries. The final forms of the test were endorsed by the NRCs of the participating countries. In addition, countries had an opportunity to match the content of the test to their curriculum. They identified items measuring topics not covered in their intended curriculum. The information from this Test-Curriculum Matching Analysis, provided in Appendix C, indicates that omitting such items has little effect on the overall pattern of results.

Exhibit A.3: **Distribution of Science Items by Content Domain and Cognitive Domain**

Content Domain	Percentage of Items	Total Number of Items	Number of Multiple-Choice Items	Number of Constructed-Response Items[1]	Number of Score Points[2]
Life Science	29	54	29	25	65
Chemistry	16	31	20	11	34
Physics	24	46	28	18	49
Earth Science	16	31	22	9	33
Environmental Science	14	27	10	17	30
Total	100	189	109	80	211

Cognitive Domain	Percentage of Items	Total Number of Items	Number of Multiple-Choice Items	Number of Constructed-Response Items[1]	Number of Score Points[2]
Factual Knowledge	30	57	50	7	59
Conceptual Understanding	39	73	42	31	80
Reasoning and Analysis	31	59	17	42	72
Total	100	189	109	80	211

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

1 Constructed-response items include both short-answer and extended-response types.
Because results are rounded to the nearest whole number, some totals may appear inconsistent.

2 In scoring the tests, correct answers to most items were worth one point. However, responses to some constructed-response items were evaluated for partial credit with a fully correct answer awarded two points. Thus, the number of score points exceeds the number of items in the test.

Exhibit A.3: **Distribution of Science Items by Content Domain and Cognitive Domain**

Content Domain	Percentage of Items	Total Number of Items	Number of Multiple-Choice Items	Number of Constructed-Response Items[1]	Number of Score Points[2]
Life Science	43	65	41	24	72
Physical Science	35	53	29	24	59
Earth Science	22	34	21	13	37
Total	100	152	91	61	168

Cognitive Domain	Percentage of Items	Total Number of Items	Number of Multiple-Choice Items	Number of Constructed-Response Items[1]	Number of Score Points[2]
Factual Knowledge	35	54	41	13	59
Conceptual Understanding	42	64	38	26	70
Reasoning and Analysis	23	34	12	22	39
Total	100	152	91	61	168

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

1 Constructed-response items include both short-answer and extended-response types.

2 In scoring the tests, correct answers to most items were worth one point. However, responses to some constructed-response items were evaluated for partial credit with a fully correct answer awarded two points. Thus, the number of score points exceeds the number of items in the test.

Exhibit A.4: **Distribution of Score Points in TIMSS 2003 from Each Assessment Year by Science Content Domain**

Grade 8

Content Domain	From 1995	From 1999	New in 2003	Total
Life Science	6	12	47	65
Chemistry	4	11	19	34
Physics	5	17	27	49
Earth Science	6	6	21	33
Environmental Science	3	6	21	30
Total	24	52	135	211

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Grade 4

Content Domain	From 1995	From 1999	New in 2003	Total
Life Science	12	N/A	60	72
Physical Science	9	N/A	50	59
Earth Science	12	N/A	25	37
Total	33	N/A	135	168

TIMSS 2003 Assessment Design

Not all of the students in the TIMSS assessment responded to all of the science items. To ensure broad subject-matter coverage without overburdening individual students, TIMSS 2003, as in the 1995 and 1999 assessments, used a matrix-sampling technique that assigns each assessment item to one of a set of item blocks, and then assembles student test booklets by combining the item blocks according to a balanced design. Each student takes one booklet containing both mathematics and science items. Thus, the same students participated in both the mathematics and science testing.

Exhibit A.5 summarizes the TIMSS 2003 assessment design, presenting both the matrix-sampling item blocks for mathematics and science and the item block-to-booklet assignment plan. According to the design, the 313 mathematics and science items at fourth grade and 383 items at eighth grade are divided among 28 item blocks at each grade, 14 mathematics blocks labeled M01 through M14, and 14 science blocks labeled S01 through S14. Each block contains either mathematics items only or science items only. This general block design is the same for both grades, although the planned assessment time per block is 12 minutes for fourth grade and 15 minutes for eighth grade. At the eighth grade, six blocks in each subject (blocks 01 – 06) contain secure items from 1995 and 1999 to measure trends and eight blocks (07 – 14) contain new items developed for TIMSS 2003. Since fourth grade was not included in the 1999 assessment, trend items from 1995 only were available, and these were placed in the first three blocks. The remaining 11 blocks contain items new in 2003.

In the TIMSS 2003 design, the 28 blocks of items are distributed across 12 student booklets, as shown in Exhibit A.5. Each booklet consists of six blocks of items. To enable linking between booklets, each block appears in two, three, or four different booklets. The assessment time for individual students is 72 minutes at fourth grade (six 12-minute blocks) and 90 minutes at eighth grade (six 15-minute blocks), which is comparable to that in the 1995 and 1999 assessments. The

booklets are organized into two three-block sessions (Parts I and II), with a break between the parts.

The 2003 assessment was the first TIMSS assessment in which calculators were permitted, and so it was important that the design allow students to use calculators when working on the new 2003 items. However, because calculators were not permitted in TIMSS 1995 or 1999, the design also had to ensure that students did not use calculators when working on trend items from these assessments. The solution was to place the blocks containing trend items (blocks M01 – M06 and S01 – S06) in Part I of the test booklets, to be completed without calculators before the break. After the break, calculators were allowed for the new items (blocks M07 – M14 and S07 – S14). To provide a more balanced design, however, and have information about differences with calculator access, two mathematics trend blocks (M05 and M06) and two science trend blocks (S05 and S06) also were placed in Part II of one booklet each.

Exhibit A.5: TIMSS 2003 Assessment Design

TIMSS 2003 Item Blocks for Matrix-Sampling

Source of Items	Mathematics Blocks	Science Blocks
Trend Items (TIMSS 1995 or 1999)	M01	S01
Trend Items (TIMSS 1995 or 1999)	M02	S02
Trend Items (TIMSS 1995 or 1999)	M03	S03
Trend Items (TIMSS 1999)	M04	S04
Trend Items (TIMSS 1999)	M05	S05
Trend Items (TIMSS 1999)	M06	S06
New Replacement Items (TIMSS 2003)	M07	S07
New Replacement Items (TIMSS 2003)	M08	S08
New Replacement Items (TIMSS 2003)	M09	S09
New Replacement Items (TIMSS 2003)	M10	S10
New Replacement Items (TIMSS 2003)	M11	S11
New Replacement Items (TIMSS 2003)	M12	S12
New Replacement Items (TIMSS 2003)	M13	S13
New Replacement Items (TIMSS 2003)	M14	S14

Booklet Design for TIMSS 2003

Student Booklet	Part I			Part II		
Booklet 1	M01	M02	S06	S07	M05	M07
Booklet 2	M02	M03	S05	S08	M06	M08
Booklet 3	M03	M04	S04	S09	M13	M11
Booklet 4	M04	M05	S03	S10	M14	M12
Booklet 5	M05	M06	S02	S11	M09	M13
Booklet 6	M06	M01	S01	S12	M10	M14
Booklet 7	S01	S02	M06	M07	S05	S07
Booklet 8	S02	S03	M05	M08	S06	S08
Booklet 9	S03	S04	M04	M09	S13	S11
Booklet 10	S04	S05	M03	M10	S14	S12
Booklet 11	S05	S06	M02	M11	S09	S13
Booklet 12	S06	S01	M01	M12	S10	S14

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Background Questionnaires

As in previous assessments, TIMSS in 2003 administered a broad array of questionnaires to collect data on the educational context for student achievement. For TIMSS 2003, a concerted effort was made to streamline and upgrade the questionnaires. This work began with articulating the information to be collected in the TIMSS 2003 framework and continued with extensive field testing.[4]

Across the two grades and two subjects, TIMSS 2003 involved 11 questionnaires. *National Research Coordinators* completed four questionnaires. With the assistance of their curriculum experts, they provided detailed information on the organization, emphasis, and content coverage of the mathematics and science curriculum at fourth and eighth grades. The *fourth- and eighth-grade students* who were tested answered questions pertaining to their attitudes towards mathematics and science, their academic self-concept, classroom activities, home background, and out-of-school activities. The *mathematics and science teachers* of sampled students responded to questions about teaching emphasis on the topics in the curriculum frameworks, instructional practices, professional training and education, and their views on mathematics and science. Separate questionnaires for mathematics and science teachers were administered at the eighth grade, while to reflect the fact that most younger students are taught all subjects by the same teacher, a single questionnaire was used at the fourth grade. The principals or heads of schools at the fourth and eighth grades responded to questions about school staffing and resources, school safety, mathematics and science course offerings, and teacher support.

4 For more information, see Chrostowski, S.J. (2004), "Developing the TIMSS 2003 Background Questionnaires" in M.O. Martin, I.V.S. Mullis, and S.J. Chrostowski (eds.), *TIMSS 2003 Technical Report*, Chestnut Hill, MA: Boston College.

Translation and Verification

The TIMSS data collection instruments were prepared in English and translated into 34 languages. Of the 49 countries and four benchmarking participants, 17 collected data in two languages and one country, Egypt, in three languages – Arabic, English, and French. In addition to translation, it sometimes was necessary to modify the international versions for cultural reasons, even in the countries that tested wholly or partly in English. This process represented an enormous effort for the national centers, with many checks along the way. The translation effort included (1) developing explicit guidelines for translation and cultural adaptation; (2) translation of the instruments by the national centers in accordance with the guidelines, using two or more independent translations; (3) consultation with subject-matter experts on cultural adaptations to ensure that the meaning and difficulty of items did not change; (4) verification of translation quality by professional translators from an independent translation company; (5) corrections by the national centers in accordance with the suggestions made; (6) verification by the International Study Center that corrections were made; and (7) a series of statistical checks after the testing to detect items that did not perform comparably across countries.[5]

5 More details about the translation verification procedures can be found in Chrostowski, S.J. and Malak, B. (2004), "Translation and Cultural Adaptation of the TIMSS 2003 Instruments" in M.O. Martin, I.V.S. Mullis, and S.J. Chrostowski (eds.), *TIMSS 2003 Technical Report*, Chestnut Hill, MA: Boston College.

Population Definition and Sampling

Since it is a curriculum-based study, TIMSS 2003 had as its intended target population all students at the end of their eighth and fourth years of formal schooling in the participating countries. However, for comparability with previous TIMSS assessments, the formal definition for the eighth grade specified all students enrolled in the upper of the two adjacent grades that contained the largest proportion of 13-year-old students at the time of testing, and for fourth grade, all students enrolled in the upper of the two adjacent grades that contained the largest proportion of 9-year-olds. These correspond to the eighth and fourth grades in practically every country.[6]

The selection of valid and efficient samples is crucial to the quality and success of an international comparative study such as TIMSS. The accuracy of the survey results depends on the quality of sampling information and that of the sampling activities themselves. For TIMSS, NRCs worked on all phases of sampling with the TIMSS sampling experts from Statistics Canada and the IEA Data Processing Center (DPC). NRCs received training in how to select the school and student samples and in the use of the sampling software. In consultation with the TIMSS sampling referee (Keith Rust, Westat, Inc.), the TIMSS sampling experts reviewed the national sampling plans, sampling data, sampling frames, and sample execution. The sampling documentation was used by the TIMSS & PIRLS International Study Center, in consultation with the sampling experts and the sampling referee, to evaluate the quality of the samples.

In a few situations where it was not possible to test the entire internationally desired population (all students enrolled in the upper of the two adjacent grades that contained the largest proportion of 13-year-old or 9-year-old students at the time of testing), countries were permitted to define a national desired population that excluded part of the internationally desired population. Exhibit A.6 shows any differences in coverage between the international and national desired populations for eighth and fourth grades. Almost all participants at the

6 The sample design for TIMSS is described in detail in Foy, P., and Joncas, M. (2004), "TIMSS 2003 Sampling Design" in M.O. Martin, I.V.S. Mullis and S.J. Chrostowski (eds.), *TIMSS 2003 Technical Report*, Chestnut Hill, MA: Boston College.

eighth grade achieved 100 percent coverage (47 out of 51), with Indonesia, Lithuania, Morocco, and Serbia the exceptions. Consequently, the results for these countries are annotated in exhibits in this report. At fourth grade, only Lithuania of the 29 participants had less than 100 percent coverage.

Within the desired population, countries could define a population that excluded a small percentage (less than five percent) of certain kinds of schools or students that would be very difficult or resource-intensive to test (e.g., schools for students with special needs or schools that were very small or located in extremely rural areas). Countries excluding more than 10 percent of their population are annotated in the exhibits in this report. Exhibit A.6 shows that only three countries exceeded the 10 percent limit at eighth grade (Israel, Macedonia, and Syria) and no fourth-grade participant did so.

Within countries, TIMSS used a two-stage sample design, in which the first stage involved selecting about 150 public and private schools in each country. Within each school, countries were to use random procedures to select one eighth-grade mathematics class (for eighth-grade participants) and one fourth-grade classroom (fourth-grade participants). All of the students in the sampled class were to participate in the TIMSS testing. This approach was designed to yield a representative sample of at least 4,000 students per country at each grade level. Typically, between 1,200 and 2,000 students responded to each achievement item in each country, depending on the booklets in which the items appeared.

Exhibits A.7 and A.8 present achieved sample sizes for schools and students, respectively, for participating countries. Exhibit A.9 shows the participation rates for schools, students, and overall, both with and without the use of replacement schools. Most countries achieved the minimum acceptable participation rates – 85 percent of both the schools and students, or a combined rate (the product of school and student participation) of 75 percent – although Hong Kong SAR, the Netherlands, and Scotland did so only after including replacement

Exhibit A.6: Coverage of TIMSS 2003 Target Population

SCIENCE Grade 8

Countries	International Desired Population		National Desired Population		
	Coverage	Notes on Coverage	School-Level Exclusions	Within-Sample Exclusions	Overall Exclusions
Armenia	100%		2.9%	0.0%	2.9%
Australia	100%		0.4%	0.9%	1.3%
Bahrain	100%		0.0%	0.0%	0.0%
Belgium (Flemish)	100%		3.1%	0.1%	3.2%
Botswana	100%		0.8%	2.2%	3.0%
Bulgaria	100%		0.5%	0.0%	0.5%
Chile	100%		1.6%	0.7%	2.2%
Chinese Taipei	100%		0.2%	4.6%	4.8%
Cyprus	100%		1.1%	1.5%	2.5%
Egypt	100%		3.4%	0.0%	3.4%
England	100%		2.1%	0.0%	2.1%
Estonia	100%		2.6%	0.8%	3.4%
Ghana	100%		0.9%	0.0%	0.9%
Hong Kong, SAR	100%		3.3%	0.1%	3.4%
Hungary	100%		5.5%	3.2%	8.5%
Indonesia	80%	Non-islamic schools	0.1%	0.3%	0.4%
Iran, Islamic Rep. of	100%		5.5%	1.1%	6.5%
Israel	100%		15.2%	8.6%	22.5%
Italy	100%		0.0%	3.6%	3.6%
Japan	100%		0.5%	0.1%	0.6%
Jordan	100%		0.5%	0.8%	1.3%
Korea, Rep. of	100%		1.5%	3.4%	4.9%
Latvia	100%		3.6%	0.1%	3.7%
Lebanon	100%		1.4%	0.0%	1.4%
Lithuania	89%	Students taught in Lithuanian	1.4%	1.2%	2.6%
Macedonia, Rep. of	100%		12.5%	0.0%	12.5%
Malaysia	100%		4.0%	0.0%	4.0%
Moldova, Rep. of	100%		0.7%	0.5%	1.2%
Morocco	69%	All students but Souss Massa Draa, Casablanca, Gharb-Chrarda	1.5%	0.0%	1.5%
Netherlands	100%		3.0%	0.0%	3.0%
New Zealand	100%		1.7%	2.7%	4.4%
Norway	100%		0.9%	1.5%	2.3%
Palestinian Nat'l Auth.	100%		0.2%	0.3%	0.5%
Philippines	100%		1.5%	0.0%	1.5%
Romania	100%		0.4%	0.1%	0.5%
Russian Federation	100%		1.7%	3.9%	5.5%
Saudi Arabia	100%		0.3%	0.2%	0.5%
Scotland	100%		0.0%	0.0%	0.0%
Serbia	81%	Serbia without Kosovo	2.4%	0.6%	2.9%
Singapore	100%		0.0%	0.0%	0.0%
Slovak Republic	100%		5.0%	0.0%	5.0%
Slovenia	100%		1.3%	0.1%	1.4%
South Africa	100%		0.6%	0.0%	0.6%
Sweden	100%		0.3%	2.5%	2.8%
Syrian Arab Republic	100%		18.7%	0.0%	18.8%
Tunisia	100%		1.8%	0.0%	1.8%
United States	100%		0.0%	4.9%	4.9%
Benchmarking Participants					
Basque Region, Spain	100%		2.1%	3.8%	5.8%
Indiana State, US	100%		0.0%	7.8%	7.8%
Ontario Province, Can.	100%		1.0%	5.0%	6.0%
Quebec Province, Can.	100%		1.4%	3.5%	4.8%

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit A.6: Coverage of TIMSS 2003 Target Population

Countries	International Desired Population		National Desired Population		
	Coverage	Notes on Coverage	School-Level Exclusions	Within-Sample Exclusions	Overall Exclusions
Armenia	100%		2.9%	0.0%	2.9%
Australia	100%		1.2%	1.6%	2.7%
Belgium (Flemish)	100%		5.9%	0.4%	6.3%
Chinese Taipei	100%		0.3%	2.8%	3.1%
Cyprus	100%		1.5%	1.4%	2.9%
England	100%		1.9%	0.0%	1.9%
Hong Kong, SAR	100%		3.7%	0.1%	3.8%
Hungary	100%		4.4%	3.9%	8.1%
Iran, Islamic Rep. of	100%		3.6%	2.1%	5.7%
Italy	100%		0.1%	4.1%	4.2%
Japan	100%		0.4%	0.3%	0.8%
Latvia	100%		4.3%	0.1%	4.4%
Lithuania	92%	Students taught in Lithuanian	2.1%	2.6%	4.6%
Moldova, Rep. of	100%		2.0%	1.6%	3.6%
Morocco	100%		2.2%	0.0%	2.2%
Netherlands	100%		4.1%	1.1%	5.2%
New Zealand	100%		1.5%	2.5%	4.0%
Norway	100%		1.7%	2.7%	4.4%
Philippines	100%		3.8%	0.7%	4.5%
Russian Federation	100%		2.2%	4.7%	6.8%
Scotland	100%		1.5%	0.0%	1.5%
Singapore	100%		0.0%	0.0%	0.0%
Slovenia	100%		0.8%	0.5%	1.3%
Tunisia	100%		0.9%	0.0%	0.9%
United States	100%		0.0%	5.1%	5.1%
Yemen	100%		0.6%	8.9%	9.5%
Benchmarking Participants					
Indiana State, US	100%		0.0%	7.2%	7.2%
Ontario Province, Can.	100%		1.3%	3.5%	4.8%
Quebec Province, Can.	100%		2.7%	0.9%	3.6%

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit A.7: School Sample Sizes

Countries	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	149	0	149
Australia	230	226	186	21	207
Bahrain	67	67	67	0	67
Belgium (Flemish)	150	150	122	26	148
Botswana	152	150	146	0	146
Bulgaria	170	169	163	1	164
Chile	195	195	191	4	195
Chinese Taipei	150	150	150	0	150
Cyprus	59	59	59	0	59
Egypt	217	217	215	2	217
England	160	160	62	25	87
Estonia	154	152	151	0	151
Ghana	150	150	150	0	150
Hong Kong, SAR	150	150	112	13	125
Hungary	160	157	154	1	155
Indonesia	150	150	148	2	150
Iran, Islamic Rep. of	188	181	181	0	181
Israel	150	147	143	3	146
Italy	172	171	164	7	171
Japan	150	150	146	0	146
Jordan	150	140	140	0	140
Korea, Rep. of	151	150	149	0	149
Latvia	150	149	137	3	140
Lebanon	160	160	148	4	152
Lithuania	150	150	137	6	143
Macedonia, Rep. of	150	150	142	7	149
Malaysia	150	150	150	0	150
Moldova, Rep. of	150	149	147	2	149
Morocco	227	165	131	0	131
Netherlands	150	150	118	12	130
New Zealand	175	174	149	20	169
Norway	150	150	138	0	138
Palestinian Nat'l Auth.	150	145	145	0	145
Philippines	160	160	132	5	137
Romania	150	149	148	0	148
Russian Federation	216	216	214	0	214
Saudi Arabia	160	160	154	1	155
Scotland	150	150	115	13	128
Serbia	150	150	149	0	149
Singapore	164	164	164	0	164
Slovak Republic	180	179	170	9	179
Slovenia	177	177	169	5	174
South Africa	265	265	241	14	255
Sweden	160	160	155	4	159
Syrian Arab Republic	150	150	121	13	134
Tunisia	150	150	150	0	150
United States	301	296	211	21	232
Benchmarking Participants					
Basque Region, Spain	120	120	119	1	120
Indiana State, US	56	56	54	0	54
Ontario Province, Can.	200	196	171	15	186
Quebec Province, Can.	199	185	173	2	175

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit A.7: School Sample Sizes

Countries	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	148	0	148
Australia	230	227	178	26	204
Belgium (Flemish)	150	150	133	16	149
Chinese Taipei	150	150	150	0	150
Cyprus	150	150	150	0	150
England	150	150	79	44	123
Hong Kong, SAR	150	150	116	16	132
Hungary	160	159	156	1	157
Iran, Islamic Rep. of	176	171	171	0	171
Italy	172	171	165	6	171
Japan	150	150	150	0	150
Latvia	150	149	137	3	140
Lithuania	160	160	147	6	153
Moldova, Rep. of	153	151	147	4	151
Morocco	227	225	197	0	197
Netherlands	150	149	77	53	130
New Zealand	228	228	194	26	220
Norway	150	150	134	5	139
Philippines	160	160	122	13	135
Russian Federation	206	205	204	1	205
Scotland	150	150	94	31	125
Singapore	182	182	182	0	182
Slovenia	177	177	169	5	174
Tunisia	150	150	150	0	150
United States	310	300	212	36	248
Yemen	150	150	150	0	150
Benchmarking Participants					
Indiana State, US	56	56	56	0	56
Ontario Province, Can.	200	196	179	10	189
Quebec Province, Can.	198	194	192	1	193

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit A.8: Student Sample Sizes

Countries	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	90%	6388	56	0	6332	606	5726
Australia	93%	5286	60	16	5210	419	4791
Bahrain	98%	4351	64	0	4287	88	4199
Belgium (Flemish)	97%	5161	19	7	5135	165	4970
Botswana	98%	5388	70	70	5248	98	5150
Bulgaria	96%	4489	167	0	4322	205	4117
Chile	99%	6528	15	39	6474	97	6377
Chinese Taipei	99%	5525	54	37	5434	55	5379
Cyprus	96%	4314	79	66	4169	167	4002
Egypt	97%	7259	0	0	7259	164	7095
England	86%	3360	34	0	3326	496	2830
Estonia	96%	4242	28	5	4209	169	4040
Ghana	93%	5690	189	0	5501	401	5100
Hong Kong, SAR	97%	5204	33	4	5167	195	4972
Hungary	95%	3506	7	34	3465	163	3302
Indonesia	99%	5884	61	0	5823	61	5762
Iran, Islamic Rep. of	98%	5215	118	52	5045	103	4942
Israel	95%	4880	2	319	4559	241	4318
Italy	97%	4628	35	173	4420	142	4278
Japan	96%	5121	51	5	5065	209	4856
Jordan	96%	4871	176	41	4654	165	4489
Korea, Rep. of	99%	5451	18	50	5383	74	5309
Latvia	89%	4146	23	5	4118	488	3630
Lebanon	96%	4030	64	0	3966	152	3814
Lithuania	89%	6619	58	955	5606	642	4964
Macedonia, Rep. of	97%	4028	0	0	4028	135	3893
Malaysia	98%	5464	46	0	5418	104	5314
Moldova, Rep. of	96%	4262	58	0	4204	171	4033
Morocco	91%	3243	25	0	3218	275	2943
Netherlands	94%	3283	2	0	3281	216	3065
New Zealand	93%	4343	170	65	4108	307	3801
Norway	92%	4569	24	61	4484	351	4133
Palestinian Nat'l Auth.	99%	5543	117	14	5412	55	5357
Philippines	96%	7498	288	0	7210	293	6917
Romania	98%	4249	53	4	4192	88	4104
Russian Federation	97%	4926	50	62	4814	147	4667
Saudi Arabia	97%	4553	115	5	4433	138	4295
Scotland	89%	3962	24	0	3938	422	3516
Serbia	96%	4514	52	2	4460	164	4296
Singapore	97%	6236	5	0	6231	213	6018
Slovak Republic	95%	4428	16	0	4412	197	4215
Slovenia	93%	3883	19	2	3862	284	3578
South Africa	92%	9905	320	0	9585	633	8952
Sweden	89%	4941	58	93	4790	534	4256
Syrian Arab Republic	98%	5001	0	1	5000	105	4895
Tunisia	98%	5106	74	0	5032	101	4931
United States	94%	9891	90	279	9522	610	8912
Benchmarking Participants							
Basque Region, Spain	98%	2736	41	113	2582	68	2514
Indiana State, US	97%	2402	43	107	2252	64	2188
Ontario Province, Can.	95%	4693	59	208	4426	209	4217
Quebec Province, Can.	92%	4919	78	46	4795	384	4411

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit A.8: Student Sample Sizes

Countries	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	91%	6275	57	0	6218	544	5674
Australia	94%	4675	69	39	4567	246	4321
Belgium (Flemish)	98%	4866	17	20	4829	117	4712
Chinese Taipei	99%	4793	11	88	4694	33	4661
Cyprus	97%	4536	27	60	4449	121	4328
England	93%	3917	45	0	3872	287	3585
Hong Kong, SAR	95%	4901	23	4	4874	266	4608
Hungary	94%	3603	11	67	3525	206	3319
Iran, Islamic Rep. of	98%	4587	83	80	4424	72	4352
Italy	97%	4641	23	185	4433	151	4282
Japan	97%	4690	16	16	4658	123	4535
Latvia	94%	3980	16	4	3960	273	3687
Lithuania	92%	5701	35	852	4814	392	4422
Moldova, Rep. of	97%	4162	46	0	4116	135	3981
Morocco	93%	4546	0	0	4546	282	4264
Netherlands	96%	3080	0	30	3050	113	2937
New Zealand	95%	4785	145	107	4533	225	4308
Norway	95%	4706	22	107	4577	235	4342
Philippines	95%	5225	40	31	5154	582	4572
Russian Federation	97%	4229	54	66	4109	146	3963
Scotland	92%	4283	34	0	4249	313	3936
Singapore	98%	6851	16	0	6835	167	6668
Slovenia	92%	3410	13	17	3380	254	3126
Tunisia	99%	4408	23	0	4385	51	4334
United States	95%	10795	49	429	10317	488	9829
Yemen	93%	4550	0	0	4550	345	4205
Benchmarking Participants							
Indiana State, US	98%	2472	44	151	2277	44	2233
Ontario Province, Can.	96%	4813	91	158	4564	202	4362
Quebec Province, Can.	91%	4864	51	73	4740	390	4350

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit A.9: Participation Rates (Weighted)

Countries	School Participation		Class Participation	Student Participation	Overall Participation	
	Before Replacement	After Replacement			Before Replacement	After Replacement
Armenia	99%	99%	99%	90%	89%	89%
Australia	81%	90%	100%	93%	75%	83%
Bahrain	100%	100%	100%	98%	98%	98%
Belgium (Flemish)	82%	99%	98%	97%	77%	94%
Botswana	98%	98%	100%	98%	96%	96%
Bulgaria	97%	97%	99%	96%	92%	92%
Chile	98%	100%	100%	99%	97%	99%
Chinese Taipei	100%	100%	100%	99%	99%	99%
Cyprus	100%	100%	100%	96%	96%	96%
Egypt	99%	100%	100%	97%	97%	97%
England	40%	54%	99%	86%	34%	46%
Estonia	99%	99%	100%	96%	95%	95%
Ghana	100%	100%	100%	93%	93%	93%
Hong Kong, SAR	74%	83%	99%	97%	72%	80%
Hungary	98%	99%	100%	95%	94%	94%
Indonesia	98%	100%	100%	99%	97%	99%
Iran, Islamic Rep. of	100%	100%	100%	98%	98%	98%
Israel	98%	99%	100%	95%	93%	94%
Italy	96%	100%	100%	97%	93%	97%
Japan	97%	97%	100%	96%	93%	93%
Jordan	100%	100%	100%	96%	96%	96%
Korea, Rep. of	99%	99%	100%	99%	98%	98%
Latvia	92%	94%	100%	89%	81%	83%
Lebanon	93%	95%	100%	96%	89%	91%
Lithuania	92%	95%	100%	89%	81%	84%
Macedonia, Rep. of	94%	99%	100%	97%	91%	96%
Malaysia	100%	100%	100%	98%	98%	98%
Moldova, Rep. of	99%	100%	100%	96%	95%	96%
Morocco	79%	79%	100%	91%	71%	71%
Netherlands	79%	87%	100%	94%	74%	81%
New Zealand	86%	97%	100%	93%	80%	90%
Norway	92%	92%	100%	92%	85%	85%
Palestinian Nat'l Auth.	100%	100%	100%	99%	99%	99%
Philippines	81%	86%	100%	96%	78%	82%
Romania	99%	99%	100%	98%	98%	98%
Russian Federation	99%	99%	100%	97%	96%	96%
Saudi Arabia	95%	97%	100%	97%	93%	94%
Scotland	76%	85%	100%	89%	68%	76%
Serbia	99%	99%	100%	96%	96%	96%
Singapore	100%	100%	100%	97%	97%	97%
Slovak Republic	96%	100%	100%	95%	91%	95%
Slovenia	94%	99%	100%	93%	87%	91%
South Africa	89%	96%	100%	92%	82%	88%
Sweden	97%	99%	99%	89%	85%	87%
Syrian Arab Republic	81%	89%	100%	98%	79%	87%
Tunisia	100%	100%	100%	98%	98%	98%
United States	71%	78%	99%	94%	66%	73%
Benchmarking Participants						
Basque Region, Spain	100%	100%	100%	98%	97%	98%
Indiana State, US	97%	97%	100%	97%	94%	94%
Ontario Province, Can.	84%	93%	100%	95%	80%	89%
Quebec Province, Can.	91%	93%	100%	92%	84%	85%

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit A.9: Participation Rates (Weighted)

Countries	School Participation		Class Participation	Student Participation	Overall Participation	
	Before Replacement	After Replacement			Before Replacement	After Replacement
Armenia	99%	99%	100%	91%	90%	90%
Australia	78%	90%	100%	94%	73%	85%
Belgium (Flemish)	89%	99%	100%	98%	87%	97%
Chinese Taipei	100%	100%	100%	99%	99%	99%
Cyprus	100%	100%	100%	97%	97%	97%
England	54%	82%	100%	93%	50%	76%
Hong Kong, SAR	77%	88%	99%	95%	73%	83%
Hungary	98%	99%	100%	94%	92%	93%
Iran, Islamic Rep. of	100%	100%	100%	98%	98%	98%
Italy	97%	100%	100%	97%	93%	97%
Japan	100%	100%	100%	97%	97%	97%
Latvia	91%	94%	100%	94%	85%	88%
Lithuania	92%	96%	99%	92%	84%	87%
Moldova, Rep. of	97%	100%	100%	97%	94%	97%
Morocco	87%	87%	100%	93%	81%	81%
Netherlands	52%	87%	100%	96%	50%	84%
New Zealand	87%	98%	100%	95%	82%	93%
Norway	89%	93%	100%	95%	85%	88%
Philippines	78%	85%	100%	95%	75%	81%
Russian Federation	99%	100%	100%	97%	96%	97%
Scotland	64%	83%	100%	92%	59%	77%
Singapore	100%	100%	100%	98%	98%	98%
Slovenia	95%	99%	100%	92%	87%	91%
Tunisia	100%	100%	100%	99%	99%	99%
United States	70%	82%	99%	95%	66%	78%
Yemen	100%	100%	100%	93%	93%	93%
Benchmarking Participants						
Indiana State, US	100%	100%	100%	98%	98%	98%
Ontario Province, Can.	89%	94%	100%	96%	85%	90%
Quebec Province, Can.	99%	100%	100%	91%	90%	91%

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

schools. The United States and Morocco had overall participation rates after including replacement schools of just below 75 percent (73% and 71%, respectively), and were annotated accordingly. Despite extraordinary efforts to secure full participation, England's participation fell below the minimum requirement of 50 percent, and so their results were annotated and placed below a line in exhibits showing achievement. Because of scheduling difficulties, Korea was unable to test its eighth-grade students in May 2003 as planned. Instead, the students were tested in September 2003, when they had moved into the ninth grade. The results for Korea are annotated accordingly in exhibits in this report.

At fourth grade, all participants achieved the minimum acceptable participation rates, although Australia, England, Hong Kong SAR, the Netherlands, Scotland, and the United States did so only after including replacement schools.

Whereas countries achieved a high degree of compliance with sampling guidelines in 2003, occasionally countries' data were omitted from exhibits dealing with trends from earlier assessments because of comparability issues. Because of differences in population coverage, 1999 eighth-grade data for Australia, Morocco, and Slovenia and fourth-grade data for Italy are not shown in this report. Israel, Italy, and South Africa, experienced difficulties with sampling at the classroom level in 1995; consequently their eighth-grade data from that assessment are not shown in this report.

Data Collection

Each participating country was responsible for carrying out all aspects of the data collection, using standardized procedures developed for the study. Training manuals were created for school coordinators and test administrators that explained procedures for receipt and distribution of materials as well as for the activities related to the testing sessions. These manuals covered procedures for test security, standardized scripts to regulate directions and timing, rules for answering students' questions, and steps to ensure that identification on the test booklets and questionnaires corresponded to the information on the forms used to track students.[7]

Each country was responsible for conducting quality control procedures and describing this effort in the NRC's report documenting procedures used in the study. In addition, the TIMSS & PIRLS International Study Center considered it essential to monitor compliance with standardized procedures. NRCs were asked to nominate one or more persons unconnected with their national center to serve as quality control monitors for their countries. The International Study Center developed manuals for the monitors and briefed them in two-day training sessions about TIMSS, the responsibilities of the national centers in conducting the study, and their roles and responsibilities.

In all, 50 quality control monitors drawn from the 49 countries and four Benchmarking participants participated in the training.[8] Where necessary, quality control monitors who attended the training session were permitted to recruit other monitors to assist them in covering the territory and meeting the testing timetable. All together, the international quality control monitors and those trained by them observed 1,147 testing sessions (755 for grade 8 and 392 for grade 4),[9] and conducted interviews with the National Research Coordinator in each of the participating countries.[10]

The results of the interviews indicate that, in general, NRCs had prepared well for data collection and, despite the heavy demands

7 Data collection procedures for TIMSS is described in detail in Barth, J., Gonzalez, E.J., and Neuschmidt, O. (2004), "TIMSS 2003 Survey Operations Procedures" in M.O. Martin, I.V.S. Mullis and S.J. Chrostowski (eds.), *TIMSS 2003 Technical Report*, Chestnut Hill, MA: Boston College.

8 Iran and Israel were the only countries whose quality control monitors were not trained; Ontario and Quebec shared the same quality control monitor.

9 Operational constraints prevented quality control monitor visits in five testing sessions in Japan.

10 Steps taken to ensure high-quality data collection in TIMSS are described in detail in Gonzalez, E.J. and Diaconu, D. (2004), "Quality Assurance in the TIMSS 2003 Data Collection" in M.O. Martin, I.V.S. Mullis, and S.J. Chrostowski (eds.), *TIMSS 2003 Technical Report*, Chestnut Hill, MA: Boston College.

of the schedule and shortages of resources, were able to conduct the data collection efficiently and professionally. Similarly, the TIMSS tests appeared to have been administered in compliance with international procedures, including the activities before the testing session, those during testing, and the school-level activities related to receiving, distributing, and returning material from the national centers.

Scoring the Constructed-Response Items

Because 40 to 50 percent of the test time was devoted to constructed-response items, TIMSS needed to develop procedures for reliably evaluating student responses within and across countries. Scoring used two-digit codes with rubrics specific to each item. The first digit designates the correctness level of the response. The second digit, combined with the first, represents a diagnostic code identifying specific types of approaches, strategies, or common errors and misconceptions. Although not used in this report, analyses of responses based on the second digit should provide insight into ways to help students better understand science concepts and problem-solving approaches.

To ensure reliable scoring procedures based on the TIMSS rubrics, the International Study Center prepared detailed guides containing the rubrics and explanations of how to implement them, together with example student responses for the various rubric categories. These guides, along with training packets containing extensive examples of student responses for practice in applying the rubrics, were used as a basis for intensive training in scoring the constructed-response items. The training sessions were designed to help representatives of national centers who would then be responsible for training personnel in their countries to apply the two-digit codes reliably.

To gather and document empirical information about the within-country agreement among scorers, TIMSS arranged to have systematic samples of at least 100 student responses to each item scored independently by two readers. Exhibit A.10 shows the average and range of the within-country exact percent of agreement between scorers on the

constructed-response items in the science test for the TIMSS participants. The exhibit shows agreement for both the correctness score (the first digit) and for the two-digit diagnostic score. A high percentage of exact agreement was observed, with an overall average of 97 percent for correctness score and 92 percent for diagnostic score at the eighth grade and 96 and 92 percent, respectively at the fourth grade. The TIMSS data from the reliability studies indicate that scoring procedures were robust for the science items, especially for the correctness score used for the analyses in this report.

The double scoring of a sample of the student test booklets provided a measure of the consistency within each country with which constructed-response questions were scored. TIMSS 2003 also took steps to show that those constructed-response items from 1999 that were used in 2003 were scored in the same way in both assessments. In anticipation of this, countries that participated in TIMSS 1999 sent samples of scored student booklets from the 1999 eighth-grade data collection to the IEA Data Processing Center, where they were digitally scanned and stored in presentation software for later use. As a check on scoring consistency from 1999 to 2003, staff members working in each country on scoring the 2003 eighth-grade data were asked also to score these 1999 responses using the DPC software. The items from 1995 that were used in TIMSS 2003 all were in multiple-choice format, and therefore scoring reliability was not an issue. As shown in Exhibit A.11, there was a very high degree of scoring consistency, with 92 percent exact agreement, on average, internationally, between the scores awarded in 1999 and those given by the 2003 scorers. There was somewhat less agreement at the diagnostic score level, with 81 percent exact agreement, on average.

To monitor the consistency with which the scoring rubrics were applied across countries, TIMSS collected from the Southern-Hemisphere countries that administered TIMSS in English a sample of 150 student responses to 21 constructed-response science questions. This set of 3,150 student responses was then sent to each Northern-Hemisphere

Exhibit A.10: TIMSS 2003 Within-Country Scoring Reliability for the Constructed-Response Science Items

SCIENCE Grade 8

Countries	Correctness Score Agreement			Diagnostic Score Agreement		
	Average of Exact Percent Agreement Across Items	Range of Exact Percent Agreement		Average of Exact Percent Agreement Across Items	Range of Exact Percent Agreement	
		Min	Max		Min	Max
Armenia	98	92	100	97	90	100
Australia	99	94	100	97	89	100
Bahrain	98	94	100	95	85	100
Belgium (Flemish)	97	89	100	93	83	100
Botswana	95	74	100	87	74	97
Bulgaria	91	72	99	84	64	99
Chile	97	91	100	94	89	99
Chinese Taipei	99	97	100	98	86	100
Cyprus	96	87	100	91	80	99
Egypt	100	98	100	100	97	100
England	98	92	100	96	85	100
Estonia	99	97	100	98	88	100
Ghana	98	93	100	93	83	99
Hong Kong, SAR	99	97	100	97	92	100
Hungary	96	87	100	92	83	100
Indonesia	96	87	100	86	68	99
Iran, Islamic Rep. of	98	87	100	95	84	100
Israel	95	89	100	84	66	98
Italy	98	91	100	96	90	100
Japan	97	81	100	93	80	100
Jordan	99	97	100	96	91	100
Korea, Rep. of	98	84	100	95	74	100
Latvia	94	78	100	87	50	100
Lebanon	100	98	100	99	95	100
Lithuania	90	69	100	82	58	100
Macedonia, Rep. of	99	96	100	97	92	100
Malaysia	99	98	100	99	97	100
Moldova, Rep. of	100	99	100	100	99	100
Morocco	94	86	100	86	69	95
Netherlands	90	70	100	84	61	100
New Zealand	98	92	100	93	84	100
Norway	95	83	100	91	80	100
Palestinian Nat'l Auth.	95	82	100	87	69	99
Philippines	98	89	100	94	83	99
Romania	99	96	100	98	94	100
Russian Federation	99	92	100	98	91	100
Saudi Arabia	97	87	100	91	68	99
Scotland	97	89	100	94	85	100
Serbia	99	94	100	98	92	100
Singapore	100	99	100	99	98	100
Slovak Republic	99	95	100	97	89	100
Slovenia	90	70	100	81	61	100
South Africa	99	94	100	96	88	99
Sweden	92	76	100	85	68	99
Tunisia	98	90	100	94	73	100
United States	92	72	100	83	68	99
International Avg.	97	88	100	92	80	99
Benchmarking Participants						
Basque Country, Spain	96	87	100	92	79	100
Indiana State, US	94	82	100	87	67	100
Ontario Province, Can.	91	77	100	83	62	98
Quebec Province, Can.	92	80	100	84	66	100

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit A.10: TIMSS 2003 Within-Country Scoring Reliability for the Constructed-Response Science Items

Countries	Correctness Score Agreement			Diagnostic Score Agreement		
	Average of Exact Percent Agreement Across Items	Range of Exact Percent Agreement		Average of Exact Percent Agreement Across Items	Range of Exact Percent Agreement	
		Min	Max		Min	Max
Armenia	99	97	100	97	91	100
Australia	99	94	100	98	91	100
Belgium (Flemish)	99	89	100	95	86	100
Chinese Taipei	98	89	100	96	89	100
Cyprus	94	76	100	89	75	99
England	98	87	100	96	86	100
Hong Kong, SAR	99	97	100	97	89	100
Hungary	95	80	100	91	78	100
Iran, Islamic Rep. of	96	85	100	93	83	99
Italy	94	77	100	90	77	100
Japan	97	86	100	94	83	100
Latvia	96	82	100	92	71	99
Lithuania	93	81	100	86	50	99
Moldova, Rep. of	100	100	100	100	100	100
Morocco	97	93	100	92	78	99
Netherlands	91	71	99	84	70	99
New Zealand	97	86	100	92	83	99
Norway	97	85	100	93	84	100
Philippines	97	89	100	91	77	99
Russian Federation	99	98	100	99	96	100
Scotland	98	90	100	96	85	100
Singapore	100	99	100	99	97	100
Slovenia	91	74	100	85	69	100
Tunisia	93	79	100	82	68	96
United States	93	70	100	86	68	99
International Avg.	96	85	100	92	80	99
Benchmarking Participants						
Indiana State, US	95	76	100	92	62	100
Ontario Province, Can.	95	80	100	90	75	100
Quebec Province, Can.	95	81	100	89	72	99

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit A.11: TIMSS 2003 Trend Scoring Reliability (1999–2003) for the Constructed-Response Science Items

Countries	Correctness Score Agreement			Diagnostic Score Agreement		
	Average of Exact Percent Agreement Across Items	Range of Exact Percent Agreement		Average of Exact Percent Agreement Across Items	Range of Exact Percent Agreement	
		Min	Max		Min	Max
Australia	93	75	100	81	56	100
Belgium (Flemish)	92	79	100	83	68	100
Bulgaria	96	87	100	83	45	100
Chile	91	80	100	77	47	100
Chinese Taipei	92	70	100	80	38	100
Cyprus	90	70	99	79	50	99
Hong Kong, SAR	89	74	100	80	58	100
Hungary	92	74	100	84	64	100
Indonesia	90	63	100	75	41	97
Iran, Islamic Rep.	92	68	100	82	55	99
Israel	93	80	100	81	46	100
Italy	94	86	100	88	73	100
Japan	92	72	100	84	62	100
Jordan	96	90	100	87	76	99
Korea, Rep. of	93	77	100	85	56	100
Latvia	79	36	100	65	21	98
Lithuania	86	66	100	74	40	100
Macedonia, Rep. of	99	89	100	98	80	100
Malaysia	92	80	100	74	35	100
New Zealand	94	87	99	79	52	98
Philippines	90	44	100	76	32	100
Romania	96	91	100	90	73	100
Russian Federation	93	80	100	79	55	99
Singapore	97	93	100	88	61	100
Slovak Republic	89	73	100	76	56	100
Slovenia	94	71	100	90	72	100
South Africa	93	71	100	79	19	100
United States	94	83	100	84	70	100
International Avg.	92	75	100	81	54	100
Benchmarking Participants						
Ontario Province, Can.	91	76	100	81	60	100
Quebec Province, Can.	91	76	100	81	60	100

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit A.12: TIMSS 2003 Cross-Country Scoring Reliability for the Constructed-Response Science Items

Item Label	Total Valid Comparisons	Exact Percent Agreement	
		Correctness Score Agreement	Diagnostic Score Agreement
S032202	99900	83	73
S022283	99900	93	86
S022154	99900	83	70
S022191	99900	94	83
S022088A	99900	83	72
S022088B	99900	76	61
S022286	99900	91	77
S032625A	99900	97	94
S032625B	99900	92	72
S032120A	99900	78	61
S032120B	99900	87	69
S032063	99900	81	73
S032306	99900	88	83
S032640	99900	89	79
S032272	99900	95	88
S032650A	99900	90	84
S032650B	99900	87	80
S032056	99900	88	74
S032369	99900	80	71
S032565	99900	90	78
S032516	99900	84	74
Average Percent Agreement		87	76

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

country having scorers proficient in English and scored independently by one or if possible two of these scorers. Each of the responses was scored by 37 scorers from the countries that participated. Making all possible comparisons among scorers gave 666 comparisons for each student response to each item, and 99,900 total comparisons when aggregated across all 150 student responses to that item. Agreement across countries was defined in terms of the percentage of these comparisons that were in exact agreement. Exhibit A.12 shows that scorer reliability across countries was high, with the percent exact agreement averaging 87 percent across the 21 items for the correctness score and 76 percent for the diagnostic score.

Test Reliability

Exhibit A.13 displays the mathematics test reliability coefficient for each country. This coefficient is the median Cronbach's alpha reliability across the 12 test booklets. At both grade levels, median reliabilities generally were high, with an international median (the median of the reliability coefficients for all countries) of 0.84 at both grades. Despite the generally high reliabilities, there were some countries with median reliabilities below 0.80, namely Bahrain, Botswana, Ghana, Indonesia, Morocco, Saudi Arabia, Syria, and Tunisia at the eighth grade and Belgium (Flemish), Hong Kong SAR, Morocco, and the Netherlands at the fourth grade.

Exhibit A.13: **Cronbach's Alpha Reliability Coefficient – TIMSS 2003 Science Test**

Countries	Reliability Coefficient[1]	
	Grade 8	Grade 4
Armenia	0.81	0.84
Australia	0.86	0.85
Bahrain	0.78	
Belgium (Flemish)	0.84	0.77
Botswana	0.72	
Bulgaria	0.88	
Chile	0.82	
Chinese Taipei	0.89	0.80
Cyprus	0.81	0.81
Egypt	0.85	
England	0.88	0.86
Estonia	0.84	
Ghana	0.63	
Hong Kong, SAR	0.83	0.76
Hungary	0.88	0.84
Indonesia	0.79	
Iran, Islamic Rep. of	0.81	0.81
Israel	0.87	
Italy	0.85	0.85
Japan	0.86	0.82
Jordan	0.87	
Korea, Rep. of	0.87	
Latvia	0.83	0.80
Lebanon	0.81	
Lithuania	0.85	0.80
Macedonia, Rep. of	0.85	
Malaysia	0.83	
Moldova, Rep. of	0.82	0.87
Morocco	0.70	0.74
Netherlands	0.85	0.75
New Zealand	0.87	0.87
Norway	0.83	0.84
Palestinian Nat'l Auth.	0.83	
Philippines	0.81	0.86
Romania	0.89	
Russian Federation	0.86	0.86
Saudi Arabia	0.71	
Scotland	0.85	0.85
Serbia	0.86	
Singapore	0.91	0.87
Slovak Republic	0.87	
Slovenia	0.84	0.83
South Africa	0.84	
Sweden	0.86	
Syrian Arab Republic	0.77	
Tunisia	0.67	0.81
United States	0.88	0.85
Yemen		0.80
International Median	0.84	0.84
Benchmarking Participants		
Basque Country, Spain	0.81	
Indiana State, US	0.85	0.82
Ontario Province, Can.	0.84	0.84
Quebec Province, Can.	0.82	0.81

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

1 The reliability coefficient for each country is the median Cronbach's alpha reliability across the 12 test booklets.

Data Processing

To ensure the availability of comparable, high-quality data for analysis, TIMSS took rigorous quality control steps to create the international database.[11] TIMSS prepared manuals and software for countries to use in entering their data, so that the information would be in a standardized international format before being forwarded to the IEA Data Processing Center in Hamburg for creation of the international database. Upon arrival at the Data Processing Center, the data underwent an exhaustive cleaning process. This involved several iterative steps and procedures designed to identify, document, and correct deviations from the international instruments, file structures, and coding schemes. The process also emphasized consistency of information within national data sets and appropriate linking among the many student, teacher, and school data files.

Throughout the process, the TIMSS 2003 data were checked and double-checked by the IEA Data Processing Center, the International Study Center, and the national centers. The national centers were contacted regularly and given multiple opportunities to review the data for their countries. In conjunction with the IEA Data Processing Center, the International Study Center reviewed item statistics for each cognitive item in each country to identify poorly performing items. On the fourth-grade science test, two items were deleted for all countries. In addition, 10 countries had one or more items deleted (in most cases, one or two). Usually the poor statistics (negative point-biserials for the key, large item-by-country interactions, and statistics indicating lack of fit with the model) were a result of translation, adaptation, or printing deviations. At eighth grade, no science items were deleted for all countries, but 16 countries had one or more items deleted (mostly one or two).

11 These steps are detailed in Barth, J., Carstens, R., and Neuschmidt, O. (2004), "Creating and Checking the TIMSS 2003 Database" in M.O. Martin, I.V.S. Mullis, and S.J. Chrostowski (eds.), *TIMSS 2003 Technical Report*, Chestnut Hill, MA: Boston College.

IRT Scaling and Data Analysis

The general approach to reporting the TIMSS achievement data was based primarily on item response theory (IRT) scaling methods.[12] The science results were summarized using a family of 2-parameter and 3-parameter IRT models for dichotomously-scored items (right or wrong), and generalized partial credit models for items with 0, 1, or 2 available score points. The IRT scaling method produces a score by averaging the responses of each student to the items that he or she took in a way that takes into account the difficulty and discriminating power of each item. The methodology used in TIMSS includes refinements that enable reliable scores to be produced even though individual students responded to relatively small subsets of the total science item pool. Achievement scales were produced for each of the science content areas (life science, chemistry, physics, earth science, and environmental science at the eighth grade and life science, physical science, and earth science at the fourth grade), as well as for science overall.

The IRT methodology was preferred for developing comparable estimates of performance for all students, since students answered different test items depending upon which of the 12 test booklets they received. The IRT analysis provides a common scale on which performance can be compared across countries. In addition to providing a basis for estimating mean achievement, scale scores permit estimates of how students within countries vary and provide information on percentiles of performance.

As shown in Exhibit A.5, TIMSS has a complicated booklet design, with blocks of items appearing in different positions in different booklets. For example, the items in block M1 appear as the first block in Booklet 1, as the second block in Booklet 6, and as the third block in Booklet 12. This allows the booklets to be linked together efficiently, but also to monitor and counterbalance any position effect. In TIMSS 2003, the counterbalanced booklet design made it possible to detect an unexpectedly strong position effect in the data as the item statistics for each country were reviewed. More specifically, this position

12 For a detailed description of the TIMSS scaling, see Gonzalez, E.J., Galia, J., and Li, I. (2004), "Scaling Methods and Procedures for the TIMSS 2003 Mathematics and Science Scales" in M.O. Martin, I.V.S. Mullis, and S.J. Chrostowski (eds.), *TIMSS 2003 Technical Report*, Chestnut Hill, MA: Boston College.

effect occurred because some students in all countries did not reach all the items in the third block position, which was the end of the first half of each booklet before the break. The same effect was evident for the sixth block position, which was the last block in the booklets. The IRT scaling addressed this problem by treating items in the third and sixth block positions as if they were unique, even though they also appeared in other positions. For example, the mathematics items in block M1 from Booklet 1 (the first position) and from Booklet 6 (second position) were considered to be the same items for scaling and reporting purposes, but those in Booklet 12 (the third position) were scaled as items that were different and unique.

The TIMSS science achievement scale was designed to provide a reliable measure of student achievement spanning 1995, 1999, and 2003. The metric of the scale was established originally with the 1995 assessment. When all countries participating in 1995 at the eighth grade are treated equally, the TIMSS scale average over those countries is 500 and the standard deviation is 100. The same applies for the fourth-grade assessment. Since the countries varied in size, each country was weighted to contribute equally to the mean and standard deviation of the scale. The average and standard deviation of the scale scores are arbitrary and do not affect scale interpretation. To preserve the metric of the original 1995 scale, the 1999 eighth-grade assessment was scaled using students from the countries that participated in both 1995 and 1999. Then students from the countries that tested in 1999 but not 1995 were assigned scores on the basis of the scale.

At the eighth grade, TIMSS developed the 2003 scale in the same way as in 1999, preserving the metric first with students from countries that participated in both 1999 and 2003,[13] and then assigning scores on the basis of the scale to students tested in 2003 but not the earlier assessment. At fourth grade, because there was no assessment in 1999, the 2003 and 1995 data were linked directly together using students from countries that participated in both assessments, and the

13 Because the 1995 student data had already been linked to the 1999 student data, it was not necessary to include the 1995 data in the 1999-2003 calibration.

students tested in 2003 but not 1995 were assigned scores on the basis of the scale.

To allow more accurate estimation of summary statistics for student subpopulations, the TIMSS scaling made use of plausible-value technology, whereby five separate estimates of each student's score were generated on each scale, based on the student's responses to the items in the student's booklet and the student's background characteristics. The five score estimates are known as "plausible values," and the variability between them encapsulates the uncertainty inherent in the score estimation process.

In addition to the scales for science overall, IRT scales also were created for each of the science content areas for the 2003 data. However, insufficient common items were used in 1995 and 1999 to establish reliable IRT content area scales for trend purposes. The trend exhibits presented in Chapter 3 were based on the average percentage of students responding correctly to the common items in each content area.

Estimating Sampling Error

Because the statistics presented in this report are estimates of national performance based on samples of students, rather than the values that could be calculated if every student in every country had answered every question, it is important to have measures of the degree of uncertainty of the estimates. The jackknife procedure was used to estimate the standard error associated with each statistic presented in this report.[14] The jackknife standard errors also include an error component due to variation among the five plausible values generated for each student. The use of confidence intervals, based on the standard errors, provides a way to make inferences about the population means and proportions in a manner that reflects the uncertainty associated with the sample estimates. An estimated sample statistic plus or minus two standard errors represents a 95 percent confidence interval for the corresponding population result.

14 Procedures for computing jackknifed standard errors are presented in Gonzalez, E.J., Galia, J., Arora, A., Erberber, E., and Diaconu, D. (2004), "Reporting Student Achievement in Mathematics and Science" in M.O. Martin, I.V.S. Mullis, and S.J. Chrotowski (eds.), *TIMSS 2003 Technical Report*, Chestnut Hill, MA: Boston College.

Assessing Statistical Significance

This report makes extensive use of statistical hypothesis-testing to provide a basis for evaluating the significance of differences in percentages and in average achievement scores. Each separate test follows the usual convention of holding to 0.05 the probability that reported differences could be due to sampling variability alone. There is one important difference in the way TIMSS 2003 reports significance tests compared with the practice in 1995 and 1999. In the previous assessments, significance tests in exhibits where the results of many tests are reported simultaneously were based on a Bonferroni procedure for multiple comparisons. The Bonferroni procedure was not used in TIMSS 2003. The procedure takes into account the number of comparisons being made, which is a function of the number of countries participating. Since this varies from assessment to assessment, the Bonferroni procedure makes it difficult to compare results from one assessment to the next. However, users of the reports should be aware that, following the logic of statistical hypothesis testing, on average, about five percent of statistical tests will be significant by chance alone.

Setting International Benchmarks of Student Achievement

In order to provide meaningful descriptions of what performance on the TIMSS science scale could mean in terms of the science that students know and can do, TIMSS identified four points on the scale for use as international benchmarks. Selected to represent the range of performance shown by students internationally, the advanced benchmark is 625, the high benchmark is 550, the intermediate benchmark is 475, and the low benchmark is 400. Although the fourth- and eighth-grade scales are different, the same benchmark points are used at both grades.

To interpret the TIMSS scale scores and analyze achievement at the international benchmarks, TIMSS conducted a scale anchoring analysis to describe achievement of students at those four points on

the scale. Scale anchoring is a way of describing students' performance at different points on a scale in terms of what they know and can do. It involves a statistical component, in which items that discriminate between successive points on the scale are identified, and a judgmental component in which subject-matter experts examine the items and generalize to students' knowledge and understandings.[15]

15 The scale-anchoring procedure is described fully in Gonzalez, E.J., Galia, J., Arora, A., Erberber, E., and Diaconu, D. (2004), "Reporting Student Achievement in Mathematics and Science" in M.O. Martin, I.V.S. Mullis, and S.J. Chrotowski (eds.), *TIMSS 2003 Technical Report*, Chestnut Hill, MA: Boston College. An application of the procedure to the 1995 TIMSS data may be found in Kelly, D.L., Mullis, I.V.S., and Martin, M.O. (2000), Profiles of Student Achievement in Mathematics at the *TIMSS International Benchmarks: U.S. Performance and Standards in an International Context*, Chestnut Hill, MA: Boston College.

B

Appendix B

Multiple Comparisons of Average Achievement in Science Content Areas

Exhibit B.1: Multiple Comparisons of Average Achievement in Life Science

SCIENCE Grade 8

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.

Countries	Singapore	Chinese Taipei	Korea, Rep. of	Hong Kong, SAR	Japan	Estonia	England	United States	Hungary	Netherlands	Australia	Sweden	Belgium (Flemish)	New Zealand	Slovenia	Lithuania	Russian Federation	Slovak Republic	Scotland	Latvia	Malaysia	Italy	Norway	Israel	Jordan	Bulgaria	Romania	Serbia	Moldova, Rep. of	Armenia
Singapore			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Korea, Rep. of	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong, SAR	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Estonia	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
England	▼	▼	▼									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
United States	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hungary	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Netherlands	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Australia	▼	▼	▼	▼	▼	▼									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Sweden	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Belgium (Flemish)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
New Zealand	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼										▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Lithuania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Russian Federation	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovak Republic	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Scotland	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲
Latvia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲
Malaysia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲
Italy	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲
Norway	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲
Israel	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲
Jordan	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲
Bulgaria	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲
Romania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲
Serbia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲
Moldova, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲
Armenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	
Macedonia, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	
Iran, Islamic Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	
Bahrain	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Palestinian Nat'l Auth.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Chile	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Egypt	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Indonesia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Saudi Arabia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Botswana	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Lebanon	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Ghana	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
South Africa	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Benchmarking Participants																														
Basque Country, Spain	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲
Indiana State, US	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Ontario Province, Can.	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Quebec Province, Can.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲

Note: 5% of these comparisons would be statistically significant by chance alone.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit B.1: Multiple Comparisons of Average Achievement in Life Science

SCIENCE Grade 8

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.

Macedonia, Rep. of	Iran, Islamic Rep. of	Bahrain	Cyprus	Palestinian Nat'l Auth.	Chile	Egypt	Indonesia	Tunisia	Saudi Arabia	Morocco	Philippines	Botswana	Lebanon	Ghana	South Africa	Basque Country, Spain	Indiana State, US	Ontario Province, Can.	Quebec Province, Can.	Countries
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	Singapore
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	Chinese Taipei
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	Korea, Rep. of
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	Hong Kong, SAR
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▲	Japan
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▲	Estonia
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲	England
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲	United States
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲	Hungary
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲	Netherlands
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲				Australia
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼		Sweden
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼		Belgium (Flemish)
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼		New Zealand
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼		Slovenia
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	Lithuania
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	Russian Federation
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	Slovak Republic
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	Scotland
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	Latvia
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	Malaysia
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	Italy
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	Norway
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	Israel
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Jordan
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Bulgaria
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Romania
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Serbia
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Moldova, Rep. of
		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Armenia
			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Macedonia, Rep. of
			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Iran, Islamic Rep. of
			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Bahrain
▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Cyprus
▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Palestinian Nat'l Auth.
▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Chile
▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Egypt
▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Indonesia
▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Tunisia
▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Saudi Arabia
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▼	▼	▼	▼	Morocco
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▼	▼	▼	▼	Philippines
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▼	▼	▼	▼	Botswana
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▼	▼	▼	▼	Lebanon
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▼	▼	▼	▼	Ghana
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▼	▼	▼	▼	South Africa
																				Benchmarking Participants
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	Basque Country, Spain
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲	Indiana State, US
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲	Ontario Province, Can.
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼		Quebec Province, Can.

▲ Average achievement significantly higher than comparison country

▼ Average achievement significantly lower than comparison country

Note: 5% of these comparisons would be statistically significant by chance alone.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit B.2: Multiple Comparisons of Average Achievement in Chemistry

SCIENCE Grade 8

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.

Countries	Chinese Taipei	Singapore	Hungary	Japan	Estonia	Hong Kong, SAR	Lithuania	Slovenia	Korea, Rep. of	Russian Federation	England	Sweden	Slovak Republic	Netherlands	Latvia	Malaysia	United States	Australia	Belgium (Flemish)	New Zealand	Israel	Scotland	Italy	Norway	Bulgaria	Moldova, Rep. of	Jordan	Romania	Serbia	Macedonia, Rep. of
Chinese Taipei			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Singapore			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hungary	▼	▼		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan	▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Estonia	▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong, SAR	▼	▼	▼	▼	▼		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Lithuania	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovenia	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Korea, Rep. of	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Russian Federation	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
England	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Sweden	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovak Republic	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Netherlands	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Latvia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Malaysia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
United States	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Australia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼										▲	▲	▲	▲	▲	▲	▲	▲
Belgium (Flemish)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲
New Zealand	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲
Israel	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲
Scotland	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲
Italy	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲
Norway	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲
Bulgaria	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲
Moldova, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲
Jordan	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼								
Romania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							
Serbia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						
Macedonia, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				
Armenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			
Iran, Islamic Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Palestinian Nat'l Auth.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Egypt	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Bahrain	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Lebanon	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Chile	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Indonesia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Saudi Arabia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Botswana	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
South Africa	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Ghana	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Benchmarking Participants																														
Basque Country, Spain	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						
Indiana State, US	▼	▼	▼	▼	▼	▼	▼	▼	▼										▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Ontario Province, Can.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼										▲	▲	▲	▲	▲	▲	▲	▲
Quebec Province, Can.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲

Note: 5% of these comparisons would be statistically significant by chance alone.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit B.2: Multiple Comparisons of Average Achievement in Chemistry

SCIENCE Grade 8

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.

Armenia	Iran, Islamic Rep. of	Palestinian Nat'l Auth.	Cyprus	Egypt	Bahrain	Lebanon	Tunisia	Chile	Morocco	Indonesia	Saudi Arabia	Botswana	Philippines	South Africa	Ghana	Basque Country, Spain	Indiana State, US	Ontario Province, Can.	Quebec Province, Can.	Countries
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	Chinese Taipei
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	Singapore
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	Hungary
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	Japan
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	Estonia
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	Hong Kong, SAR
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	Lithuania
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	Slovenia
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	Korea, Rep. of
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▲	Russian Federation
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▲	England
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▲	Sweden
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲		Slovak Republic
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲				Netherlands
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲				Latvia
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲				Malaysia
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲				United States
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▼	Australia
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼		▼	Belgium (Flemish)
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼		▼	New Zealand
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼		▼	Israel
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼		▼	Scotland
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	Italy
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	Norway
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	Bulgaria
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	Moldova, Rep. of
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	Jordan
	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	Romania
	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	Serbia
	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	Macedonia, Rep. of
	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	Armenia
▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Iran, Islamic Rep. of
▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Palestinian Nat'l Auth.
▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Cyprus
▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Egypt
▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Bahrain
▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Lebanon
▼	▼	▼	▼	▼	▼	▼		▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Tunisia
▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Chile
▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Morocco
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▼	▼	▼	▼	Indonesia
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▼	▼	▼	▼	Saudi Arabia
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▼	▼	▼	▼	Botswana
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▼	▼	▼	▼	Philippines
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▼	▼	▼	▼	South Africa
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▼	▼	▼	▼	Ghana
																				Benchmarking Participants
	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	Basque Country, Spain
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲				Indiana State, US
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▼	Ontario Province, Can.
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲		Quebec Province, Can.

▲ Average achievement significantly higher than comparison country

▼ Average achievement significantly lower than comparison country

Note: 5% of these comparisons would be statistically significant by chance alone.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit B.3: Multiple Comparisons of Average Achievement in Physics

SCIENCE Grade 8

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.

Countries	Korea, Rep. of	Singapore	Chinese Taipei	Japan	Hong Kong, SAR	England	Estonia	Netherlands	Hungary	Sweden	Australia	Lithuania	Malaysia	Slovak Republic	New Zealand	United States	Scotland	Belgium (Flemish)	Latvia	Russian Federation	Slovenia	Norway	Bulgaria	Israel	Armenia	Moldova, Rep. of	Romania	Serbia	Italy	Jordan
Korea, Rep. of			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Singapore			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong, SAR	▼	▼	▼	▼		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
England	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Estonia	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Netherlands	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hungary	▼	▼	▼	▼	▼		▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Sweden	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Australia	▼	▼	▼	▼	▼	▼	▼	▼	▼										▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Lithuania	▼	▼	▼	▼	▼	▼	▼	▼	▼										▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Malaysia	▼	▼	▼	▼	▼	▼	▼	▼	▼												▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovak Republic	▼	▼	▼	▼	▼	▼	▼	▼	▼												▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
New Zealand	▼	▼	▼	▼	▼	▼	▼	▼	▼													▲	▲	▲	▲	▲	▲	▲	▲	▲
United States	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼												▲	▲	▲	▲	▲	▲	▲	▲	▲
Scotland	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼												▲	▲	▲	▲	▲	▲	▲	▲	▲
Belgium (Flemish)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼												▲	▲	▲	▲	▲	▲	▲	▲	▲
Latvia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼										▲	▲	▲	▲	▲	▲	▲	▲	▲
Russian Federation	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼												▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲
Norway	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲
Bulgaria	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲
Israel	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲
Armenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲
Moldova, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲
Romania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼						
Serbia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					
Italy	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					
Jordan	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				
Macedonia, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Iran, Islamic Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Bahrain	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Palestinian Nat'l Auth.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Indonesia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Lebanon	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Egypt	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Chile	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Saudi Arabia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Botswana	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
South Africa	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Ghana	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Benchmarking Participants																														
Basque Country, Spain	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲
Indiana State, US	▼	▼	▼	▼	▼	▼	▼	▼	▼													▲	▲	▲	▲	▲	▲	▲	▲	▲
Ontario Province, Can.	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Quebec Province, Can.	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲

Note: 5% of these comparisons would be statistically significant by chance alone.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit B.3: Multiple Comparisons of Average Achievement in Physics

SCIENCE Grade 8

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.

Countries	Macedonia, Rep. of	Cyprus	Iran, Islamic Rep. of	Bahrain	Palestinian Nat'l Auth.	Indonesia	Lebanon	Egypt	Morocco	Chile	Saudi Arabia	Tunisia	Philippines	Botswana	South Africa	Ghana	Basque Country, Spain	Indiana State, US	Ontario Province, Can.	Quebec Province, Can.
Korea, Rep. of	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Singapore	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong, SAR	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
England	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Estonia	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Netherlands	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲
Hungary	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲
Sweden	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			
Australia	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			
Lithuania	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	
Malaysia	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	
Slovak Republic	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	
New Zealand	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	
United States	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼
Scotland	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼
Belgium (Flemish)	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼
Latvia	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼
Russian Federation	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼
Slovenia	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼
Norway	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼
Bulgaria	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼
Israel	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼
Armenia	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼
Moldova, Rep. of	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼
Romania	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Serbia	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Italy	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Jordan		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Macedonia, Rep. of		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Cyprus	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Iran, Islamic Rep. of	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Bahrain	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Palestinian Nat'l Auth.	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Indonesia	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Lebanon	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Egypt	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Morocco	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼
Chile	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▼	▼	▼	▼
Saudi Arabia	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▼	▼	▼	▼
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▼	▼	▼	▼
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▼	▼	▼	▼
Botswana	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▼	▼	▼	▼
South Africa	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▼	▼	▼	▼
Ghana	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▼	▼	▼	▼
Benchmarking Participants																				
Basque Country, Spain	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▼	▼
Indiana State, US	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	
Ontario Province, Can.	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		
Quebec Province, Can.	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			

▲ Average achievement significantly higher than comparison country

▼ Average achievement significantly lower than comparison country

Note: 5% of these comparisons would be statistically significant by chance alone.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit B.4: Multiple Comparisons of Average Achievement in Earth Science

SCIENCE Grade 8

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.

Countries	Estonia	Singapore	Hong Kong, SAR	Chinese Taipei	England	Korea, Rep. of	Hungary	Netherlands	Sweden	United States	Australia	Japan	New Zealand	Slovenia	Slovak Republic	Russian Federation	Norway	Scotland	Latvia	Italy	Lithuania	Belgium (Flemish)	Malaysia	Bulgaria	Israel	Moldova, Rep. of	Jordan	Serbia	Romania	Iran, Islamic Rep. of
Estonia			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Singapore						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong, SAR	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
England	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Korea, Rep. of	▼	▼	▼	▼				▲	▲	▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hungary	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Netherlands	▼	▼	▼	▼	▼									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Sweden	▼	▼	▼	▼	▼	▼								▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
United States	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Australia	▼	▼	▼	▼	▼											▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan	▼	▼	▼	▼	▼	▼								▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
New Zealand	▼	▼	▼	▼	▼	▼	▼													▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼					▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovak Republic	▼	▼	▼	▼	▼	▼	▼	▼		▼									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Russian Federation	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Norway	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Scotland	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼											▲	▲	▲	▲	▲	▲	▲	▲
Latvia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼	▼								▲	▲	▲	▲	▲	▲	▲	▲
Italy	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲
Lithuania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲
Belgium (Flemish)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲
Malaysia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲
Bulgaria	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲
Israel	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲
Moldova, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					
Jordan	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					
Serbia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					
Romania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					
Iran, Islamic Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					
Armenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Bahrain	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Macedonia, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Palestinian Nat'l Auth.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Chile	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Indonesia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Egypt	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Lebanon	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Saudi Arabia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Botswana	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Ghana	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
South Africa	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Benchmarking Participants																														
Basque Country, Spain	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲
Indiana State, US	▼	▼	▼	▼										▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Ontario Province, Can.	▼	▼	▼	▼	▼									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Quebec Province, Can.						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲

Note: 5% of these comparisons would be statistically significant by chance alone.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit B.4: Multiple Comparisons of Average Achievement in Earth Science

SCIENCE Grade 8

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.

Armenia	Cyprus	Bahrain	Macedonia, Rep. of	Palestinian Nat'l Auth.	Chile	Indonesia	Tunisia	Egypt	Morocco	Lebanon	Saudi Arabia	Philippines	Botswana	Ghana	South Africa		Basque Country, Spain	Indiana State, US	Ontario Province, Can.	Quebec Province, Can.	Countries
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▲	▲		Estonia
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▲	▲		Singapore
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▲	▲		Hong Kong, SAR
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▲	▲		Chinese Taipei
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲		▲		England
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲			▼	Korea, Rep. of
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲			▼	Hungary
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲			▼	Netherlands
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲			▼	Sweden
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲			▼	United States
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲			▼	Australia
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲			▼	Japan
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲			▼	New Zealand
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▼	▼	▼	Slovenia
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▼	▼	▼	Slovak Republic
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▼	▼	▼	Russian Federation
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▼	▼	▼	Norway
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▼	▼	▼	Scotland
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▼	▼	▼	Latvia
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▼	▼	▼	Italy
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▼	▼	▼	Lithuania
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▼	▼	▼	Belgium (Flemish)
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▼	▼	▼	Malaysia
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	▼	Bulgaria
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	▼	Israel
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	▼	Moldova, Rep. of
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	▼	Jordan
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	▼	Serbia
	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	▼	Romania
	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	▼	Iran, Islamic Rep. of
	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	▼	Armenia
▼		▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	▼	Cyprus
▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	▼	Bahrain
▼							▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	▼	Macedonia, Rep. of
▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	▼	Palestinian Nat'l Auth.
▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	▼	Chile
▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	▼	Indonesia
▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	▼	Tunisia
▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲		▼	▼	▼	▼	Egypt
▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲		▼	▼	▼	▼	Morocco
▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲		▼	▼	▼	▼	Lebanon
▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲		▼	▼	▼	▼	Saudi Arabia
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲	▲		▼	▼	▼	▼	Philippines
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲		▼	▼	▼	▼	Botswana
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▼	▼	▼	▼	Ghana
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▼	▼	▼	▼	South Africa
																					Benchmarking Participants
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▼	▼	▼	Basque Country, Spain
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲			▼	Indiana State, US
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲			▼	Ontario Province, Can.
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▲	▲		Quebec Province, Can.

▲ Average achievement significantly higher than comparison country

▼ Average achievement significantly lower than comparison country

Note: 5% of these comparisons would be statistically significant by chance alone.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit B.5: Multiple Comparisons of Average Achievement in Environmental Science

SCIENCE Grade 8

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.

Countries	Singapore	Chinese Taipei	Hong Kong, SAR	Korea, Rep. of	England	Estonia	Netherlands	Japan	Australia	United States	Hungary	New Zealand	Belgium (Flemish)	Slovenia	Malaysia	Scotland	Slovak Republic	Latvia	Lithuania	Sweden	Italy	Norway	Jordan	Russian Federation	Iran, Islamic Rep. of	Israel	Romania	Bulgaria	Serbia	Moldova, Rep. of
Singapore			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong, SAR	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Korea, Rep. of	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
England	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Estonia	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Netherlands	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Australia	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
United States	▼	▼	▼	▼									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hungary	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
New Zealand	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Belgium (Flemish)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Malaysia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Scotland	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovak Republic	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Latvia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Lithuania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Sweden	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲
Italy	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲
Norway	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲
Jordan	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲
Russian Federation	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲
Iran, Islamic Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲
Israel	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲
Romania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲
Bulgaria	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				
Serbia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				
Moldova, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				
Indonesia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				
Palestinian Nat'l Auth.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	
Macedonia, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Bahrain	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Chile	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Egypt	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Armenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Saudi Arabia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Botswana	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Lebanon	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Ghana	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
South Africa	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Benchmarking Participants																														
Basque Country, Spain	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲		▲	▲	▲	▲
Indiana State, US	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Ontario Province, Can.	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Quebec Province, Can.	▼	▼	▼	▼		▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲

Note: 5% of these comparisons would be statistically significant by chance alone.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit B.5: Multiple Comparisons of Average Achievement in Environmental Science

SCIENCE Grade 8

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.

Indonesia	Palestinian Nat'l Auth.	Macedonia, Rep. of	Cyprus	Bahrain	Tunisia	Chile	Egypt	Armenia	Saudi Arabia	Philippines	Morocco	Botswana	Lebanon	Ghana	South Africa	Basque Country, Spain	Indiana State, US	Ontario Province, Can.	Quebec Province, Can.	Countries
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	Singapore
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	Chinese Taipei
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	Hong Kong, SAR
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲	Korea, Rep. of
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲				England
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲	Estonia
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲				Netherlands
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲				Japan
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲				Australia
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼		United States
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼		Hungary
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼		New Zealand
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	Belgium (Flemish)
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	Slovenia
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	Malaysia
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	Scotland
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	Slovak Republic
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	Latvia
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	Lithuania
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	Sweden
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	Italy
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	Norway
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	Jordan
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	Russian Federation
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Iran, Islamic Rep. of
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	Israel
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Romania
	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Bulgaria
	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Serbia
		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Moldova, Rep. of
		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Indonesia
					▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Palestinian Nat'l Auth.
▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Macedonia, Rep. of
▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Cyprus
▼								▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Bahrain
▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Tunisia
▼								▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Chile
▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Egypt
▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▼	▼	▼	▼	Armenia
▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▼	▼	▼	▼	Saudi Arabia
▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▼	▼	▼	▼	Philippines
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▼	▼	▼	▼	Morocco
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▼	▼	▼	▼	Botswana
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▼	▼	▼	▼	Lebanon
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▼	▼	▼	▼	Ghana
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▼	▼	▼	▼	South Africa
																				Benchmarking Participants
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼	Basque Country, Spain
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲				Indiana State, US
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲	Ontario Province, Can.
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼		Quebec Province, Can.

▲ Average achievement significantly higher than comparison country

▼ Average achievement significantly lower than comparison country

Note: 5% of these comparisons would be statistically significant by chance alone.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit B.6: Multiple Comparisons of Average Achievement in Life Science

SCIENCE Grade 4

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.

Countries	Singapore	Netherlands	Chinese Taipei	United States	Hungary	Hong Kong, SAR	England	Latvia	Japan	Russian Federation	Belgium (Flemish)	Australia	Italy	New Zealand	Lithuania	Scotland	Moldova, Rep. of	Slovenia	Cyprus	Norway	Armenia	Iran, Islamic Rep. of	Philippines	Morocco	Tunisia	Indiana State, US	Ontario Province, Can.	Quebec Province, Can.
Singapore			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▲
Netherlands			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼		▲
Chinese Taipei	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼		▲
United States	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼		▲
Hungary	▼	▼							▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼		▲
Hong Kong, SAR	▼	▼									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼		▲
England	▼	▼	▼								▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼		▲
Latvia	▼	▼	▼	▼							▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
Japan	▼	▼	▼	▼	▼						▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
Russian Federation	▼	▼	▼	▼												▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
Belgium (Flemish)	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
Australia	▼	▼	▼	▼	▼	▼										▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
Italy	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
New Zealand	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
Lithuania	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
Scotland	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	
Moldova, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	
Slovenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▼	▼	▼
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▼	▼	▼
Norway	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▼	▼	▼
Armenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▼	▼	▼
Iran, Islamic Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▼	▼	▼
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲	▼	▼	▼
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▼	▼	▼
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▼	▼	▼
Benchmarking Participants																												
Indiana State, US		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▲
Ontario Province, Can.	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼		▲
Quebec Province, Can.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	

▲ Average achievement significantly higher than comparison country

▼ Average achievement significantly lower than comparison country

Note: 5% of these comparisons would be statistically significant by chance alone.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit B.7: Multiple Comparisons of Average Achievement in Physical Science

SCIENCE Grade 4

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.

Countries	Singapore	Japan	Chinese Taipei	Hong Kong, SAR	England	Latvia	United States	Russian Federation	Hungary	Australia	New Zealand	Lithuania	Italy	Belgium (Flemish)	Netherlands	Scotland	Slovenia	Moldova, Rep. of	Cyprus	Norway	Armenia	Iran, Islamic Rep. of	Philippines	Tunisia	Morocco	Indiana State, US	Ontario Province, Can.	Quebec Province, Can.
Singapore		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▲
Hong Kong, SAR	▼	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▲
England	▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲	▲
Latvia	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼		▲
United States	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼		▲
Russian Federation	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼		▲
Hungary	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
Australia	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
New Zealand	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
Lithuania	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
Italy	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
Belgium (Flemish)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
Netherlands	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▲
Scotland	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	
Slovenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▲	▼	▼	
Moldova, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▼	▼	
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲	▲	▲	▲	▲	▼	▼	▼
Norway	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲	▲	▲	▲	▼	▼	▼
Armenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▼	▼	▼
Iran, Islamic Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▼	▼	▼
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▼	▼	▼
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▼	▼	▼
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▼	▼	▼
Benchmarking Participants																												
Indiana State, US	▼	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲
Ontario Province, Can.	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲
Quebec Province, Can.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▲	▼	▼	

▲ Average achievement significantly higher than comparison country

▼ Average achievement significantly lower than comparison country

Note: 5% of these comparisons would be statistically significant by chance alone.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit B.8: Multiple Comparisons of Average Achievement in Earth Science

SCIENCE Grade 4

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.

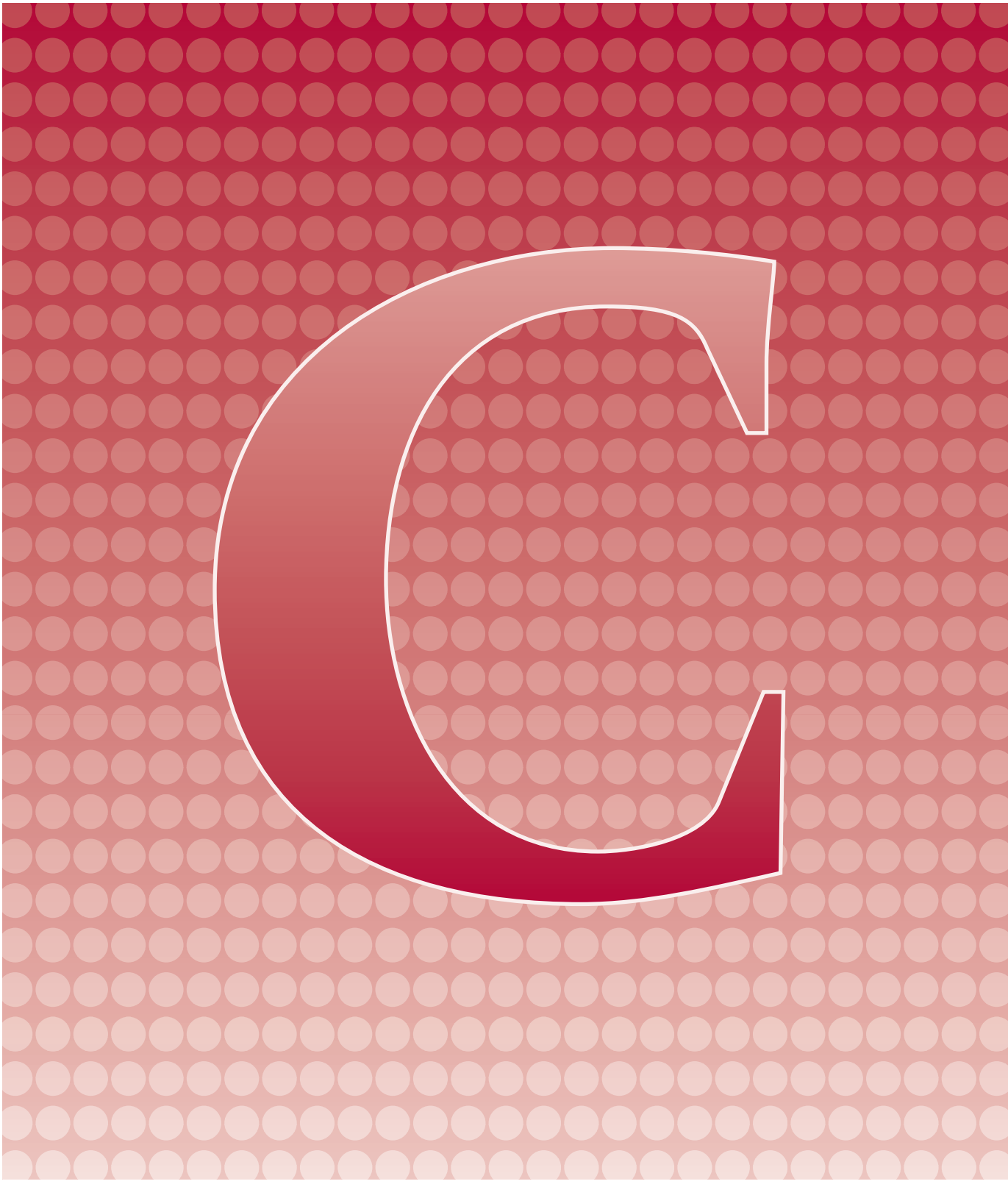
Countries	Chinese Taipei	Singapore	Hong Kong, SAR	England	United States	Japan	Latvia	Russian Federation	Hungary	New Zealand	Belgium (Flemish)	Italy	Australia	Moldova, Rep. of	Lithuania	Netherlands	Scotland	Slovenia	Cyprus	Norway	Armenia	Iran, Islamic Rep. of	Tunisia	Philippines	Morocco		Indiana State, US	Ontario Province, Can.	Quebec Province, Can.
Chinese Taipei		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲	▲
Singapore	▼									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼		▲
Hong Kong, SAR	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼		▲
England	▼									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼		▲
United States	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼		▲
Japan	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼		▲
Latvia	▼									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼		▲
Russian Federation	▼													▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼		▲
Hungary	▼		▼		▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▲
New Zealand	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▲
Belgium (Flemish)	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▲
Italy	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▲
Australia	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▲
Moldova, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	
Lithuania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	
Netherlands	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	
Scotland	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	▼
Slovenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲		▼	▼	▼
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲		▼	▼	▼
Norway	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲	▲	▲	▲		▼	▼	▼
Armenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲	▲	▲		▼	▼	▼
Iran, Islamic Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲	▲		▼	▼	▼
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲		▼	▼	▼
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▼	▼	▼
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▼	▼	▼
Benchmarking Participants																													
Indiana State, US		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▲	▲
Ontario Province, Can.	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼		▲
Quebec Province, Can.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	▼	

▲ Average achievement significantly higher than comparison country

▼ Average achievement significantly lower than comparison country

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Note: 5% of these comparisons would be statistically significant by chance alone.



Appendix C

The Test-Curriculum Matching Analysis: Science

To ensure that comparisons of student achievement across countries would be as fair and equitable as possible, TIMSS developed extensive assessment frameworks and specifications that addressed the important aspects of science in countries' curricula and instructional programs, and went to great lengths to develop assessment items that faithfully represented those specifications. Similar to the procedures used for developing the original TIMSS instruments, developing the TIMSS 2003 tests involved a series of reviews by representatives of the participating countries, experts in science, and testing specialists.[1] The National Research Coordinators (NRCs) from each country formally approved the TIMSS 2003 tests, thus accepting them as being sufficiently fair to compare their students' science achievement with that of students from other countries.

Although the tests were developed to represent an agreed-upon framework and were intended to have as much in common across countries as possible, it was inevitable that the match between the TIMSS 2003 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

1 See Appendix A for more information on test development.

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 appropriateness of the TIMSS 2003 science test for the eighth- and fourth-grade students in the participating countries. TCMA also shows how student performance for individual countries varies when based only on the test questions that are judged to be relevant to their own curricula.[2]

To gather data about the extent to which the TIMSS 2003 tests were relevant to the curricula of the participating countries, each NRC reported whether each item was in that country's intended curriculum at the grade tested (eighth or fourth grade in most countries). The NRC was asked to choose a person or persons who were very familiar with the curriculum at these grades to make this determination. Since an item might be in the curriculum for some but not all students in a country, an item was to be determined appropriate if it was in the intended curriculum for more than 50 percent of the students. The NRCs had considerable flexibility in selecting items and may have considered items inappropriate for other reasons. All participants returned the information for analysis except Syria at eighth grade and Yemen at fourth grade.

Exhibits C.1 and C.2 present the TCMA results for the TIMSS 2003 tests at eighth and fourth grades. Exhibit C.1 shows the average percent correct on the science items selected as appropriate by each country. Exhibit C.2 shows the standard errors corresponding to the percentages presented in Exhibit C.1.

In Exhibit C.1, the last row of the exhibit shows the number of items (score points) identified as appropriate in each country.[3] At the eighth grade, the percentage of score points ranged from 100 percent (206 score points) in Israel and Saudi Arabia to 31 percent (63 score points) in Belgium (Flemish). Generally, the proportion of items judged

2 Because there may also be curriculum areas covered in some countries that are not covered by the TIMSS 2003 tests, the TCMA does not provide complete information about how well the tests cover the curricula of the countries.

3 Some items were assigned more score points than others. In particular, some items had two parts, and some extended-response items were scored on a two-point scale. The TCMA uses score points in order to give the same weight to items given them in test scoring.

appropriate was high, with 40 of the 50 participants indicating that items representing three-quarters or more of the score points (154 out of a possible 206) were appropriate. Only Belgium (Flemish) and Chile considered less than 50 percent of the score points appropriate. At the fourth grade, the percentage of score points ranged from 98 percent (161 score points) in Hungary, the United States, Latvia, Lithuania, Moldova, and Armenia to 27 percent (44 score points) in Japan. Eighteen of the 28 fourth-grade participants indicated that items representing three-quarters or more of the score points (124 out of a possible 165) were appropriate.

Since most countries indicated that some items were not included in their intended curriculum at the grade tested, the data were analyzed to determine whether the inclusion of these items had any effect on the international performance comparisons.[4]

The first column in Exhibit C.1 shows the average percent correct on all test items for each participant. 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 this exhibit, reading across a row provides the average percent correct for the students in that country on the items selected by each of the countries listed across the top of the exhibit. For example, at the eighth-grade, Singapore, where the average percent correct was 65 percent on its own set of items, had 63 percent correct for the items selected by Chinese Taipei, 63 percent for the items selected by Estonia, 62 percent for the items selected by Korea, and so forth. The column for a country listed across the top shows how each of the other participants performed on the subset of items selected as appropriate for that country's students. Using the set of items selected by Bulgaria as an example, on average, 63 percent of these items were answered correctly by students in Singapore, 62 percent by students in Chinese Taipei, 58 percent by students in Estonia, 58 percent by those in Korea, and so forth. The shaded

4 It should be noted that the science achievement presented in Exhibit C.1 is based on average percent correct, which is different from the average scale scores that are presented in Chapter 1.

Exhibit C.1: Average Percent Correct for Test-Curriculum Matching Analysis – Science

Based on Subset of Items Specially Identified by Each Country as Addressing its Curriculum
(See Exhibit C.2 for corresponding standard errors)

SCIENCE Grade 8

Instructions: 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.

Countries	Average Percent Correct on All Items	Singapore	Chinese Taipei	Estonia	Korea, Rep. of	Hong Kong, SAR	Japan	Hungary	England	Sweden	Netherlands	United States	Australia	Slovak Republic	Lithuania	Russian Federation	Slovenia	New Zealand	Latvia	Belgium (Flemish)	Scotland	Malaysia	Italy	Israel	Norway	Jordan
Singapore	62 (0.9)	65	63	63	62	63	63	62	62	63	64	63	62	62	63	64	62	65	63	67	62	64	63	62	62	61
Chinese Taipei	61 (0.8)	63	61	61	61	61	63	61	60	61	63	62	61	60	62	62	61	63	62	65	60	62	62	61	61	59
Estonia	58 (0.6)	59	57	58	58	58	58	58	58	58	60	59	59	58	59	60	59	61	59	62	57	59	59	58	58	57
Korea, Rep. of	57 (0.4)	58	57	57	58	58	59	58	58	57	60	58	57	57	58	57	57	60	58	61	57	59	59	57	58	56
Hong Kong, SAR	57 (0.7)	58	57	57	58	58	58	57	57	57	60	58	57	56	58	58	57	59	58	64	57	58	58	57	57	56
Japan	57 (0.5)	57	57	57	57	57	61	57	57	57	59	58	57	57	58	59	56	59	58	59	56	57	58	57	57	55
Hungary	56 (0.6)	57	56	56	56	56	58	57	56	57	57	57	57	56	57	59	57	59	57	61	55	57	58	56	57	55
England	55 (0.9)	56	54	55	55	55	55	55	55	55	57	56	55	55	56	55	55	58	56	61	54	56	56	55	55	53
Sweden	53 (0.7)	53	52	52	52	53	54	52	52	53	54	54	53	53	54	54	53	56	54	58	52	54	54	53	53	51
Netherlands	52 (0.8)	53	51	53	53	53	52	53	53	52	56	54	53	52	54	52	53	56	54	59	51	54	55	52	53	50
United States	52 (0.7)	52	51	52	52	52	49	52	52	52	53	52	52	52	52	52	52	55	52	58	51	53	54	52	52	50
Australia	51 (0.8)	51	50	51	51	52	49	51	52	51	54	52	52	51	52	52	52	55	52	57	50	52	53	51	52	50
Slovak Republic	51 (0.7)	51	51	51	51	51	52	51	51	52	52	52	51	52	52	54	52	54	52	56	50	52	53	51	51	50
Lithuania	51 (0.5)	52	50	52	51	51	52	51	51	52	53	52	51	51	52	52	51	54	52	56	50	52	52	51	51	50
Russian Federation	50 (0.7)	51	50	51	50	50	51	51	50	51	52	51	51	51	51	55	51	53	51	55	49	52	52	50	51	49
Slovenia	50 (0.4)	50	49	50	49	49	51	50	49	50	51	51	51	50	51	51	51	52	51	55	49	51	51	50	50	48
New Zealand	50 (1.1)	50	49	50	50	50	48	50	50	49	51	51	50	49	51	49	50	53	51	54	49	51	51	50	50	48
Latvia	49 (0.6)	49	48	49	49	49	49	49	49	49	51	50	49	49	50	50	50	52	50	53	47	50	50	49	49	47
Belgium (Flemish)	49 (0.5)	49	48	48	49	49	48	49	49	49	52	50	49	49	50	48	49	51	50	56	47	49	51	49	49	47
Scotland	49 (0.8)	49	48	48	49	49	48	48	49	49	51	50	49	48	50	48	49	51	50	54	47	49	50	49	49	47
Malaysia	48 (0.8)	49	48	48	48	48	49	47	48	48	50	49	48	48	49	49	48	51	49	53	47	50	49	48	48	47
Italy	46 (0.6)	46	45	46	46	46	45	46	46	46	47	46	46	46	46	47	46	48	46	54	45	47	47	46	46	44
Israel	45 (0.6)	46	45	46	45	45	47	45	45	46	46	46	46	46	46	47	46	48	46	51	45	47	47	45	46	44
Norway	45 (0.5)	44	44	45	45	46	44	45	45	45	46	46	46	45	46	46	46	48	46	49	44	46	47	45	45	43
Jordan	42 (0.7)	42	42	43	42	42	44	42	42	42	43	43	42	42	43	44	42	44	43	46	42	43	43	42	42	43
Bulgaria	42 (1.0)	42	41	42	41	41	44	42	42	42	43	42	42	42	42	44	42	44	42	47	41	42	43	42	42	41
Romania	41 (0.9)	41	40	41	40	40	42	41	40	41	43	41	41	41	41	43	41	43	41	45	40	42	42	41	41	40
Serbia	40 (0.5)	40	39	40	39	39	41	39	39	40	40	40	40	40	40	42	40	42	40	45	39	41	41	40	40	39
Moldova, Rep. of	40 (0.7)	40	39	40	39	39	42	40	40	41	41	40	40	40	40	42	40	41	40	44	39	41	41	40	40	39
Armenia	38 (0.7)	39	38	38	37	37	40	38	38	39	40	39	38	38	39	40	38	40	39	41	37	39	40	38	38	38
Iran, Islamic Rep. of	38 (0.5)	38	37	38	38	37	38	38	38	37	39	39	38	38	39	40	38	40	39	41	37	39	39	38	38	37
Macedonia, Rep. of	37 (0.7)	38	37	37	37	36	40	37	37	38	38	37	38	37	37	39	38	39	37	42	36	38	38	37	37	36
Bahrain	36 (0.3)	37	36	36	36	36	40	36	36	37	38	37	36	36	37	37	35	38	37	41	36	37	38	36	37	36
Palestinian Nat'l Auth.	35 (0.6)	36	35	36	35	35	38	35	35	35	36	36	36	35	36	37	35	37	36	38	35	37	36	35	35	36
Cyprus	35 (0.3)	36	34	35	35	34	37	35	35	35	36	36	35	35	36	36	35	37	36	40	34	36	36	35	35	33
Chile	34 (0.5)	34	33	34	33	33	32	33	33	34	34	34	33	34	34	35	34	35	34	39	33	35	35	34	34	32
Egypt	33 (0.6)	34	33	33	33	33	35	33	33	33	34	34	33	33	34	34	33	34	34	36	33	34	34	33	33	33
Indonesia	32 (0.5)	33	31	32	32	32	32	31	32	32	34	32	32	32	32	33	32	34	32	38	31	33	33	32	32	31
Lebanon	29 (0.6)	31	29	29	29	28	33	29	29	30	29	30	30	29	30	31	30	30	30	33	29	31	30	29	29	29
Tunisia	29 (0.3)	30	30	29	29	29	32	29	29	30	31	30	30	29	30	31	30	31	30	35	29	31	30	29	29	28
Morocco	28 (0.3)	30	28	28	28	27	32	28	28	29	29	29	29	29	29	29	28	30	29	33	27	29	29	28	29	27
Saudi Arabia	28 (0.6)	29	28	29	28	28	31	28	28	29	29	29	29	28	29	29	28	30	29	33	28	29	30	28	28	28
Philippines	28 (0.8)	28	27	28	28	27	28	27	28	28	28	28	28	28	28	28	28	29	28	34	27	29	29	28	28	27
Botswana	26 (0.4)	27	25	25	26	25	27	25	25	25	26	26	26	26	26	26	26	26	26	30	25	26	27	26	26	25
South Africa	19 (0.7)	20	18	19	19	18	20	19	19	19	18	19	19	19	19	20	19	19	19	21	19	20	19	19	19	19
Ghana	19 (0.4)	19	18	19	18	17	20	18	18	19	17	18	19	19	18	20	19	18	18	21	18	19	19	19	19	18
International Avg.	43 (0.1)	44	43	43	43	43	44	43	43	43	45	44	43	43	44	44	43	45	44	48	42	44	44	43	43	42
Benchmarking Participants																										
Basque Country, Spain	44 (0.7)	44	43	44	44	44	44	44	44	44	46	45	44	44	45	45	44	47	45	51	43	45	46	44	44	42
Indiana State, US	52 (1.1)	52	51	52	52	52	49	52	52	52	54	53	52	52	53	52	52	55	53	59	51	53	54	52	52	50
Ontario Province, Can.	53 (0.7)	53	52	53	54	54	50	53	53	53	56	54	53	53	54	53	54	57	54	60	52	54	55	53	54	52
Quebec Province, Can.	53 (0.7)	53	52	53	53	54	52	53	53	53	55	54	53	53	54	54	54	57	54	59	52	55	55	53	54	51
Number of Items (Score Points) Identified*	206	176	164	184	194	177	104	198	199	192	145	195	179	190	195	129	176	167	195	63	180	189	188	206	202	181

* Of the 189 items in the Science test, some extended-response items were scored on a two-point scale, resulting in 211 total score points. Following item review, response categories were combined for a number of items, resulting in 206 total score points.

( ) Standard errors appear in parentheses.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit C.1: Average Percent Correct for Test-Curriculum Matching Analysis – Science

Based on Subset of Items Specially Identified by Each Country as Addressing its Curriculum
(See Exhibit C.2 for corresponding standard errors)

SCIENCE Grade 8

Instructions: 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.

Bulgaria	Romania	Serbia	Moldova, Rep. of	Armenia	Iran, Islamic Rep. of	Macedonia, Rep. of	Bahrain	Palestinian Nat'l Auth.	Cyprus	Chile	Egypt	Indonesia	Lebanon	Tunisia	Morocco	Saudi Arabia	Philippines	Botswana	South Africa	Ghana	Basque Country, Spain	Indiana State, US	Ontario Province, Can.	Quebec Province, Can.	Average Percent Correct on All Items	Countries
63	64	63	63	63	64	63	63	65	63	65	63	63	64	62	63	62	62	64	65	64	63	62	62	61	62 (0.9)	Singapore
62	62	61	62	62	62	61	61	62	61	64	61	62	63	60	62	61	60	61	63	61	61	60	61	60	61 (0.8)	Chinese Taipei
58	60	58	59	59	59	59	58	59	58	62	58	59	59	58	58	58	58	57	60	60	58	58	59	59	58 (0.6)	Estonia
58	59	58	58	58	59	58	58	59	58	59	58	58	59	57	58	57	56	58	58	59	58	58	59	58	57 (0.4)	Korea, Rep. of
57	58	57	58	58	58	57	58	59	57	60	58	58	59	57	56	57	57	58	60	58	57	57	58	57	57 (0.7)	Hong Kong, SAR
57	58	57	58	58	58	58	57	58	57	59	58	58	59	57	58	57	56	58	57	57	57	57	57	56	57 (0.5)	Japan
57	59	57	57	57	58	57	56	58	56	60	57	57	58	56	57	56	56	55	58	58	56	56	57	56	56 (0.6)	Hungary
55	57	55	56	56	56	55	55	56	54	57	56	56	56	55	54	55	54	55	56	57	55	55	56	54	55 (0.9)	England
53	55	53	54	54	54	54	53	54	52	56	53	54	55	52	52	53	52	52	53	54	53	53	54	53	53 (0.7)	Sweden
53	55	53	54	54	53	53	53	53	51	55	53	54	54	53	52	52	52	53	54	54	53	53	54	53	52 (0.8)	Netherlands
52	53	52	52	52	52	52	52	52	50	54	52	52	52	51	50	52	52	51	53	53	52	52	53	52	52 (0.7)	United States
51	53	52	52	52	52	51	52	52	50	54	52	52	52	52	50	51	52	52	52	53	52	51	53	52	51 (0.8)	Australia
52	54	52	52	52	53	52	51	52	51	55	52	52	53	51	51	51	51	49	54	52	51	51	52	51	51 (0.7)	Slovak Republic
52	52	51	52	52	52	52	51	53	50	55	51	52	52	50	51	51	51	50	53	52	51	51	51	51	51 (0.5)	Lithuania
50	53	51	51	51	51	51	50	52	50	55	51	51	52	50	51	50	51	49	54	52	51	50	51	51	50 (0.7)	Russian Federation
50	51	50	51	51	50	50	50	51	49	53	50	51	51	49	49	50	50	49	52	52	50	50	50	50	50 (0.4)	Slovenia
50	52	50	51	51	50	50	51	51	49	52	50	51	50	50	48	50	49	49	50	52	50	50	51	50	50 (1.1)	New Zealand
49	51	49	50	50	50	49	49	49	49	53	49	50	51	49	48	49	49	48	51	51	49	49	50	49	49 (0.6)	Latvia
49	51	49	50	50	49	49	49	49	48	52	49	50	50	50	47	49	49	50	50	50	49	49	50	50	49 (0.5)	Belgium (Flemish)
49	50	49	50	50	49	49	49	50	48	50	49	50	50	49	48	49	48	48	49	50	49	48	50	49	49 (0.8)	Scotland
48	51	48	49	49	49	48	49	50	48	52	49	49	50	48	49	48	47	49	50	48	48	47	49	48	48 (0.8)	Malaysia
46	48	46	46	46	47	46	46	47	44	49	46	46	46	45	45	46	46	46	48	48	46	46	47	46	46 (0.6)	Italy
46	48	46	46	46	47	46	46	47	45	49	46	46	47	45	46	45	45	45	48	48	46	45	46	45	45 (0.6)	Israel
45	47	45	46	46	45	45	45	45	44	48	45	46	46	45	43	45	45	44	45	47	45	45	46	46	45 (0.5)	Norway
42	44	42	43	43	44	42	43	44	41	44	43	43	43	41	42	42	42	43	46	44	42	42	43	41	42 (0.7)	Jordan
42	44	42	42	42	43	43	42	43	42	45	42	42	44	41	42	42	41	40	45	43	42	42	42	41	42 (1.0)	Bulgaria
41	43	41	41	41	42	41	41	42	40	44	41	41	42	40	41	41	40	40	44	42	41	41	41	40	41 (0.9)	Romania
41	42	40	40	40	41	41	40	42	39	44	41	40	41	39	41	40	39	39	43	41	40	40	40	39	40 (0.5)	Serbia
40	42	40	40	40	41	41	40	42	40	44	40	40	42	39	41	40	39	39	43	41	40	39	40	39	40 (0.7)	Moldova, Rep. of
40	41	38	39	39	40	39	39	41	39	42	38	39	39	36	40	38	37	36	42	39	38	38	38	37	38 (0.7)	Armenia
39	40	38	39	39	40	38	38	40	37	42	38	39	40	37	39	38	37	36	41	40	38	38	39	37	38 (0.5)	Iran, Islamic Rep. of
38	39	37	37	37	39	38	38	39	37	41	38	37	39	36	39	37	37	36	40	39	37	37	37	36	37 (0.7)	Macedonia, Rep. of
37	39	37	37	37	38	37	38	39	36	39	37	37	38	36	38	36	35	36	41	39	37	36	37	35	36 (0.3)	Bahrain
36	37	35	36	36	37	36	37	38	35	38	36	36	37	34	36	35	34	35	39	37	36	35	35	35	35 (0.6)	Palestinian Nat'l Auth.
35	37	35	36	36	36	35	35	36	35	38	35	36	37	34	35	35	35	34	38	37	35	35	35	34	35 (0.3)	Cyprus
34	36	34	34	34	35	34	34	34	33	38	34	34	34	33	33	34	34	33	36	36	34	34	34	33	34 (0.5)	Chile
34	35	33	34	34	35	34	34	35	33	37	34	34	34	32	34	33	32	33	36	35	33	33	33	32	33 (0.6)	Egypt
32	34	32	32	32	33	31	32	33	31	33	32	32	33	32	32	32	31	34	35	33	32	32	32	32	32 (0.5)	Indonesia
31	31	30	30	30	31	30	30	33	30	34	30	30	32	28	32	29	29	29	33	31	30	29	29	28	29 (0.6)	Lebanon
30	31	29	30	30	31	29	31	31	29	32	30	30	31	29	29	29	29	30	34	31	30	29	30	29	29 (0.3)	Tunisia
29	30	28	29	29	29	29	28	30	29	31	29	29	31	28	31	28	28	29	32	30	29	28	29	28	28 (0.3)	Morocco
29	31	28	29	29	29	29	29	31	28	31	29	29	30	27	29	28	27	28	32	30	28	28	29	27	28 (0.6)	Saudi Arabia
28	29	28	28	28	29	28	28	29	27	31	28	28	29	27	28	28	27	27	31	29	28	28	28	27	28 (0.8)	Philippines
26	27	26	26	26	26	26	26	27	26	28	26	26	27	25	27	26	25	27	29	27	26	26	26	25	26 (0.4)	Botswana
19	20	19	19	19	19	19	19	20	19	22	19	19	20	18	20	19	18	18	22	20	19	19	19	18	19 (0.7)	South Africa
19	20	18	18	18	19	19	19	20	19	22	19	18	20	17	20	19	18	18	21	20	19	18	18	17	19 (0.4)	Ghana
44	45	43	44	44	44	44	44	45	43	46	44	44	45	43	43	43	43	43	46	45	43	43	44	43	43 (0.1)	International Avg.
																										Benchmarking Participants
45	46	45	45	45	45	44	44	45	43	47	45	45	45	44	43	44	44	44	46	46	44	44	45	44	44 (0.7)	Basque Country, Spain
52	54	52	53	53	53	52	52	52	50	55	53	53	52	52	50	52	52	51	53	54	52	52	53	52	52 (1.1)	Indiana State, US
53	55	54	54	54	54	53	54	54	52	55	54	54	54	53	51	53	53	53	53	55	54	53	55	54	53 (0.7)	Ontario Province, Can.
53	55	54	54	54	54	53	53	54	52	55	53	54	54	54	51	53	53	53	54	55	53	53	55	54	53 (0.7)	Quebec Province, Can.
166	166	201	195	195	175	179	162	160	160	95	195	195	148	174	128	206	174	130	106	143	204	196	186	159	206	Number of Items (Score Points) Identified*

* Of the 189 items in the Science test, some extended-response items were scored on a two-point scale, resulting in 211 total score points. Following item review, response categories were combined for a number of items, resulting in 206 total score points.

( ) Standard errors appear in parentheses.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit C.1: Average Percent Correct for Test-Curriculum Matching Analysis – Science

Based on Subset of Items Specially Identified by Each Country as Addressing its Curriculum
(See Exhibit C.2 for corresponding standard errors)

SCIENCE Grade 4

Instructions: 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.

Countries	Average Percent Correct on All Items	Singapore	Chinese Taipei	Japan	Hungary	England	United States	Latvia	Hong Kong, SAR	Russian Federation	Australia	Netherlands	New Zealand	Italy	Belgium (Flemish)	Lithuania	Scotland	Slovenia	Moldova, Rep. of	Cyprus	Norway	Iran, Islamic Rep. of	Armenia	Philippines	Tunisia	Morocco	Indiana State, US	Ontario Province, Can.	Quebec Province, Can.
Singapore	67 (1.1)	70	73	69	68	69	67	67	69	70	68	70	69	71	69	67	70	68	67	69	68	71	67	67	70	70	70	69	66
Chinese Taipei	66 (0.3)	66	72	64	66	65	65	65	66	70	67	67	66	69	66	65	69	67	65	66	67	68	65	66	68	67	70	66	65
Japan	65 (0.3)	67	71	69	66	65	65	65	67	68	66	68	66	68	67	65	67	66	65	67	66	68	65	64	67	67	71	67	64
Hungary	64 (0.6)	65	67	60	65	64	64	64	64	70	65	66	65	69	66	64	68	65	64	65	66	67	64	63	66	67	67	66	64
England	63 (0.7)	64	69	64	64	64	63	63	64	68	65	66	65	67	64	63	67	65	63	64	65	66	63	64	65	64	69	65	63
United States	63 (0.5)	64	67	61	64	64	63	63	64	68	64	65	64	67	64	63	66	64	63	64	65	66	63	62	65	65	69	65	63
Latvia	63 (0.5)	63	66	60	63	63	62	62	64	68	64	65	63	67	64	62	65	64	62	63	65	65	62	62	65	64	67	64	62
Hong Kong, SAR	62 (0.7)	63	68	61	62	62	62	62	63	65	63	64	63	66	63	62	65	63	62	62	63	65	62	62	64	63	65	63	61
Russian Federation	61 (0.9)	62	65	59	62	61	61	61	62	67	62	63	63	66	63	61	65	63	61	62	63	64	61	61	65	63	66	63	61
Australia	61 (0.8)	61	65	59	61	61	61	61	61	66	62	63	62	65	62	61	64	61	61	61	62	63	61	60	63	63	67	62	60
Netherlands	60 (0.5)	61	63	53	61	60	60	60	61	65	61	63	60	65	63	60	62	61	60	61	62	62	60	57	62	62	64	62	60
New Zealand	59 (0.5)	60	63	58	60	60	59	59	60	64	61	61	60	64	61	59	63	60	59	60	61	62	59	58	62	61	65	61	59
Italy	59 (0.7)	61	63	58	60	59	59	59	61	64	60	62	61	65	61	59	63	60	59	61	61	63	59	58	62	62	64	61	59
Belgium (Flemish)	59 (0.4)	60	63	56	60	60	59	59	60	64	60	62	59	64	62	59	62	60	59	60	62	62	59	57	61	61	65	61	59
Lithuania	59 (0.5)	60	63	56	60	59	59	59	60	64	60	61	60	63	61	59	62	61	59	60	61	62	59	59	61	61	64	61	59
Scotland	56 (0.6)	57	61	54	57	57	56	56	57	61	58	59	57	61	58	56	60	57	56	57	58	59	56	55	58	57	62	58	56
Slovenia	54 (0.5)	55	59	54	55	55	54	54	55	59	55	58	55	59	57	54	57	56	54	55	56	57	54	54	56	56	60	56	54
Moldova, Rep. of	53 (0.8)	53	57	49	53	53	53	53	53	58	53	55	54	57	54	53	56	54	53	53	54	56	53	53	56	55	58	55	53
Cyprus	53 (0.4)	54	59	49	53	53	52	52	54	56	53	55	53	57	54	52	56	54	52	54	54	57	52	53	56	54	56	55	53
Norway	52 (0.4)	52	55	47	52	51	51	51	53	56	52	53	53	56	53	51	55	53	51	50	54	54	51	50	53	53	55	53	51
Iran, Islamic Rep. of	41 (0.7)	42	47	39	42	42	41	41	42	45	42	43	43	45	42	41	45	43	41	42	42	45	41	42	44	43	45	43	41
Armenia	41 (0.7)	42	44	34	41	41	41	41	42	45	42	43	42	45	42	41	45	43	41	41	43	45	41	42	44	43	45	43	41
Philippines	31 (1.3)	31	35	29	31	32	31	31	31	32	31	32	32	34	30	31	34	32	31	31	32	34	31	34	32	33	34	32	30
Tunisia	27 (0.6)	28	33	27	28	28	27	27	28	30	28	28	29	30	28	27	30	29	27	28	28	30	27	26	30	29	30	29	27
Morocco	27 (0.6)	27	31	22	27	27	26	26	27	28	27	27	27	29	26	26	29	27	26	27	28	30	26	27	30	29	30	28	26
International Avg.	55 (0.1)	55	59	52	55	55	55	55	56	59	56	57	56	59	56	55	58	56	55	55	56	58	55	54	57	56	59	56	54
Benchmarking Participants																													
Indiana State, US	66 (0.8)	67	70	65	67	67	66	66	67	71	68	68	67	70	67	66	69	67	66	67	68	68	66	65	68	68	72	68	66
Ontario Province, Can.	65 (0.7)	66	69	63	66	66	65	65	66	69	66	67	66	69	66	65	68	65	65	66	66	67	65	63	67	66	71	67	64
Quebec Province, Can.	58 (0.5)	58	61	54	58	58	57	57	58	63	59	60	58	62	59	57	61	59	57	58	59	60	57	55	60	59	63	59	58
Number of Items (Score Points) Identified*	165	130	69	44	161	134	161	161	140	108	155	115	136	134	126	161	122	136	161	130	150	123	161	66	89	100	68	149	148

* Of the 152 items in the Science test, some extended-response items were scored on a two-point scale, resulting in 168 total score points. Following item review, some items were deleted and response categories were combined for a number of items, resulting in 150 items and 165 total score points.

( ) Standard errors appear in parentheses.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

diagonal element in the exhibit shows how each country performed on the subset of items that it selected based on its own curriculum. Thus, Bulgarian students averaged 42 percent correct on the set of items identified by Bulgaria for the analysis.

The international averages on each country's selected items are presented in the lower part of the exhibit. They show that the selection of items for the participating countries varied somewhat in average difficulty, ranging from 42 percent for those chosen by Scotland and Jordan at the eighth grade to 48 percent for those chosen by Belgium (Flemish). Similarly at the fourth grade, the average percent correct ranged from 52 percent for those items chosen by Japan to 59 percent for those chosen by Chinese Taipei, Italy, Russian Federation, and Indiana State. Despite these differences in the difficulty of the selected items, the overall message of Exhibit C.1 is that different item selections do not make a major difference in how well countries perform relative to one another. The items selected by some countries were more difficult than those selected by others. The relative performance of countries on various item selections did vary somewhat, but generally not in a statistically significant manner.[5]

Comparing the diagonal element for a country with the overall average percent correct shows the difference between performance on the subset of items chosen as appropriate and performance on the test as a whole. In general, there were only small increases in each country's performance on its own subset of items. To illustrate, the average percent correct for Singapore across all eighth-grade science items was 62 percent. The diagonal element shows that Singaporean students had a slightly greater average percent correct (65 percent) across the set of items selected as appropriate for Singapore than they did overall. Almost all participants had a difference of one or two percentage points between the two performance measures, with the largest difference – seven percent – for Belgium (Flemish) (49 percent compared with 56 percent).

5 Small differences in performance shown in this exhibit are not statistically significant. The standard errors for the estimated average percent correct statistics are in Exhibit C.2. It can be said with 95 percent confidence that the value for the entire population falls between the sample estimate plus or minus two standard errors.

Exhibit C.2: Standard Errors for the Test-Curriculum Matching Analysis – Science

SCIENCE Grade 8

Instructions: 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.

Countries	Average Percent Correct on All Items	Singapore	Chinese Taipei	Estonia	Korea, Rep. of	Hong Kong, SAR	Japan	Hungary	England	Sweden	Netherlands	United States	Australia	Slovak Republic	Lithuania	Russian Federation	Slovenia	New Zealand	Latvia	Belgium (Flemish)	Scotland	Malaysia	Italy	Israel	Norway	Jordan
Singapore	62 (0.9)	1.0	1.0	1.0	0.9	1.0	1.0	0.9	0.9	0.9	0.9	1.0	0.9	0.9	1.0	1.0	1.0	0.9	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9
Chinese Taipei	61 (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
Estonia	58 (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
Korea, Rep. of	57 (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
Hong Kong, SAR	57 (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
Japan	57 (0.5)	0.4	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.4	0.4	0.5	0.5	0.5
Hungary	56 (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	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.6
England	55 (0.9)	0.9	1.0	1.0	0.9	1.0	0.9	1.0	1.0	0.9	1.0	1.0	1.0	0.9	1.0	1.0	0.9	1.0	1.0	1.0	1.0	0.9	1.0	0.9	1.0	0.9
Sweden	53 (0.7)	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.6	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
Netherlands	52 (0.8)	0.8	0.8	0.8	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	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
United States	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
Australia	51 (0.8)	0.9	0.8	0.8	0.8	0.9	0.9	0.9	0.8	0.9	0.9	0.8	0.8	0.8	0.8	0.9	0.8	0.9	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8
Slovak Republic	51 (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	0.8	0.8	0.7	0.7	0.7	0.7	0.7
Lithuania	51 (0.5)	0.5	0.5	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	0.5	0.6	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5
Russian Federation	50 (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
Slovenia	50 (0.4)	0.4	0.4	0.5	0.5	0.5	0.5	0.4	0.5	0.4	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	0.4	0.4	0.4
New Zealand	50 (1.1)	1.1	1.2	1.2	1.1	1.2	1.1	1.2	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.2	1.1	1.2	1.1	1.2	1.1	1.1	1.1	1.1	1.1	1.1
Latvia	49 (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
Belgium (Flemish)	49 (0.5)	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5
Scotland	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	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Malaysia	48 (0.8)	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8
Italy	46 (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	0.7	0.6	0.6	0.6	0.6	0.6	0.6
Israel	45 (0.6)	0.6	0.7	0.6	0.6	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.7	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.6
Norway	45 (0.5)	0.5	0.5	0.5	0.6	0.6	0.5	0.6	0.5	0.6	0.6	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.5	0.6	0.5	0.6	0.6	0.5	0.5	0.5
Jordan	42 (0.7)	0.7	0.8	0.7	0.7	0.8	0.8	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.8	0.7	0.8	0.7	0.8	0.8	0.8	0.7	0.7	0.7	0.7
Bulgaria	42 (1.0)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.1	1.0	1.1	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0
Romania	41 (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	0.9
Serbia	40 (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	0.5	0.5	0.5	0.5	0.5	0.5
Moldova, Rep. of	40 (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	0.8	0.7	0.7	0.7	0.7	0.7	0.7
Armenia	38 (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	0.8	0.7	0.7	0.7	0.9	0.7	0.7	0.7	0.7	0.7	0.7
Iran, Islamic Rep. of	38 (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
Macedonia, Rep. of	37 (0.7)	0.7	0.7	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
Bahrain	36 (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	0.4	0.3	0.3	0.3	0.3	0.3	0.3
Palestinian Nat'l Auth.	35 (0.6)	0.6	0.6	0.6	0.6	0.6	0.7	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
Cyprus	35 (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	0.4	0.3	0.3	0.3	0.3	0.3	0.3
Chile	34 (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
Egypt	33 (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	0.7	0.6	0.6	0.6	0.6	0.6	0.6
Indonesia	32 (0.5)	0.5	0.5	0.5	0.6	0.6	0.5	0.5	0.6	0.5	0.6	0.6	0.6	0.5	0.6	0.6	0.5	0.6	0.6	0.7	0.5	0.6	0.6	0.5	0.5	0.5
Lebanon	29 (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	0.8	0.6	0.6	0.6	0.6	0.6	0.6
Tunisia	29 (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	0.3	0.3	0.3	0.3	0.4	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.3
Morocco	28 (0.3)	0.3	0.4	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.4	0.3	0.5	0.3	0.3	0.3	0.3	0.3	0.3
Saudi Arabia	28 (0.6)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.5	0.6	0.6	0.6	0.5	0.6	0.6	0.8	0.6	0.6	0.6	0.6	0.6	0.6
Philippines	28 (0.8)	0.7	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.0	0.8	0.8	0.8	0.8	0.8	0.8
Botswana	26 (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	19 (0.7)	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.8	0.7	0.8	0.7	0.8	0.7	0.7	0.8	0.7	0.7	0.7
Ghana	19 (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	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.4	0.4
International Avg.	43 (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
Benchmarking Participants																										
Basque Country, Spain	44 (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	0.6	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7
Indiana State, US	52 (1.1)	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.1	1.2	1.1	1.0	1.1	1.1	1.1	1.1	1.1	1.1
Ontario Province, Can.	53 (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
Quebec Province, Can.	53 (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	0.8	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7
Number of Items (Score Points) Identified*	206	176	164	184	194	177	104	198	199	192	145	195	179	190	195	129	176	167	195	63	180	189	188	206	202	181

* Of the 189 items in the Science test, some extended-response items were scored on a two-point scale, resulting in 211 total score points. Following item review, response categories were combined for a number of items, resulting in 206 total score points.

( ) Standard errors for the average percent of correct responses on all items appear in parentheses. The matrix contains standard errors corresponding to the average percent correct responses based on TCMA subset of items, as displayed in Table C.1.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit C.2: Standard Errors for the Test-Curriculum Matching Analysis – Science

SCIENCE Grade 8

Instructions: 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.

Bulgaria	Romania	Serbia	Moldova, Rep. of	Armenia	Iran, Islamic Rep. of	Macedonia, Rep. of	Bahrain	Palestinian Nat'l Auth.	Cyprus	Chile	Egypt	Indonesia	Lebanon	Tunisia	Morocco	Saudi Arabia	Philippines	Botswana	South Africa	Ghana	Basque Country, Spain	Indiana State, US	Ontario Province, Can.	Quebec Province, Can.	Average Percent Correct on All Items	Countries
1.0	0.9	0.9	1.0	1.0	1.0	0.9	1.0	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	1.0	1.0	0.9	1.0	0.9	0.9	0.9	1.0	62 (0.9)	Singapore
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	61 (0.8)	Chinese Taipei
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	0.5	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6	0.6	58 (0.6)	Estonia
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	57 (0.4)	Korea, Rep. of
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	0.8	0.7	0.7	0.7	0.7	0.7	0.7	57 (0.7)	Hong Kong, SAR
0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.5	0.4	0.5	0.4	0.5	0.5	0.5	0.4	0.4	0.5	0.5	0.5	0.5	57 (0.5)	Japan
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	56 (0.6)	Hungary
1.0	0.9	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	0.9	0.9	1.0	0.9	1.0	0.9	0.9	1.0	1.0	0.9	0.9	0.9	1.0	1.0	1.0	55 (0.9)	England
0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.7	0.7	0.6	0.7	0.6	0.7	0.7	0.7	0.6	0.6	0.7	0.7	0.7	0.7	53 (0.7)	Sweden
0.8	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.7	0.8	0.7	0.8	0.8	0.7	0.8	0.7	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.8	52 (0.8)	Netherlands
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	52 (0.7)	United States
0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.9	0.9	0.8	0.8	0.8	0.8	0.9	0.9	51 (0.8)	Australia
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	0.6	0.7	0.7	0.7	0.7	0.7	51 (0.7)	Slovak Republic
0.5	0.5	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	0.6	0.5	0.5	0.5	0.5	0.5	0.5	51 (0.5)	Lithuania
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	0.6	0.7	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	50 (0.7)	Russian Federation
0.5	0.5	0.4	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.5	0.4	0.5	0.4	0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.5	0.5	50 (0.4)	Slovenia
1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.2	1.1	1.1	1.2	1.2	1.1	1.1	1.1	1.1	1.2	1.2	50 (1.1)	New Zealand
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	49 (0.6)	Latvia
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	0.6	0.5	0.5	0.5	0.5	0.6	0.6	49 (0.5)	Belgium (Flemish)
0.8	0.7	0.8	0.8	0.8	0.8	0.7	0.8	0.7	0.8	0.8	0.8	0.8	0.7	0.8	0.7	0.8	0.8	0.8	0.7	0.7	0.8	0.8	0.8	0.8	49 (0.8)	Scotland
0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8	48 (0.8)	Malaysia
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	46 (0.6)	Italy
0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.7	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	45 (0.6)	Israel
0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.6	0.5	0.5	0.6	0.6	0.5	0.5	0.5	0.6	0.6	0.6	45 (0.5)	Norway
0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.7	0.7	0.7	0.7	0.7	42 (0.7)	Jordan
1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.0	1.0	1.0	1.0	42 (1.0)	Bulgaria
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	41 (0.9)	Romania
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	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	40 (0.5)	Serbia
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	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	40 (0.7)	Moldova, Rep. of
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	0.8	0.7	0.7	0.7	0.8	0.8	0.7	0.7	0.7	0.7	38 (0.7)	Armenia
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	38 (0.5)	Iran, Islamic Rep. of
0.7	0.7	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	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.7	37 (0.7)	Macedonia, Rep. of
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	0.4	0.3	0.3	0.3	0.3	0.3	36 (0.3)	Bahrain
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	35 (0.6)	Palestinian Nat'l Auth.
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	0.4	0.3	0.3	0.3	0.3	0.3	35 (0.3)	Cyprus
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	34 (0.5)	Chile
0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	33 (0.6)	Egypt
0.5	0.6	0.5	0.6	0.6	0.6	0.5	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.6	0.6	0.6	0.6	0.5	0.5	0.6	0.6	32 (0.5)	Indonesia
0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	29 (0.6)	Lebanon
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	0.3	0.3	0.3	0.3	29 (0.3)	Tunisia
0.3	0.4	0.3	0.3	0.3	0.4	0.3	0.4	0.3	0.3	0.4	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.3	0.3	0.3	28 (0.3)	Morocco
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	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	28 (0.6)	Saudi Arabia
0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.7	0.8	0.8	0.8	0.7	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	28 (0.8)	Philippines
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	26 (0.4)	Botswana
0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.8	0.8	0.7	0.7	0.7	0.8	0.8	19 (0.7)	South Africa
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	19 (0.4)	Ghana
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	43 (0.1)	International Avg.
																										Benchmarking Participants
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	0.6	0.7	0.7	0.7	0.7	0.6	0.7	0.7	44 (0.7)	Basque Country, Spain
1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.1	1.2	52 (1.1)	Indiana State, US
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	0.6	0.7	0.7	0.7	0.7	0.7	53 (0.7)	Ontario Province, Can.
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	0.6	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.8	53 (0.7)	Quebec Province, Can.
166	166	201	195	195	175	179	162	160	160	95	195	195	148	174	128	206	174	130	106	143	204	196	186	159	206	Number of Items (Score Points) Identified*

* Of the 189 items in the Science test, some extended-response items were scored on a two-point scale, resulting in 211 total score points. Following item review, response categories were combined for a number of items, resulting in 206 total score points.

( ) Standard errors for the average percent of correct responses on all items appear in parentheses. The matrix contains standard errors corresponding to the average percent correct responses based on TCMA subset of items, as displayed in Table C.1.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit C.2: Standard Errors for the Test-Curriculum Matching Analysis – Science

SCIENCE Grade 4

Instructions: 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.

Countries	Average Percent Correct on All Items	Singapore	Chinese Taipei	Japan	Hungary	England	United States	Latvia	Hong Kong, SAR	Russian Federation	Australia	Netherlands	New Zealand	Italy	Belgium (Flemish)	Lithuania	Scotland	Slovenia	Moldova, Rep. of	Cyprus	Norway	Iran, Islamic Rep. of	Armenia	Philippines	Tunisia	Morocco	Indiana State, US	Ontario Province, Can.	Quebec Province, Can.
Singapore	67 (1.1)	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Chinese Taipei	66 (0.3)	0.3	0.3	0.5	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	0.3	0.4	0.3	0.3	0.3	0.3	0.3
Japan	65 (0.3)	0.3	0.3	0.4	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	0.3	0.3	0.3	0.3
Hungary	64 (0.6)	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.5	0.5	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6	0.5	0.6	0.6	0.5	0.5	0.5	0.6	0.6
England	63 (0.7)	0.7	0.7	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	0.7	0.7	0.7	0.7	0.7
United States	63 (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
Latvia	63 (0.5)	0.5	0.5	0.7	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	0.6	0.5	0.5	0.5	0.5	0.5
Hong Kong, SAR	62 (0.7)	0.7	0.7	0.9	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	0.8	0.7	0.7	0.7	0.7	0.7
Russian Federation	61 (0.9)	0.9	0.9	1.1	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.9	0.9	0.9	0.9
Australia	61 (0.8)	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.7	0.7	0.8	0.8	0.7	0.7	0.8	0.8	0.8	0.7	0.8	0.8	0.8
Netherlands	60 (0.5)	0.5	0.6	0.7	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	59 (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	0.6	0.5	0.5	0.5	0.5	0.5
Italy	59 (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	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Belgium (Flemish)	59 (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
Lithuania	59 (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	0.4	0.5	0.5	0.5	0.5	0.4	0.5	0.5	0.5	0.4	0.5	0.5	0.5
Scotland	56 (0.6)	0.6	0.6	0.8	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	0.7	0.6	0.6	0.6	0.6	0.6
Slovenia	54 (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	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
Moldova, Rep. of	53 (0.8)	0.8	0.7	0.9	0.8	0.8	0.8	0.8	0.8	0.9	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
Cyprus	53 (0.4)	0.5	0.4	0.6	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.5	0.5	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.5	0.4	0.4	0.5	0.5	0.4
Norway	52 (0.4)	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
Iran, Islamic Rep. of	41 (0.7)	0.8	0.9	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	0.7	0.8	0.8	0.7	0.8	0.8	0.7	0.9	0.8	0.8	0.8	0.8
Armenia	41 (0.7)	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.7	0.8	0.8
Philippines	31 (1.3)	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.3	1.3	1.3	1.4	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.3	1.4	1.3	1.3
Tunisia	27 (0.6)	0.6	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.7	0.6	0.7	0.7	0.6	0.7	0.6	0.6	0.7	0.6	0.7	0.6	0.6	0.7	0.7	0.7	0.6	0.6
Morocco	27 (0.6)	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.7	0.7	0.7	0.7	0.6	0.6
International Avg.	55 (0.1)	0.1	0.1	0.2	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
Benchmarking Participants																													
Indiana State, US	66 (0.8)	0.8	0.8	0.9	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	0.7	0.8	0.8	0.7	0.8	0.8	0.7	0.8	0.8
Ontario Province, Can.	65 (0.7)	0.7	0.7	0.9	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	0.8	0.8	0.6	0.7	0.7
Quebec Province, Can.	58 (0.5)	0.6	0.6	0.6	0.5	0.6	0.5	0.5	0.5	0.6	0.5	0.6	0.5	0.6	0.6	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.6	0.5	0.6	0.5	0.5	0.5
Number of Items (Score Points) Identified*	165	130	69	44	161	134	161	161	140	108	155	115	136	134	126	161	122	136	161	130	150	123	161	66	89	100	68	149	148

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

* Of the 152 items in the Science test, some extended-response items were scored on a two-point scale, resulting in 168 total score points. Following item review, some items were deleted and response categories were combined for a number of items, resulting in 150 items and 165 total score points.

( ) Standard errors for the average percent of correct responses on all items appear in parentheses. The matrix contains standard errors corresponding to the average percent correct responses based on TCMA subset of items, as displayed in Table C.1.

It is clear that the selection of items does not have a major effect on the general relationship among countries. Countries 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 eighth grade, Singapore had the highest average percent correct on the test as a whole and on all of the different item selections, with Chinese Taipei, Estonia, and Korea 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. As an example, consider the 195 score points selected by Armenia. The students in Armenia did a little better on these items than on the test as a whole, with 39 percent correct on these items, on average, compared with 38 percent correct on all items. However, most other countries also did better on these particular items, with an international average of 44 percent correct on the items selected by Armenia. All 29 participants that performed better than Armenia on the overall test also performed better on the items selected by Armenia.

The TCMA results provide evidence that the TIMSS 2003 science test provides a reasonable basis for comparing achievement of the participating countries and benchmarking entities. This result is not unexpected, since making the test as fair as possible was a major consideration in test 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 essentially 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 results is largely unaffected.

D

Appendix D

Percentiles and Standard Deviations of Science Achievement

Exhibit D.1: Percentiles of Achievement in Science

SCIENCE Grade 8

Countries	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Armenia	324 (6.7)	407 (5.4)	463 (3.9)	520 (4.7)	589 (6.1)
Australia	397 (6.6)	478 (5.3)	531 (4.1)	580 (3.6)	644 (5.1)
Bahrain	311 (4.3)	389 (2.3)	441 (2.4)	491 (3.4)	556 (4.6)
Belgium (Flemish)	394 (7.2)	477 (3.2)	523 (2.9)	562 (1.8)	613 (2.3)
Botswana	220 (5.0)	306 (3.6)	367 (2.9)	425 (3.7)	503 (8.7)
Bulgaria	310 (13.8)	421 (6.9)	487 (3.9)	544 (4.2)	618 (5.2)
Chile	275 (5.2)	355 (3.0)	412 (3.0)	471 (4.7)	550 (6.4)
Chinese Taipei	434 (4.9)	519 (4.6)	577 (4.4)	628 (3.3)	690 (4.4)
Cyprus	306 (4.1)	390 (3.5)	445 (2.5)	497 (2.3)	567 (2.4)
Egypt	243 (11.8)	348 (5.9)	428 (6.5)	498 (2.6)	581 (4.5)
England	413 (7.3)	492 (4.7)	547 (6.0)	597 (5.2)	665 (3.5)
Estonia	445 (6.1)	509 (4.1)	553 (3.3)	596 (2.8)	659 (5.6)
Ghana	52 (7.2)	168 (5.8)	256 (7.9)	345 (6.7)	450 (6.2)
Hong Kong, SAR	438 (8.2)	519 (3.7)	562 (2.3)	600 (3.3)	654 (3.0)
Hungary	415 (6.9)	492 (4.5)	543 (4.1)	595 (4.3)	666 (4.9)
Indonesia	287 (8.8)	368 (4.3)	422 (4.7)	475 (4.9)	546 (2.8)
Iran, Islamic Rep. of	336 (3.5)	403 (2.5)	453 (2.1)	502 (1.9)	573 (4.8)
Israel	342 (3.2)	432 (4.7)	492 (3.5)	548 (3.2)	623 (2.8)
Italy	358 (4.8)	439 (6.6)	494 (3.2)	545 (3.1)	614 (4.9)
Japan	429 (3.7)	507 (2.9)	556 (1.9)	601 (1.6)	663 (4.3)
Jordan	319 (4.3)	417 (4.4)	481 (4.8)	538 (2.9)	612 (3.4)
Korea, Rep. of	438 (4.8)	513 (2.4)	562 (1.9)	606 (2.1)	666 (2.0)
Latvia	399 (1.5)	467 (3.1)	514 (2.4)	560 (2.9)	621 (2.5)
Lebanon	240 (5.5)	329 (4.3)	393 (5.7)	460 (5.5)	544 (4.9)
Lithuania	404 (3.3)	472 (3.4)	521 (1.9)	567 (3.1)	633 (2.6)
Macedonia, Rep. of	287 (7.7)	390 (4.9)	457 (3.8)	515 (4.6)	588 (4.7)
Malaysia	398 (7.2)	467 (4.1)	513 (4.4)	556 (4.5)	615 (6.0)
Moldova, Rep. of	346 (4.1)	423 (5.3)	475 (3.8)	524 (5.0)	589 (3.8)
Morocco	282 (4.5)	350 (2.6)	397 (3.0)	444 (3.3)	510 (5.0)
Netherlands	430 (11.0)	496 (3.3)	538 (3.4)	579 (3.6)	631 (2.6)
New Zealand	393 (6.7)	471 (4.4)	523 (4.8)	570 (4.9)	637 (11.6)
Norway	372 (4.5)	450 (3.4)	498 (1.8)	542 (3.2)	601 (3.2)
Palestinian Nat'l Auth.	273 (7.3)	373 (4.1)	441 (4.0)	503 (3.3)	576 (4.0)
Philippines	208 (5.7)	305 (5.6)	378 (7.7)	452 (6.3)	542 (7.0)
Romania	314 (7.9)	409 (6.5)	472 (7.1)	533 (5.3)	612 (9.2)
Russian Federation	389 (9.0)	464 (4.1)	515 (4.1)	565 (3.7)	633 (5.4)
Saudi Arabia	277 (8.1)	349 (3.7)	398 (4.6)	448 (4.6)	513 (3.1)
Scotland	380 (6.7)	462 (4.3)	515 (4.9)	565 (4.0)	630 (4.8)
Serbia	327 (3.9)	412 (3.6)	471 (2.9)	525 (3.9)	602 (4.5)
Singapore	403 (13.4)	522 (6.7)	589 (5.4)	644 (2.9)	709 (2.8)
Slovak Republic	390 (9.6)	467 (2.9)	520 (3.8)	569 (3.2)	637 (5.5)
Slovenia	409 (4.2)	476 (2.8)	521 (2.5)	566 (2.8)	629 (2.6)
South Africa	53 (7.6)	151 (4.0)	226 (5.1)	319 (9.5)	499 (19.2)
Sweden	397 (6.3)	476 (3.7)	528 (3.1)	575 (2.5)	640 (4.6)
Tunisia	305 (3.4)	362 (2.8)	403 (2.4)	444 (2.3)	505 (3.3)
United States	387 (5.1)	474 (4.5)	531 (3.2)	584 (3.5)	653 (4.6)
Benchmarking Participants					
Basque Country, Spain	371 (3.0)	441 (3.9)	489 (1.6)	537 (4.1)	605 (5.5)
Indiana State, US	411 (6.0)	484 (6.3)	533 (5.8)	579 (4.2)	643 (5.0)
Ontario Province, Can.	423 (4.2)	490 (3.6)	536 (2.8)	577 (2.5)	635 (3.4)
Quebec Province, Can.	427 (5.6)	491 (2.9)	533 (4.1)	572 (4.0)	629 (4.8)

( ) Standard errors appear in parentheses.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit D.1: **Percentiles of Achievement in Science**

Countries	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Armenia	271 (8.5)	371 (4.6)	445 (4.3)	506 (3.4)	579 (5.9)
Australia	374 (8.5)	473 (7.3)	528 (4.5)	576 (4.0)	644 (3.0)
Belgium (Flemish)	424 (3.1)	483 (2.1)	520 (1.8)	555 (1.4)	607 (3.8)
Chinese Taipei	434 (3.3)	509 (1.9)	554 (2.4)	598 (3.9)	659 (4.0)
Cyprus	353 (5.4)	432 (3.4)	485 (2.6)	533 (1.8)	594 (3.6)
England	396 (9.2)	488 (5.8)	545 (3.1)	597 (3.0)	669 (6.1)
Hong Kong, SAR	437 (8.5)	506 (2.8)	546 (3.4)	583 (3.9)	634 (2.2)
Hungary	393 (8.4)	479 (4.9)	536 (4.1)	584 (3.4)	652 (7.3)
Iran, Islamic Rep. of	243 (6.2)	351 (4.1)	420 (3.5)	484 (3.0)	561 (3.9)
Italy	371 (7.7)	462 (4.9)	519 (5.1)	573 (3.8)	650 (4.4)
Japan	413 (2.2)	501 (2.1)	548 (2.0)	592 (2.4)	656 (2.3)
Latvia	411 (7.6)	489 (3.5)	536 (2.4)	578 (2.6)	638 (1.4)
Lithuania	396 (6.9)	469 (4.3)	516 (2.8)	558 (2.6)	615 (2.3)
Moldova, Rep. of	342 (8.0)	443 (6.6)	505 (4.2)	555 (3.3)	624 (9.5)
Morocco	94 (13.0)	215 (9.5)	308 (8.7)	397 (7.2)	501 (4.9)
Netherlands	435 (4.8)	491 (2.0)	527 (2.6)	561 (2.1)	611 (3.6)
New Zealand	366 (6.3)	469 (3.1)	528 (2.2)	578 (2.4)	646 (3.3)
Norway	319 (7.3)	412 (5.9)	472 (4.3)	525 (2.4)	595 (4.9)
Philippines	97 (9.0)	222 (7.1)	327 (9.6)	446 (15.8)	564 (20.3)
Russian Federation	389 (7.2)	471 (5.6)	528 (5.8)	582 (4.6)	659 (6.6)
Scotland	369 (6.1)	453 (4.8)	506 (3.5)	555 (3.3)	624 (6.0)
Singapore	406 (13.6)	515 (7.8)	573 (6.1)	624 (6.3)	694 (6.8)
Slovenia	356 (5.0)	440 (4.5)	498 (3.2)	543 (2.4)	607 (4.4)
Tunisia	99 (7.4)	226 (7.3)	320 (6.3)	407 (5.5)	513 (7.4)
United States	393 (4.6)	484 (3.2)	541 (3.5)	592 (1.9)	661 (3.5)
Benchmarking Participants					
Indiana State, US	434 (5.8)	511 (3.8)	556 (4.7)	600 (4.0)	662 (7.4)
Ontario Province, Can.	405 (6.3)	491 (3.1)	545 (3.6)	593 (3.8)	661 (7.8)
Quebec Province, Can.	379 (3.6)	453 (2.7)	505 (3.0)	550 (2.7)	609 (7.5)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

( ) Standard errors appear in parentheses.

Exhibit D.2: Standard Deviations of Achievement in Science

SCIENCE Grade 8

Countries	Overall		Girls		Boys	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Armenia	461 (3.5)	81 (1.7)	468 (4.0)	79 (2.3)	455 (3.4)	83 (1.9)
Australia	527 (3.8)	75 (2.0)	517 (4.6)	72 (2.2)	537 (4.6)	77 (2.6)
Bahrain	438 (1.8)	74 (1.0)	453 (2.7)	67 (1.1)	423 (2.3)	79 (1.4)
Belgium (Flemish)	516 (2.5)	67 (2.2)	505 (3.0)	64 (2.7)	528 (3.4)	68 (3.0)
Botswana	365 (2.8)	86 (2.2)	364 (3.2)	84 (2.5)	366 (3.4)	89 (2.3)
Bulgaria	479 (5.2)	93 (3.7)	470 (6.3)	94 (4.5)	487 (5.2)	92 (3.5)
Chile	413 (2.9)	84 (1.5)	398 (3.2)	81 (1.7)	427 (3.6)	84 (1.9)
Chinese Taipei	571 (3.5)	79 (1.7)	571 (3.8)	74 (1.7)	572 (3.8)	83 (1.9)
Cyprus	441 (2.0)	79 (1.3)	443 (2.3)	75 (1.6)	440 (2.8)	83 (1.9)
Egypt	421 (3.9)	104 (1.8)	422 (4.8)	100 (2.2)	421 (5.5)	107 (2.4)
England	544 (4.1)	77 (2.4)	538 (4.7)	73 (2.2)	550 (5.1)	80 (3.1)
Estonia	552 (2.5)	65 (1.3)	554 (2.8)	66 (1.8)	551 (2.9)	64 (1.7)
Ghana	255 (5.9)	120 (2.2)	236 (6.4)	118 (2.2)	271 (6.5)	119 (3.2)
Hong Kong, SAR	556 (3.0)	66 (2.9)	552 (3.4)	63 (2.8)	561 (3.8)	68 (3.7)
Hungary	543 (2.8)	76 (1.7)	530 (3.4)	75 (2.4)	556 (3.0)	74 (1.6)
Indonesia	420 (4.1)	79 (2.3)	415 (3.9)	79 (2.6)	426 (4.6)	78 (2.3)
Iran, Islamic Rep. of	453 (2.3)	73 (1.2)	454 (3.9)	72 (2.0)	453 (3.7)	73 (2.0)
Israel	488 (3.1)	85 (1.6)	479 (3.2)	80 (2.2)	498 (4.1)	89 (2.1)
Italy	491 (3.1)	78 (1.9)	486 (2.7)	75 (2.1)	496 (3.8)	81 (2.1)
Japan	552 (1.7)	71 (1.1)	548 (3.0)	68 (1.9)	557 (2.7)	73 (1.5)
Jordan	475 (3.8)	89 (1.7)	489 (4.5)	86 (2.9)	462 (5.6)	91 (1.8)
Korea, Rep. of	558 (1.6)	70 (1.2)	552 (2.1)	67 (1.5)	564 (1.9)	71 (1.6)
Latvia	512 (2.6)	67 (1.2)	509 (2.6)	65 (1.7)	516 (3.0)	69 (1.3)
Lebanon	393 (4.3)	93 (2.3)	392 (4.8)	92 (2.8)	395 (6.0)	93 (3.0)
Lithuania	519 (2.1)	70 (1.2)	516 (2.7)	70 (1.9)	522 (2.4)	71 (1.5)
Macedonia, Rep. of	449 (3.6)	92 (2.3)	454 (3.7)	89 (2.5)	445 (4.2)	94 (2.5)
Malaysia	510 (3.7)	66 (1.9)	505 (4.3)	66 (2.4)	515 (4.0)	66 (2.2)
Moldova, Rep. of	472 (3.4)	74 (1.4)	477 (3.5)	72 (1.9)	468 (3.7)	75 (1.7)
Morocco	396 (2.5)	69 (1.2)	392 (3.2)	70 (2.0)	403 (3.8)	69 (1.7)
Netherlands	536 (3.1)	61 (2.5)	528 (3.3)	60 (2.7)	543 (3.8)	62 (2.6)
New Zealand	520 (5.0)	74 (3.1)	515 (4.8)	72 (2.8)	525 (6.7)	76 (4.0)
Norway	494 (2.2)	70 (1.2)	490 (2.2)	67 (1.7)	498 (3.0)	72 (1.7)
Palestinian Nat'l Auth.	435 (3.2)	92 (1.7)	441 (3.7)	89 (2.5)	428 (5.2)	96 (1.9)
Philippines	377 (5.8)	102 (2.4)	380 (5.9)	101 (2.5)	374 (6.4)	104 (3.0)
Romania	470 (4.9)	91 (1.9)	465 (5.5)	90 (2.6)	474 (4.9)	92 (2.5)
Russian Federation	514 (3.7)	75 (1.7)	508 (3.7)	75 (1.9)	519 (4.2)	75 (1.9)
Saudi Arabia	398 (4.0)	72 (1.5)	407 (6.2)	68 (2.1)	391 (5.4)	75 (2.1)
Scotland	512 (3.4)	76 (1.5)	506 (4.0)	73 (1.9)	517 (3.5)	78 (1.9)
Serbia	468 (2.5)	84 (1.2)	465 (2.9)	81 (1.8)	471 (2.6)	86 (1.5)
Singapore	578 (4.3)	92 (3.1)	576 (4.0)	88 (3.1)	579 (5.0)	95 (3.5)
Slovak Republic	517 (3.2)	76 (1.3)	508 (3.8)	75 (1.8)	525 (3.4)	75 (1.8)
Slovenia	520 (1.8)	67 (1.7)	517 (2.4)	64 (2.0)	524 (2.3)	69 (2.0)
South Africa	244 (6.7)	132 (5.5)	242 (7.2)	130 (6.0)	244 (7.7)	135 (6.3)
Sweden	524 (2.7)	74 (1.5)	521 (3.2)	73 (2.0)	528 (2.7)	74 (1.7)
Tunisia	404 (2.1)	60 (1.0)	392 (2.3)	59 (1.2)	416 (2.6)	60 (1.2)
United States	527 (3.1)	81 (1.6)	519 (3.2)	78 (1.7)	536 (3.4)	82 (1.8)
Benchmarking Participants						
Basque Country, Spain	489 (2.7)	71 (1.4)	481 (3.0)	69 (1.7)	496 (3.3)	73 (1.9)
Indiana State, US	531 (4.8)	71 (3.1)	521 (4.7)	68 (2.9)	540 (5.3)	72 (3.8)
Ontario Province, Can.	533 (2.7)	65 (1.2)	526 (3.1)	63 (1.7)	540 (2.8)	65 (1.4)
Quebec Province, Can.	531 (3.0)	61 (1.6)	522 (3.7)	60 (1.7)	540 (3.2)	60 (2.0)

( ) Standard errors appear in parentheses.

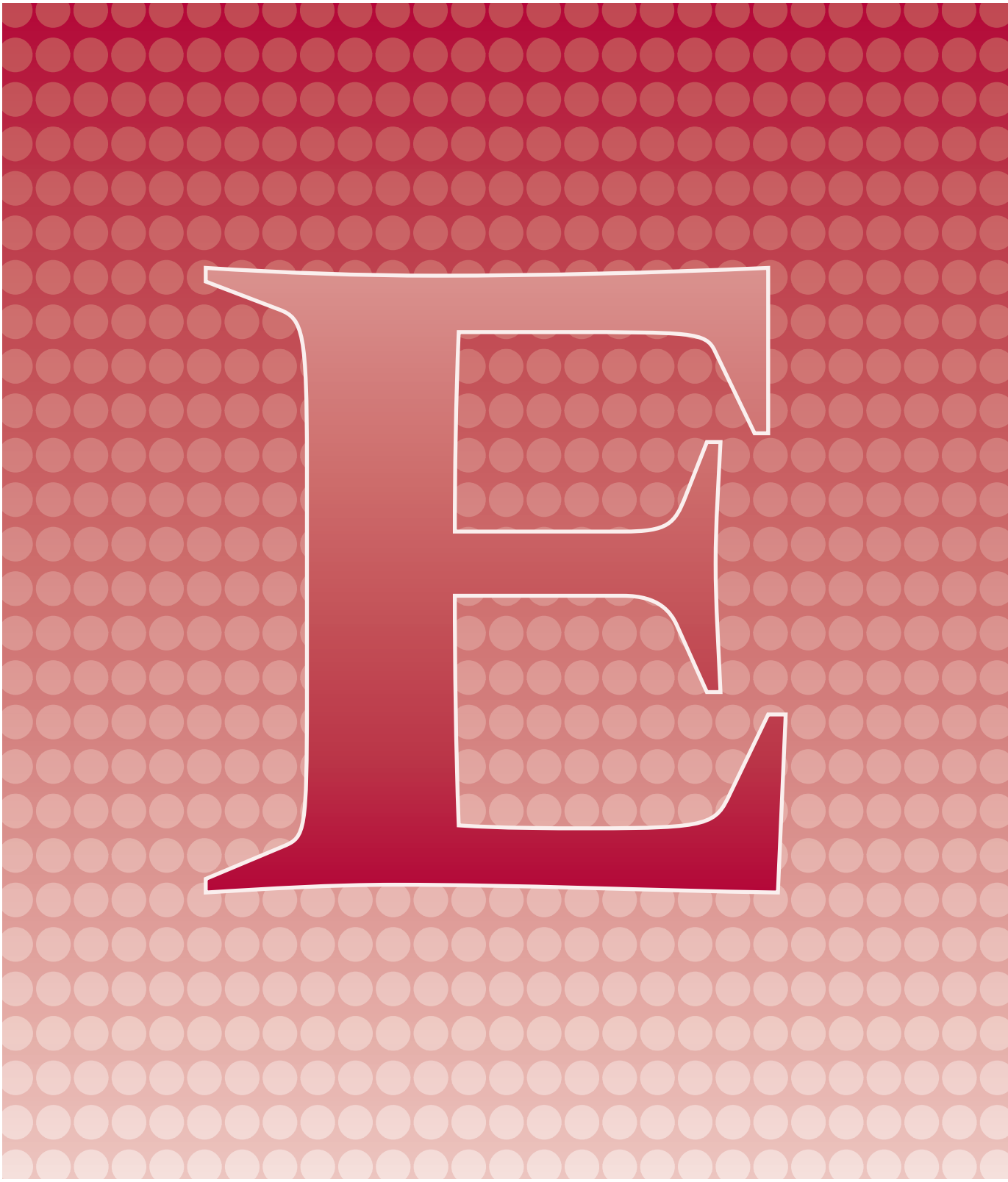
SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit D.2: Standard Deviations of Achievement in Science

Countries	Overall		Girls		Boys	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Armenia	437 (4.3)	96 (2.2)	441 (4.5)	93 (2.5)	432 (4.7)	98 (2.5)
Australia	521 (4.2)	82 (2.6)	522 (3.8)	77 (2.7)	519 (5.5)	87 (3.1)
Belgium (Flemish)	518 (1.8)	55 (1.0)	518 (1.9)	53 (1.1)	519 (2.3)	57 (1.5)
Chinese Taipei	551 (1.7)	69 (1.3)	548 (2.0)	65 (1.6)	555 (2.2)	72 (1.5)
Cyprus	480 (2.4)	74 (1.3)	477 (2.5)	72 (1.7)	484 (2.9)	76 (1.4)
England	540 (3.6)	83 (2.2)	542 (3.3)	80 (2.2)	538 (4.6)	86 (3.0)
Hong Kong, SAR	542 (3.1)	60 (1.2)	544 (3.3)	57 (1.3)	541 (3.2)	62 (1.6)
Hungary	530 (3.0)	79 (1.8)	527 (3.7)	78 (2.6)	533 (3.2)	80 (1.8)
Iran, Islamic Rep. of	414 (4.1)	97 (2.4)	426 (7.0)	93 (4.1)	406 (4.7)	98 (2.6)
Italy	516 (3.8)	85 (1.9)	514 (4.2)	85 (2.0)	517 (3.8)	85 (2.3)
Japan	543 (1.5)	73 (1.2)	542 (1.8)	69 (1.5)	545 (2.0)	76 (1.6)
Latvia	532 (2.5)	69 (1.5)	534 (2.6)	65 (1.9)	529 (3.2)	72 (2.1)
Lithuania	512 (2.6)	66 (1.5)	513 (3.0)	65 (2.1)	513 (2.9)	68 (1.5)
Moldova, Rep. of	496 (4.6)	85 (3.0)	503 (4.8)	85 (3.2)	490 (4.9)	85 (3.3)
Morocco	304 (6.7)	125 (2.7)	306 (7.9)	126 (3.4)	303 (6.8)	124 (3.1)
Netherlands	525 (2.0)	53 (1.1)	521 (2.2)	54 (1.5)	529 (2.2)	53 (1.3)
New Zealand	520 (2.5)	85 (2.0)	523 (3.3)	83 (2.1)	517 (2.5)	87 (2.2)
Norway	466 (2.6)	84 (1.6)	467 (3.2)	83 (2.4)	466 (2.9)	84 (1.7)
Philippines	332 (9.4)	145 (5.7)	339 (10.8)	146 (6.2)	324 (8.8)	145 (5.4)
Russian Federation	526 (5.2)	82 (2.3)	527 (5.9)	81 (2.8)	526 (4.9)	83 (2.4)
Scotland	502 (2.9)	78 (1.9)	496 (3.1)	76 (1.7)	508 (4.0)	79 (2.8)
Singapore	565 (5.5)	87 (3.3)	565 (5.4)	82 (3.0)	565 (6.4)	91 (3.9)
Slovenia	490 (2.5)	77 (1.4)	491 (3.0)	75 (1.9)	490 (3.2)	79 (2.0)
Tunisia	314 (5.7)	126 (2.6)	316 (6.1)	125 (3.1)	312 (6.0)	126 (3.0)
United States	536 (2.5)	81 (1.1)	533 (2.5)	79 (1.1)	538 (2.8)	83 (1.4)
Benchmarking Participants						
Indiana State, US	553 (3.7)	69 (2.0)	550 (3.9)	65 (1.8)	556 (4.5)	73 (2.6)
Ontario Province, Can.	540 (3.7)	77 (1.8)	537 (4.0)	75 (1.9)	543 (4.6)	78 (2.4)
Quebec Province, Can.	500 (2.5)	70 (1.1)	501 (2.7)	68 (1.6)	500 (3.1)	73 (1.9)

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

( ) Standard errors appear in parentheses.



Appendix E

Descriptions of Science Items at Each Benchmark

Exhibit E.1: **Descriptions of Science Items at Each International Benchmark**

SCIENCE Grade 8

Items at Low International Benchmark (400)

Life Science

S01_02 Recognizes that a human inherits traits from both parents.

S02_02 Recognizes the function of nerves in transmitting visual messages to the brain.

S03_03 Recognizes that traits are transferred to offspring through the sperm and egg.

S07_01 Identifies the circulatory system using a list of its components.

Chemistry

S02_04 From its physical description, identifies a heterogeneous powder as a mixture (requires knowledge of scientific terminology).

Physics

S03_01 Identifies the diagram depicting the correct arrangement of batteries in a flashlight.

S07_06 Given the definition of work, identifies a diagram that shows that work being done.

S09_08 Recognizes that evaporation is the process that takes place when clothes dry.

Earth Science

S03_11 Demonstrates knowledge of relative distance to explain why Jupiter, although bigger than Earth's moon, appears smaller when viewed from Earth.

Environmental Science

S14_06 Predicts a long-term effect of cutting down trees on the environment.

Items at Intermediate International Benchmark (475)

Life Science

S03_14 Demonstrates knowledge of contagious diseases by explaining why some people catch colds and others do not.

S06_09 Recognizes a characteristic that is found only in mammals.

S09_01 Recognizes that gills have the same function the lung.

S11_01 Recognizes which cells destroy bacteria that enter the body.

Chemistry

S02_09 Applies knowledge of the need of oxygen for burning to a practical situation to identify that fanning a fire provides more oxygen.

Physics

S02_03 Identifies the apparent position of reflected image in a mirror on a diagram representing three dimensions.

S02_08 Recognizes that a compressed spring has more stored energy than an uncompressed one.

S02_10 Recognizes the necessity of reflected light for visibility of an object.

S02_13 States why a nail becomes warmer when pulled out of a wooden board.

S03_10 Extrapolates from data presented in a linear distance versus time graph.

S04_06 Applies knowledge of circular motion to identify the diagram that shows that an object will move in a straight line when released from a circular path.

S05_05 Applies knowledge that sound requires a medium to travel through by contrasting a situation on Earth to a situation on the Moon.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit E.1: **Descriptions of Science Items at Each International Benchmark** *(Continued…)*

Items at Intermediate International Benchmark (475) – *Continued*

Earth Science

S01_03	Locates a point when the temperature becomes colder from data presented in a time and temperature table.
S02_06	Recognizes examples of fossil fuels.
S05_07	Given a diagram of Earth's water cycle, recognizes the Sun as the source of energy for the water cycle.
S09_11	Identifies the sun as a star.
S11_10	Given a starting point, orders the processes involved in the water cycle.
S13_02	Draws the position of the Moon relative the Sun and Earth during a solar eclipse.
S13_06	Uses knowledge of gravity to recognize that objects fall towards the center of Earth.

Environmental Science

S04_07A	Describes a positive effect on farming of the presence of a dam upriver from the farm.
S04_07B	Describes a negative effect on farming of the presence of a dam upriver from the farm.
S12_12	States how a volcanic eruption impacts the environment.
S12_13	Identifies from a list of common materials that paper breaks down fastest.

Items at High International Benchmark (550)

Life Science

S01_04	Determines characteristic used to sort animals into two groups as presented in a 3 x 2 table.
S01_10	Identifies the diagram depicting an appropriate control for a given experimental setup (effect of soil conditions on plant growth).
S02_07	From a list of organs, identifies the heart as the organ not situated in the abdomen.
S02_14	Given that a community consists of mice, snakes, and wheat plants, explains what will happen to the mice and wheat plants if the snakes are killed.
S03_02	Recognizes oxygen transport as the main function of red blood cells.
S03_13	Describes the processes that take place in the human body to prevent it from overheating during exercise.
S04_02	Demonstrates knowledge of the properties of lenses by explaining how eye glasses and contact lenses help some people see more clearly.
S05_03	Applies knowledge of the processes of photosynthesis and respiration to identify gases used up and given off by plants and animals in a forest ecosystem pictured in a diagram.
S06_07	Recognizes light absorption as the main function of chlorophyll.
S06_10	Recognizes that comparing genes can determine whether two people are related.
S06_13	Recognizes that cheese contains fat.
S08_04	States one function of the uterus.
S09_04	Recognizes that the joining of sperm and egg takes place during fertilization in animals.
S11_02	Interprets graph showing a sudden drop in the size of a population of antelope and recognizes that loss of food supply is most likely to have caused this sudden drop.
S11_04	States why exercise is important for good health.
S12_02	Explains that an acquired characteristic such as the loss of a kidney cannot be passed onto the next generation.
S12_03	Explains that camouflage helps snails avoid predators.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit E.1: **Descriptions of Science Items at Each International Benchmark** *(…Continued)*

SCIENCE Grade 8

Items at High International Benchmark (550) – *Continued*

Life Science – *Continued*

S13_08B	States one effect the introduction of goats could have on animals and plants already living in an area.
S14_08A	Completes the food web of ocean ecosystem based on information given in a table that lists a number of species and how they obtain their energy.

Chemistry

S03_04	Applies knowledge of the structure of matter to recognize that nothing remains of an object if all of its atoms are removed.
S04_04	Given three diagrams depicting candles burning in open and closed jars, explains that the candles in the closed jars will be extinguished due to lack of oxygen.
S05_02	Given a report of an experiment, distinguishes an observation from a prediction, conclusion, theory or hypothesis.
S07_04	Interprets data in a table of physical properties to identify iron, water, and oxygen.
S07_05	Identifies vinegar as an acidic solution.
S12_04	Recognizes the graph that most likely shows the effect of temperature on the solubility of sugar in water.
S12_05	Explains what causes a balloon to inflate when sodium bicarbonate in the balloon mixed with vinegar.
S13_03	Using a four-step decision diagram showing the steps used to separate iron filings, cork, sand, and salt from a mixture, identifies which component is separated by magnetism, floating/sinking, filtering, and evaporation.

Physics

S01_05	Applies scientific principle of the effect of distance on shadow size and interprets diagram to solve a quantitative problem involving the change in shadow size when the distance of the light source is increased.
S01_07	Demonstrates knowledge of polarity of magnets by labeling poles on a diagram of a magnet cut into three pieces.
S01_16	Identifies the ray diagram that shows the path of light reflected from a vertical mirror.
S04_05	Given a three-dimensional diagram depicting an object placed at an angle to a mirror plane, draws the apparent position the reflected image.
S04_12A	Draws the compass needle under the influence of a magnet and labels the poles of the compass needle.
S04_12B	Explains why a compass needle was drawn in a particular orientation under the influence of a magnet.
S05_04	Completes a brief table showing the relation between voltage and current.
S05_06	Based on a diagram demonstrating an investigation of thermal conductivity, identifies that metal conducts heat faster than glass, wood, or plastic.
S05_11	Interprets data presented in a non-linear distance vs. time graph.
S05_13	Applies knowledge of phase change and the boiling point of water to explain that the temperature of water does not exceed its boiling point despite the addition of heat.
S05_14	From a description of an experiment investigating the effect of dissolved salt on the freezing point of water, states the problem under investigation or a conclusion based on prior knowledge.
S06_02	Demonstrates an understanding that the surface of a liquid remains horizontal by drawing the level of the liquid on a frame-of-reference diagram depicting a tilted U-shaped container.
S06_03	Recognizes that the height of an alcohol column in a thermometer rises with increasing temperature because the alcohol expands more than the glass when heated.
S08_08	Identifies conduction is the process by which heat is transferred along a metal rod.
S09_09	Explains why lightning is seen before thunder is heard.
S09_10	Recognizes that a helium balloon rises because the density of helium is less than the density of air.
S12_14	Recognizes the gas molecules move faster when temperature increases.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit E.1: **Descriptions of Science Items at Each International Benchmark** *(Continued...)*

SCIENCE Grade 8

Items at High International Benchmark (550) – *Continued*

Earth Science

S01_12	Recognizes that fossil fuels were formed from the remains of living things.
S02_12	Applies knowledge of the effect of topography on river flow to identify the change in river shape and speed as it flows from a mountain to a plain.
S03_05	Recognizes a definition of sedimentary rock.
S04_11	Recognizes that Earthquakes and volcanic activity occur along the boundaries of tectonic plates.
S06_01	Recognizes the definition of an Earth year (time it takes Earth to revolve once around the Sun).
S06_06	Applies knowledge of the relative distances of the Sun and Moon from Earth to explain why light from the Moon reaches Earth in less time.
S08_10A	Interprets a contour map to recognize a topographical representation of a mountain top.
S12_10	Recognizes the main difference between planets and moons.
S12_11	Given a diagram showing whether conditions at different elevations on a mountain, identifies the most likely location of a jungle.

Environmental Science

S02_05	Recognizes the relationship between global warming and the increase in carbon dioxide levels in the atmosphere.
S02_11	Recognizes that overgrazing leads to soil erosion.
S03_07	States one reason why a hole in Earth's ozone layer may be harmful to people.
S04_08	States two reasons why some people do not have enough drinking water, even though the surface of Earth has more water than land.
S06_11	Predicts one effect a new dam could have on wildlife.
S09_13	Recognizes that using public transportation can help reduce air pollution.
S11_11	Recognizes what soil change is due to a natural cause rather than human activity.
S13_04	Distinguishes renewable from non-renewable energy sources.

Items at Advanced International Benchmark (625)

Life Science

S01_09	Applies knowledge of sexual reproduction process to draw a conclusion about how to control insect populations.
S01_15	Demonstrates knowledge of structure/function by describing one advantage of having two ears.
S05_10	Recognizes the hierarchy of organization in living organisms (cell, tissue, organ, and organism).
S07_02	States one structure that is found in plant cells but not in animal cells.
S07_03	Given that chlorophyll is needed for photosynthesis, states two other factors that are needed.
S08_01	Identifies food source as a criterion for classifying animals into two groups.
S08_02	Recognizes that organisms that are producers use energy from the sun to make food.
S09_03	Explains that photosynthesis takes place when light is shone on a plant and/or recognizes that the gas given off is oxygen.
S09_05	Recognizes that fossils found in the oldest layers of sedimentary rock are formed from organisms that lived in the sea.
S10_01	Recognizes that leafy vegetables are a good source of minerals.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit E.1: **Descriptions of Science Items at Each International Benchmark** *(…Continued)*

SCIENCE Grade 8

Items at Advanced International Benchmark (625) – *Continued*

Life Science – *Continued*

S10_03	Recognizes that chemical elements recycle back into the environment when animals/plants die.
S11_03	Compares two diagrams showing a pair of eyes and recognizes light as the environmental condition that causes the difference and recognizes that more light results in smaller pupils.
S12_06	Recognizes that vaccines provide the body with long-term immunity.
S13_07	Chooses plants or animals as the likely first inhabitants of an island and explains why.
S13_08A	States one effect the introduction of cats could have on animals and plants already living in an area.
S13_09A	Interprets two bar charts showing the distribution of beak depths of two species of birds and describes how the beak depths compare.
S13_09B	Using the information from two bar charts showing the distribution of beak depths of two species of birds, relates the size of seeds they eat to beak depth.
S14_09	From diagrams showing organisms that live in the intertidal zone, selects one organisms, identifies and explains how a physical feature or behavior that helps it to survive low tide.
S14_10	States two conditions that are found at the bottom of the ocean that make it difficult for most organisms to live there.

Chemistry

S01_01	Recognizes that the nucleus of most atoms is composed of protons and neutrons.
S01_11	Recognizes that both burning coal and exploding fireworks release energy.
S03_12	Recognizes that an ion is formed when a neutral atom gains an electron.
S04_01	Distinguishes between mixtures and a pure substance (sugar).
S05_01	From a list of gases, identifies oxygen as the gas that causes rust formation.
S06_04	Recognizes that when sugar is dissolved in water, the sugar molecules continue to exist, but in solution.
S06_05	Recognizes a phase change as not involving a chemical change.
S06_12	Recognizes that electrical conductivity has been used as a criterion to classifying materials into two groups.
S08_05	Recognizes which diagram best represents the structure of water molecules.
S09_06	Recognizes that water should be added to a saline solution to make it half as concentrated, and determines the amount.
S09_07	Explains why litmus paper does not change color in a mixture of the right proportion of hydrochloric acid and sodium hydroxide.
S10_07	Calculates the density of a metal in a block given the block's mass and length of its size.
S10_10A	Compares the previously computed density of a block of metal to the densities of different metals presented in a table and infers what the metal is and explains their answer.
S11_06	Identifies a property of metals and describe how this property can be used to determine whether an unknown substance is a metal or nonmetal.
S13_01	Identifies which of oxygen, hydrogen, and water are elements.
S14_02	Based on an incomplete table comparing pure water and salt water, explains that addition of salt increases the density.

Physics

S04_03	Applies knowledge of experimental controls and interprets diagrams to identify variables to be controlled and varied in a described experiment (effect of height of ramp on speed of cart).

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit E.1: **Descriptions of Science Items at Each International Benchmark** *(Continued...)*

Items at Advanced International Benchmark (625) – *Continued*

Physics – *Continued*

S07_07	Recognizes that mass is conserved during thermal expansion.
S07_08	Recognizes plucking a guitar string harder causes the volume to increase but does not effect the pitch.
S08_07	Interprets a circuit diagram recognizes that the current flows through two bulbs is the same.
S10_08	Describes water displacement as a procedure to find the volume of an irregularly shaped object.
S10_09A	Explains why scientists do repeated measurements.
S10_09B	Describes how scientists use the combined results from five trials to obtain a mean value.
S11_09	Recognizes that the force of gravity acts on a person regardless of position and movement.
S12_08	Recognizes that railway tracks are laid down with gaps between lengths to allow expansion on hot days.
S12_09	Predicts the effect of removing air on the propagation of sound.
S13_05	Describes that a spectrum can be seen when sunlight passes through by a glass prism.
S14_03	Recognizes that particles of a liquid are slower and closer together than particles of a gas.
S14_04	Recognizes that an iron nail becomes magnetized when current flows through a wire coiled around the nail.

Earth Science

S01_06	From a list of rock types, identifies limestone as the type involved in the formation of underground caves.
S07_09	Relates the tilt of Earth's axis as it orbits the Sun to the seasons.
S08_09	Recognizes what is a cause of tides.
S08_10B	Draws the path and direction of a river on a contour map from a mountain to a bay.
S09_12	Given a table showing information about Venus and Mercury, recognizes that the higher average surface temperature on Venus is due to the greenhouse effect.
S10_04	Interprets a map of the world showing latitude and recognizes to areas of similar average yearly temperature.
S10_05	Relates the phases of the Moon to its motion around Earth.
S11_12	Describes changes in atmospheric conditions that occur with increasing elevation.
S14_01	Recognizes the percentage of total water on Earth that is fresh water.
S14_05A	Identifies and explains a physical process that can cause weathering of rocks.

Environmental Science

S03_06	From a list of renewable and non-renewable energy sources, identifies coal as a non-renewable energy source.
S05_09	States that sulfur dioxide produced by burning coal combines with water vapor in the atmosphere to form acid rain.
S06_14A	Describe how science and technology can be used to address oil spills in the oceans.
S07_11	Interprets the data in a table to describe the effect of the amount fertilizer on the yield of rice.
S07_12	States one reason why the human population increased rapidly over the last 200 years.
S08_11A	Based on demographic and other information about two countries, predicts how their population will change over time.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit E.1: **Descriptions of Science Items at Each International Benchmark** *(…Continued)*

Items at Advanced International Benchmark (625) – *Continued*

Environmental Science – *Continued*

S08_11B	Given a table showing the demographic, grain production, oil consumption about two countries, predicts how a change in population in each country will affect the land use over the next 10 years.
S08_11C	Given a table showing the demographic, grain production, oil consumption about two countries, predicts how a change in population in each country will affect the pollution over the next 10 year.
S10_06	States one renewable energy source and describes one way it can be used.
S11_13	Recognizes that the increase in algal growth in a lake is most likely due to fertilizer runoff.

Items Above the Advanced International Benchmark (625)

Life Science

S04_10	Recognizes that cats are more closely related to whales than birds or reptiles.
S05_08	From a list of animals, identifies fish as having been on Earth for the longest period of time.
S05_12	Provides a partial explanation of why the heart beats faster during exercise that includes physiological needs (e.g., oxygen, carbon dioxide removal) or the role of the circulatory system (increased blood flow).
S08_03	Given that seeds can germinate in the light and dark, states two conditions needed for germination of seeds.
S10_02	Recognizes that the absorption of food into the blood stream mainly takes place in the small intestine.
S12_01	Recognizes that the purpose of cellular respiration is to provide energy for cell activities.
S13_10	Compares two graphs showing different overlap between the distribution of beak size for two species and infers less overlap is the most favorable situation for both species to survive due to reduced competition for food.
S14_08B	Based on a completed food web, predicts and explains what is most likely happen to a population of sharks when tuna are over-fished.

Chemistry

S01_14	Recognizes that a compound results from a reaction between chlorine gas and sodium metal.
S03_08	Identifies a chemical change from examples of physical and chemical changes.
S08_06	States one thing that could be observed that shows energy has been released during a chemical reaction.
S10_10B	Compares a given density of a metal crown to the densities of different metals shown in a table and infers the composition of the crown.
S11_05	Recognizes the concept map that best represents the particulate structure of matter going from molecules to atoms to subatomic particles (protons, neutrons, and electrons).

Physics

S01_08	Identifies the diagram that shows the most appropriate thermometer scale for accurately measuring a given range of temperatures.
S04_09	Given a table of results from an investigation of how the length of a spring changes as different masses are hung from it, describes the relationship between mass and length.
S06_08	Applies the principle of conservation of mass during phase change to explain why the mass of water remains unchanged after it is frozen.
S11_07	Recognizes a sequence of energy conversion that takes place in a battery-operated flashlight.
S11_08	Interprets a diagram showing air and water in a sphere attached to a U-tube and explains that how heating the air can cause the water level in the open tube to rise.
S12_07	Recognizes that when traveling from a mountain top to a valley, a closed empty plastic bottle collapses because the air pressure is higher in the valley is higher than on the mountain top.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit E.1: **Descriptions of Science Items at Each International Benchmark**

SCIENCE Grade 8

Items Above the Advanced International Benchmark (625) – *Continued*

Earth Science

S02_01	Applies knowledge of the effect of weathering over time to interpret diagrams and draw conclusion about the relative age of two mountain systems based on shape.
S03_09	Identifies the order of abundance in Earth's atmosphere of nitrogen, oxygen, and carbon dioxide.
S07_10	Recognizes that most fresh water on Earth is located in the polar ice caps.
S14_05B	Identifies and explains a chemical process that can cause weathering of rocks.

Environmental Science

S01_13	Recognizes that gases from burning fossil fuels are a principal cause of acid rain.
S06_14B	Describes how science and technology can be used to address global warming due to increased levels of carbon dioxide in the atmosphere.
S09_02	Describes a procedure that includes evaporation and condensation that can be used to obtain drinking water from sea water.
S14_07	Recognizes the graph that shows the increasing rate of human population growth over the last 200 years.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit E.2: **Descriptions of Science Items at Each International Benchmark**

Low International Benchmark (400) Items

Life Science

S01_09	Identifies a food in a list of edible and inedible plants.
S02_02	Recognizes that washing hands of germs prevents illness.
S02_05	Recalls information that air enters the lungs.
S02_06	Interprets a diagram and identifies roots as plant part responsible for water uptake.
S02_10	Identifies an animal that does not lay eggs in a list of familiar animals.
S03_04	Communicates an effect of environmental change (temperature) on aquatic life.
S03_06	Identifies the herbivore in a list of familiar animals.
S03_11	Interprets a diagram and reasons from everyday experience to identify teeth used for grinding.
S04_01	From a diagram showing insects and young insect forms, recognizes that the butterfly is correctly paired with its larvae.
S07_04	Recognizes from diagrams of animals which is most likely to live in a desert.
S08_02	Recognizes which foot structure belongs to a bird that lives in a pond.
S08_05	Recognizes that tadpoles hatch from frogs' eggs.
S09_01	Given a diagram, recognizes insects by presence of six legs.
S11_07	Recognizes that birds sit on their eggs to keep the eggs warm.
S12_01	Recognizes wolfs as a predator.
S12_02	Recognizes that fat layers help keeping a walrus warm.
S12_03	Recognizes that wings are common to bird, bats, and butterflies.

Physical Science

S01_01	Recalls information about attraction of iron to magnets.
S01_05	From a diagram of floating objects, identifies the heaviest object.
S02_01	Recognizes that water changes into vapor during boiling.
S02_09	Recognizes physical conditions required causing rainbows (sunlight, rain).
S03_05	Recognizes that the weight of an object does not change depending on its orientation on a scale.
S07_06	Recognizes that iron nails rust.
S09_05	Given diagrams showing a lightbulb connected to a battery, recognizes in which one the bulb will light.
S10_08	Recognizes that sugar dissolves in water.
S11_08	Recognizes that an iron nail can complete an electrical circuit and allow a bulb to blow.

Earth Science

S01_10	Recalls knowledge of Earth's annual revolution around sun.
S02_11	Interprets a diagram of the Earth's layers and identifies the center as the hottest.
S03_02	Recalls knowledge that the sun is the hottest celestial body in the solar system.
S03_08	Identifies oxygen as gas needed for breathing.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit E.2: **Descriptions of Science Items at Each International Benchmark** *(Continued…)*

Items at Low International Benchmark (400) – *Continued*

Earth Science – *Continued*

S05_09A	States the names of two seasons.
S06_07	Explains why people should not drink water directly from oceans and seas.

Items at Intermediate International Benchmark (475)

Life Science

S01_07	Recognizes that excess food is stored as fat.
S04_03	Given four diagrams, recognizes types of plants that usually found in a tropical rain forest.
S06_01	Recognizes that snakes shed their outer covering as they grow larger.
S06_03	Recognizes from diagrams of bird which is most likely to eat mammals.
S07_01	Recognizes that trees make their own food using sunlight.
S07_05	Recognizes from a picture of two types of seed that they are scattered by wind.
S09_02	States one thing that can happen to human body if it is not protected from the sun.
S09_03	Recognizes a group consisting only of living things.
S09_06	Given a diagram of six organisms, classifies them into those that give birth and those that lay eggs.
S10_03	In a diagram of a pond community, recognizes that tadpoles get their food from plants.
S10_07	Recognizes that larvae found in a bag of rice likely come from eggs laid by insects.
S13_07A	Combines information from a plan of a garden and a diagram showing plants and their light requirements, explains why roses would not grow well under an oak tree.
S14_05	Recognizes that a person's hair type can be predicted by his/her parents' hair type.
S14_06	Interprets from a food chain that snakes eat voles.

Physical Science

S01_03	Recalls knowledge that plant matter (apple core) will decay.
S03_01	Recognizes that air is contained inside soap bubbles.
S03_10	Recognizes that copper is a good heat conductor.
S04_08A	Given that a material (solid, liquid, or gas) is put into a larger container, recognizes the state of the material from the shape it takes in the larger container.
S05_05A	States one way water in ice form is used by humans.
S05_05B	States one way water in liquid form is used by humans.
S08_07	Recognizes that salt water is a mixture.
S08_08	From a list of common materials, indicates which of them will burn.
S09_07A	States one object that is made out of metal.
S12_07	States two things that electricity can be used for in daily life.
S13_01	Recognizes that all objects have mass.
S13_04	Recognizes that a candle in the largest sealed container will be the last to go out.
S14_02B	Given from a diagram showing the color of a white shirt appears to be under different colored light bulbs, infers its color under blue light.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit E.2: **Descriptions of Science Items at Each International Benchmark** *(…Continued)*

Items at Intermediate International Benchmark (475) – *Continued*

Earth Science

S01_02	Recalls information about the saltiness of ocean water.
S01_06	Recalls fact to identify that water covers most of Earth's surface.
S01_08	Recalls fact about location of fossils in rocks.
S01_11	Interprets textual description and diagrams of rock abrasion observations to identify the hardest rock.
S04_09	Given diagrams showing rocks of different shapes and sizes, recognizes which rock has been carried furthest down the river.
S05_09B	States one difference between two previously named seasons.
S06_08	States one different between the Sun and the Moon.
S07_11	States two different things human use wood for.
S13_02	Recognizes that the minerals needed to make things come from rocks.
S14_08	Orders diagrams showing ribbons on holes by decreasing wind strength.

Items at High International Benchmark (550)

Life Science

S01_04	Recognizes that sensory messages are interpreted in the brain.
S03_03	Recognizes that exercise causes an increase in breathing and pulse rates.
S05_03	Using knowledge of teeth, identifies and explains which of two skulls shows an animal that ate plants and which shows an animal that ate meat.
S06_04A	States one physical feature or behavior of fish that distinguishes them from sea mammals.
S10_05	Recognizes that plants are living things and gives a reason.
S11_01	Recognizes from a list of animals that humans have a young form that looks most like the adult form.
S11_03	From pictures of animals, pairs each animal with its distinguishing biological characteristics (skeleton, milk production, number of legs).
S12_04	States one thing can cause the temperature of the human body to be higher than normal.
S13_05B	States one thing plants need in addition to light and water in order to grow well.
S13_08	Infers from a picture of plants and its seed, how the seeds are spread.
S14_04	Recognizes that the teeth of monkeys are most like the teeth of humans.

Physical Science

S05_06	From a diagram showing a metal ruler heated at one end, recognizes the direction of heat transfer starting from the heated end.
S05_07	From a diagram showing a person blowing into water using a straw, explains why bubbles rise to the top.
S06_05	Recognizes that the hotter the water the more sugar will dissolve.
S06_06A	Describes how a liquid can be turned into a gas.
S06_06B	Describes how a liquid can be turned into a solid.
S07_07	From a diagram showing three powders, recognizes those likely to be mixtures.
S07_08	Given a set of diagrams, recognizes that ice melts most slowly in the closed container.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit E.2: **Descriptions of Science Items at Each International Benchmark** *(Continued…)*

Items at High International Benchmark (550) – *Continued*

Physical Science – *Continued*

S10_10	Describes one difference between solids and liquids.
S11_05	Recognizes that metal spoon in hot soup feels hotter than a wooden spoon in hot soup, because metal conducts heat better than wood.
S11_09	Recognizes that gravity causes an object to fall to the ground.
S14_01C	From an investigation of the effect of different colored light on the apparent color of a shirt, infers the color of an unknown light bulb.
S14_02A	Describes the results of an investigation involving white shirt seen under different colored light bulbs.

Earth Science

S02_07	Interprets pictorial diagram and identifies angle/length of shadow cast by sunlight.
S07_09	Explains that early morning moisture can be due to condensation.
S09_09	From a diagram showing a variety of landscape features, recognizes the best location for growing crops.
S10_04	Explains that when moist air becomes very cold, water in the air condenses or freezes.
S12_10	Identifies the Earth, Moon, and Sun from a diagram.

Items at Advanced International Benchmark (625)

Life Science

S04_02	States one thing human body does to cool down during exercise.
S04_04	Describes one physical change, other than growing taller and becoming heavier, that takes place in children's bodies as they become adults.
S05_01	Recognizes a group of animals that are all mammals.
S05_04	Recognizes that the energy needed to heal a cut comes from food.
S06_02	States two reasons why humans need a skeleton.
S06_04B	States one physical feature or behavior of sea mammals that distinguishes them from fish.
S07_02	Explains that the last surviving member of a species of a turtle cannot reproduction and gives a reason.
S08_01	Recognizes from a list of foods that cheese is the best source of calcium.
S08_04	Recognizes that differences in light brightness cause eyes in one picture to look different from the eyes in a second picture.
S10_01	Recognizes that flowers are yellow because the flowers of the parent plant are yellow.
S10_06	States two ways a cold can be transmitted.
S11_02	Recognizes that if the only remaining Siberian Tigers are female, they will not be able to reproduce, and will die out.
S12_11	Describes two human activities that can lead to the extinction of animals.
S13_07B	Combines information from a plan of a garden and a diagram showing plants and their light requirements, to complete a table listing plants that would grow well in different areas of the garden.
S13_09	Explains why some insects are important for flowering plants.

Physical Science

S03_07	Distinguishes between renewable and non-renewable energy sources.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit E.2: **Descriptions of Science Items at Each International Benchmark** *(…Continued)*

Items at Advanced International Benchmark (625) – *Continued*

Physical Science – *Continued*

S04_05	Interprets information from a table of physical properties of three materials to identify wood, rock, and iron.
S04_07	Recognizes from four diagrams the two diagrams that show two magnets repelling each other.
S08_10	From a diagram showing two magnets on carts with the magnet poles marked, describes what happens to the carts when they are moved close together and let go.
S10_11	Recognizes that magnetism and not gravity can make objects repel each other.
S11_04	Recognizes that fine salt dissolves faster in water than coarse salt and explains why.
S11_06	Names one thing that shows that sunlight being made up of different colors.
S12_05	From a table showing the results of an experiment, identifies what was being studied in the experiment.
S12_06	Recognizes the diagram that best shows how ice flows in water.
S12_08	Recognizes that heat needs to be supplied for melting and boiling but not for freezing.
S13_03	Identifies the two things wrong with a diagram showing the shadow of a man and the location of the sun.
S14_01A	Describes the results of an investigation involving red shirt seen under different colored light bulbs.
S14_01B	From an investigation of the effect of different colored light on the apparent color of a shirt, concludes that the shirt looks different under different lights.

Earth Science

S02_03	Applies knowledge of Earth's features to interpret a diagram and indicate the direction of river flow from mountains to sea.
S03_09	Recognizes that metals are found in rocks.
S05_08	Recognizes that the Moon can be seen because it reflects the light from the Sun.
S07_10	Recognizes that fossils are evidence that land was once discovered by the sea.
S08_03	Describes two things people can do to avoid wasting water.
S09_08	Interprets table of temperature and cloud cover data to predict location where it snowed.
S11_11	Recognizes a soil change due to natural causes.
S12_09	Recognizes that soil rich in decaying plants and animals makes plants grow.
S13_06	From a plan of a house and garden showing North, South, East, and West, identifies the side of the house that receives the most sun in the morning and explains why.

Items Above the Advanced International Benchmark (625)

Life Science

S02_04	Recognizes that a person's adult height is affected by the height of their parents.
S05_02	Predicts whether different types of plants can reproduce and justify answer.
S07_03	Evaluates and explains best experimental setup for investigating effect of salt on seaweed.
S09_04	Describes functions of the skin.
S10_02	Recognizes from a picture of an animal that lives in a hot desert that its large ears help it lose heat.
S13_05A	Explains why plants need light to grow.
S14_07	Evaluates and supports argument for the need for a balanced diet.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit E.2: **Descriptions of Science Items at Each International Benchmark**

Items Above the Advanced International Benchmark (625) – *Continued*

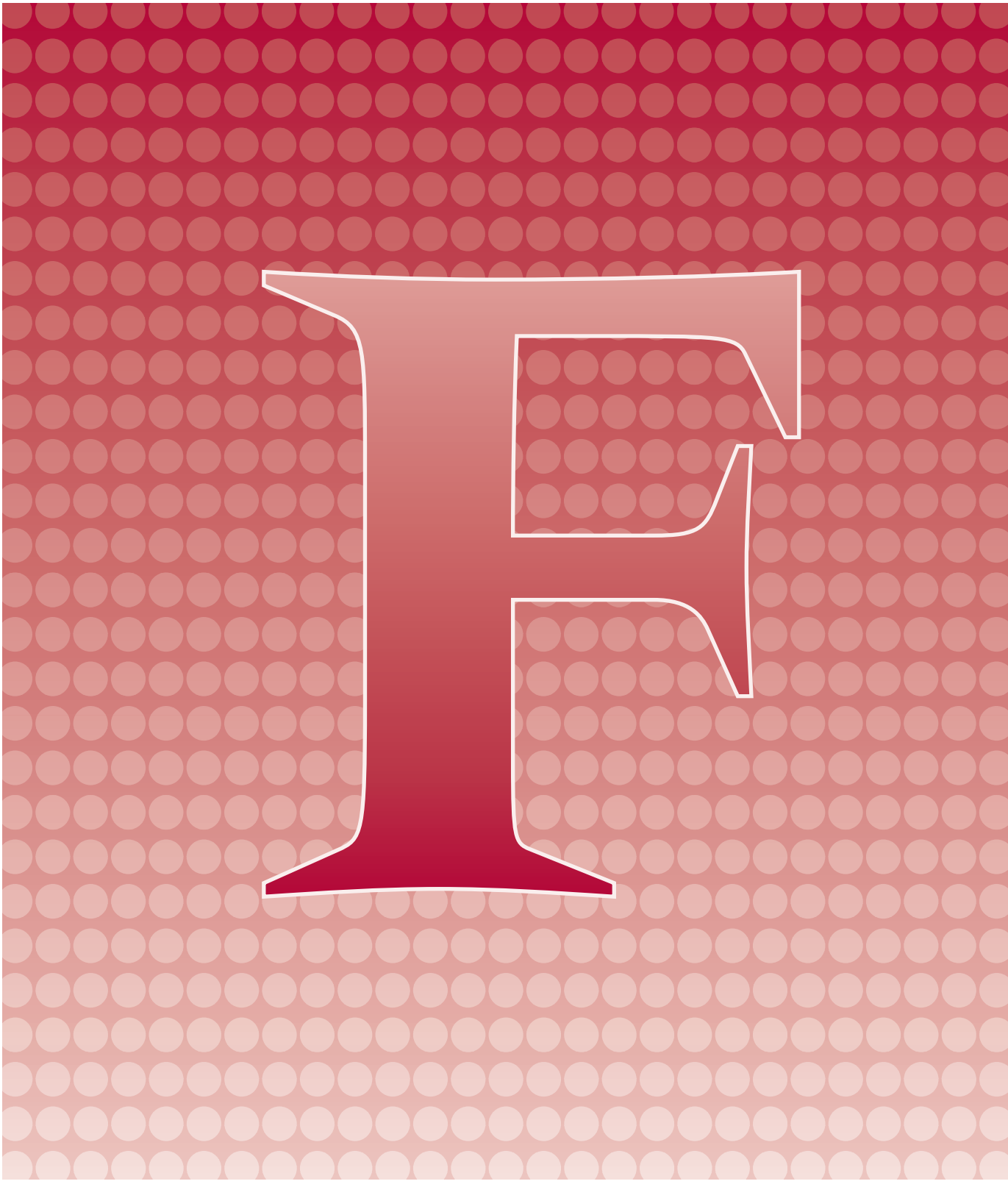
Physical Science

S04_06	Applies knowledge that water expands when it freezes to a practical problem.
S04_08B	Explains predicted volume and shape of solid, liquid and gas when transferred to different containers.
S08_09	Determines changes in temperature when a hot object is put into cold water.
S09_07B	Gives an example of a property and use of metal object.
S10_09	Identifies rusting as an example of a chemical change that produces different materials.
S14_03	Predicts and explains color of blue shirt under blue light.

Earth Science

S08_11	Relates day and night on Earth to rotation on its axis.
S09_10	Recognizes that a full moon occurs about once a month.
S11_10	Describes activities that require air.

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003



Appendix F

Syrian Arab Republic and Yemen Science Achievement

Exhibit F.1: Syrian Arab Republic – Selected Science Achievement Results

Distribution of Science Achievement							
Mean Achievement	Years of Schooling	Average Age	5th Percentile (Scale Score)	25th Percentile (Scale Score)	50th Percentile (Scale Score)	75th Percentile (Scale Score)	95th Percentile (Scale Score)
411 (3.7)	8	14	276 (4.1)	356 (5.1)	413 (4.3)	466 (3.1)	538 (6.5)

Gender Difference in Science Achievement		
Science Achievement	Girls' Mean	Boys' Mean
411 (3.7)	402 (4.2)	413 (5.8)

▲ Significantly higher than other gender

Average Achievement in Science Content Areas by Gender				
Content Area	Girls' Mean	Boys' Mean		Overall Mean
Life Science	444 (3.2)	444 (4.6)		447 (3.0)
Chemistry	437 (3.9)	439 (5.1)		440 (3.4)
Physics	410 (4.0)	427 (5.3)	▲	423 (3.5)
Earth Science	420 (4.4)	438 (5.3)	▲	432 (3.7)
Environmental Science	446 (4.0)	449 (5.1)		450 (3.1)

▲ Significantly higher than other gender

Percentages of Students Reaching International Benchmarks in Science			
Advanced International Benchmark (625)	High International Benchmark (550)	Intermediate International Benchmark (475)	Low International Benchmark (400)
0 (0.1)	4 (0.6)	22 (1.4)	56 (2.0)

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

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Exhibit F.2: Yemen – Selected Science Achievement Results

Distribution of Science Achievement							
Mean Achievement	Years of Schooling	Average Age	5th Percentile (Scale Score)	25th Percentile (Scale Score)	50th Percentile (Scale Score)	75th Percentile (Scale Score)	95th Percentile (Scale Score)
250 (9.2)	8	11	5 (0.0)	126 (9.2)	246 (13.0)	370 (13.8)	506 (6.6)

Gender Difference in Science Achievement		
Science Achievement	Girls' Mean	Boys' Mean
250 (9.2)	260 (10.7)	247 (11.1)

▲ Significantly higher than other gender

Average Achievement in Science Content Areas by Gender			
Content Area	Girls' Mean	Boys' Mean	Overall Mean
Life Science	239 (10.8)	223 (10.4)	227 (8.6)
Physical Science	280 (9.3)	268 (10.1)	271 (8.5)
Earth Science	297 (9.4)	288 (9.6)	290 (8.0)

▲ Significantly higher than other gender

Percentages of Students Reaching International Benchmarks in Science			
Advanced International Benchmark (625)	High International Benchmark (550)	Intermediate International Benchmark (475)	Low International Benchmark (400)
0 (0.1)	1 (0.4)	9 (1.3)	20 (2.1)

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

SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

Appendix G

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Developing and implementing TIMSS 2003 was an extremely ambitious and truly collaborative effort involving hundreds of individuals around the world. Staff from the national research centers in each participating country, the International Association for the Evaluation for Educational Achievement (IEA), the TIMSS & PIRLS International Study Center (ISC) at Boston College, advisors, and funding agencies worked closely to develop and implement TIMSS 2003. The project would not have been possible without the tireless efforts of all involved. Below, the individuals and organizations are acknowledged for their contributions. Given that implementing TIMSS 2003 has spanned approximately four years and involved so many people and organizations, this list may not pay heed to all who contributed throughout the life of the project. Any omission is inadvertent. TIMSS 2003 also acknowledges the students, teachers, and school principals who contributed their time and effort to the study. This report would not be possible without them.

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Management and Operations

TIMSS 2003 was conducted under the auspices of the IEA. The study was directed by Michael O. Martin and Ina V.S. Mullis, and managed centrally by the staff of the TIMSS & PIRLS International Study Center at Boston College, Lynch School of Education. Although the study was directed by the International Study Center and its staff members implemented various parts of TIMSS 2003, important activities also were carried out in centers around the world. In the IEA Secretariat, Hans Wagemaker, Executive Director, was responsible for overseeing fundraising and country participation. The IEA Secretariat also managed the ambitious translation verification effort conducted for the field test and main assessment and recruited international quality control monitors in each country. The IEA Data Processing Center was responsible for processing and verifying the data from the participating countries and for constructing the international database. Statistics Canada was responsible for collecting and evaluating the sampling documentation from each country and for calculating the sampling weights. Educational Testing Service in Princeton, New Jersey provided consultation on psychometric issues as well as technical support and software for scaling the achievement data. The Project Management Team, comprising the study directors and representatives from the International Study Center, IEA, Statistics Canada, and Educational Testing Service, met regularly throughout the study to discuss the study's progress, procedures, and schedule.

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The TIMSS 2003 National Research Coordinators and their staff had the enormous task of implementing the TIMSS 2003 design. This involved obtaining funding for the project; participating in the development of the instruments and procedures; conducting field tests; participating in and conducting training sessions; translating the instruments and procedural manuals into the local language; selecting the sample of schools and students; working with the schools to arrange for the testing; arranging for data collection, coding, and data entry; preparing the data files for submission to the IEA Data Processing Center; contributing to the development of the international reports; and preparing national reports. The way in which the national centers operated and the resources that were available varied considerably across the TIMSS 2003 countries. In some countries, the tasks were conducted centrally, while in others, various components were subcontracted to other organizations. In some countries, resources were more than adequate, while in some cases, the national centers were operating with limited resources. All of the TIMSS 2003 National Research Coordinators and their staff members are to be commended for their professionalism and their dedication in conducting all aspects of TIMSS.

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