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TIMSS

TIMSS 2003 International Mathematics 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 mathematics 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' Mathematics Achievement in 2003

- At both the eighth and fourth grades, Singapore was the top-performing country having significantly higher average achievement in mathematics than the rest of the participating countries.
- At the eighth grade, with the exception of Singapore, the Republic of Korea, Hong Kong SAR, and Chinese Taipei had significantly higher average achievement than all of the other participating countries.
- At the fourth grade, Hong Kong, SAR had significantly higher performance than all countries except Singapore, and, in turn, Japan and Chinese Taipei outperformed the rest of the countries except Singapore and Hong Kong, SAR.

Trends in Mathematics Achievement

- At the eighth grade, several countries showed significantly higher average achievement in 2003 compared to the previous assessments in 1995 and 1999. Korea, Hong Kong SAR, Latvia (LSS),[1] Lithuania, and the United States, 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 participating only in the 1999 and 2003 assessments, Israel 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 Japan, Belgium (Flemish), the Russian Federation, the Slovak Republic, Sweden, Bulgaria, Norway, Cyprus, Macedonia, Iran, and Tunisia as well as the benchmarking Canadian province of Quebec.
- At the fourth grade, many countries showed significant gains in average achievement between 1995 and 2003, including Hong Kong SAR, Latvia (LSS), England, Cyprus, New Zealand, and Slovenia as well as the benchmarking province of Ontario. The only significant declines were found in the Netherlands, Norway, and Quebec province.

Gender Differences in Mathematics Achievement

- At the eighth grade, the gender difference in TIMSS 2003 was negligible in many countries. However, there were variations across countries with girls outperforming boys in the same number of countries that boys outperformed girls. The girls had significantly higher average achievement than boys in Serbia, Macedonia, Armenia, Moldova, Singapore, the Philippines, Cyprus, Jordan, and Bahrain.

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

In contrast, boys had higher achievement in the United States, Italy, Hungary, Lebanon, Belgium (Flemish), Morocco, Chile, Ghana, and Tunisia as well as in two benchmarking participants – the US state of Indiana and Quebec province.

- The trend results at the eighth grade show a few more countries with improvement for girls than for boys. Girls had improved performance and boys did not in four countries, whereas there was no country in which boys improved and girls did not. Both girls and boys improved in five countries and Ontario province. Reflecting declines in achievement across assessments, both genders had lower achievement in TIMSS 2003 in seven countries and Quebec province as did the girls in Belgium (Flemish).
- At the fourth grade, the TIMSS 2003 results by gender paralleled those at the eighth grade. Girls had significantly higher average achievement in Singapore, Moldova, the Philippines, and Armenia. Boys had higher average achievement in the Netherlands, the United States, Italy, Cyprus, Scotland, and in the two Canadian provinces.
- The fourth-grade trend results for the genders mirror the overall results, showing more countries with improvements than declines and consistency between girls and boys. Both boys and girls improved in six countries and Ontario province, while both declined only in Norway and Quebec province.

Performance at the International Benchmarks in TIMSS 2003

TIMSS identified four benchmark levels to describe what students know and can do in mathematics 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** used algebraic, geometric, and measurement concepts in complex

problem situations. At the other end of the performance continuum, those reaching the **low benchmark** demonstrated some basic mathematical knowledge.

- The highest performing countries – Singapore, Chinese Taipei, Korea and Hong Kong SAR – had about one-third of their students or more (from 31 to 44%) reaching the advanced benchmark followed by Japan with 24 percent. In contrast, all other countries had 11 percent or less of their students reaching the advanced benchmark, including 19 of the lowest-performing countries with 1 percent or less.
- The nine highest-performing countries and the two Canadian provinces had 95 percent or more of their students reaching the low benchmark whereas the eight lowest-performing countries had less than half their students reaching the low benchmark.

At the fourth grade, students reaching the **advanced benchmark** used understanding of fractions and decimals, measurement concepts, and data interpretation in a wide variety of relatively complex situations. Those reaching the **low benchmark** demonstrated some mathematical knowledge.

- With fewer and more homogenous countries at the fourth grade, Singapore had 38 percent of its students reaching the advanced benchmark followed by 21 to 22 percent of the students in Hong Kong SAR and Japan. Five of the lowest-performing countries had 1 percent or less of their students reaching the advanced benchmark.
- Eight countries as well as the US state of Indiana had 95 percent or more their students reaching the low benchmark and all except four countries had at least three-fourths of their students reaching this level. In the four lowest-performing countries (the Philippines, Iran, Tunisia, and Morocco), less than half the students reached the low benchmark.

Students' Home Context for Learning Mathematics

- 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 almost all countries. Also, students expecting to finish university had substantially greater average mathematics 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 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 mathematics achievement.
- Mathematics 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 Mathematics Curriculum

- Most countries had mathematics 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.

- At the eighth grade, all participants emphasized understanding mathematical concepts and principles followed by mastering basic skills. At the fourth grade, mastering basic skills was emphasized most, followed by understanding concepts and principles.
- In relation to the TIMSS assessment at the eighth grade, on average, participants reported that nearly all the number topics (96%) were included in their curricula, 78 percent of the measurement topics, 67 percent of the geometry topics, 63 percent of the algebra topics, and 39 percent of the data topics.
- At the fourth grade, on average, 81 percent of the measurement topics assessed were included in the participants' curricula, 68 percent of the number topics, 62 percent of the data topics, 54 percent of the patterns and relationships topics, and 38 percent of the geometry topics.
- At the eighth grade, across countries on average, teachers reported that 95 percent of the students had been taught the number topics, 78 percent the measurement topics, 69 percent the geometry topics, 66 percent the algebra topics, and 46 percent the data topics.
- At the fourth grade, across countries on average, teachers reported that 86 percent of the students had been taught the measurement topics, 80 percent the data topics, 79 percent the patterns and relationships topics, 77 percent the number topics, and 55 percent the geometry topics.

Teachers of Mathematics

- Mathematics teachers reported considerable teaching experience. At both the eighth and fourth grades, on average, students were taught by teachers with 16 years of experience.
- On average, 76 percent of the eighth-grade students and 65 percent of the fourth-grade students were taught by teachers with at least a university degree.

- Seventy percent of the eighth-grade students, on average, had mathematics teachers with a mathematics major and more than half (54%) with a major in mathematics education or both. 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 mathematics by teachers having at least some professional development training in these areas.
- Across the five mathematics 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 15 out of 18 topics (all but three data topics). Similarly, 90 percent or more of the fourth-grade students were taught by teachers reporting readiness for teaching 14 of the 16 topics (exceptions were two geometry topics).

Classroom Instruction

- At the eighth grade, on average, teachers reported that 27 percent of the instructional time was devoted to algebra, 26 percent to geometry, 21 percent to number, 10 percent to each of measurement and data, and 6 percent to other. At fourth grade, the profile was different, with number receiving 38 percent of the instructional time. Patterns and relationships, measurement, and geometry each were given 13 to 16 percent, data 9 percent, and other 6 percent.
- At the eighth grade, on average, teachers reported asking 62 percent of students to practice numerical operations and 43 percent to work on fractions and decimals in at least half their lessons. At the fourth grade, teachers reported an overwhelming emphasis on having stu-

dents practice numerical operations (82% of students in half or more of the lessons).

- At the eighth grade, on average, for 45 percent of students, teachers reported devoting some time in at least half their lessons to asking students to decide what procedures to use for solving complex problems.
- At both eighth and fourth grades, the textbook was often the foundation of mathematics instruction. On average, about two-thirds of students at both grades had teachers who reported using a textbook as the primary basis for their lessons, and another third as a supplementary resource.
- On average, the three most common instructional activities were teacher lecture, teacher-guided student practice, and students working on problems on their own (totaling 59% of the time at eighth grade and 61% at fourth grade).
- Policies about calculator usage varied dramatically from country to country. At the eighth grade, in 10 countries nearly all the students (98% or more) were permitted to use calculators. In contrast, less than half were permitted to use calculators in seven countries. At fourth grade, on average, more than half the students were not permitted to use calculators. Only five countries reported permitting widespread calculator usage (at least 90% of students).
- The percentages of eighth-grade students asked to use calculators in half their lessons averaged from 27 percent for checking answers to 14 percent for exploring number concepts. Relatively few fourth-grade students were asked to engage in any calculator activities in as many as half their lessons.
- At the eighth grade, on average, 56 percent of students were taught by teachers who used only or mostly constructed-response tests.

These students had higher average achievement than did students whose teachers used only multiple-choice tests or a combination.

School Contexts for Learning and Instruction

- At the eighth grade, average mathematics achievement was 57 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 47 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 mathematics 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, 72 percent of eighth-grade students and 75 percent of fourth-grade students attended schools characterized as safe by their teachers. At both grades, there was a positive relationship between school safety and mathematics 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 four 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

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

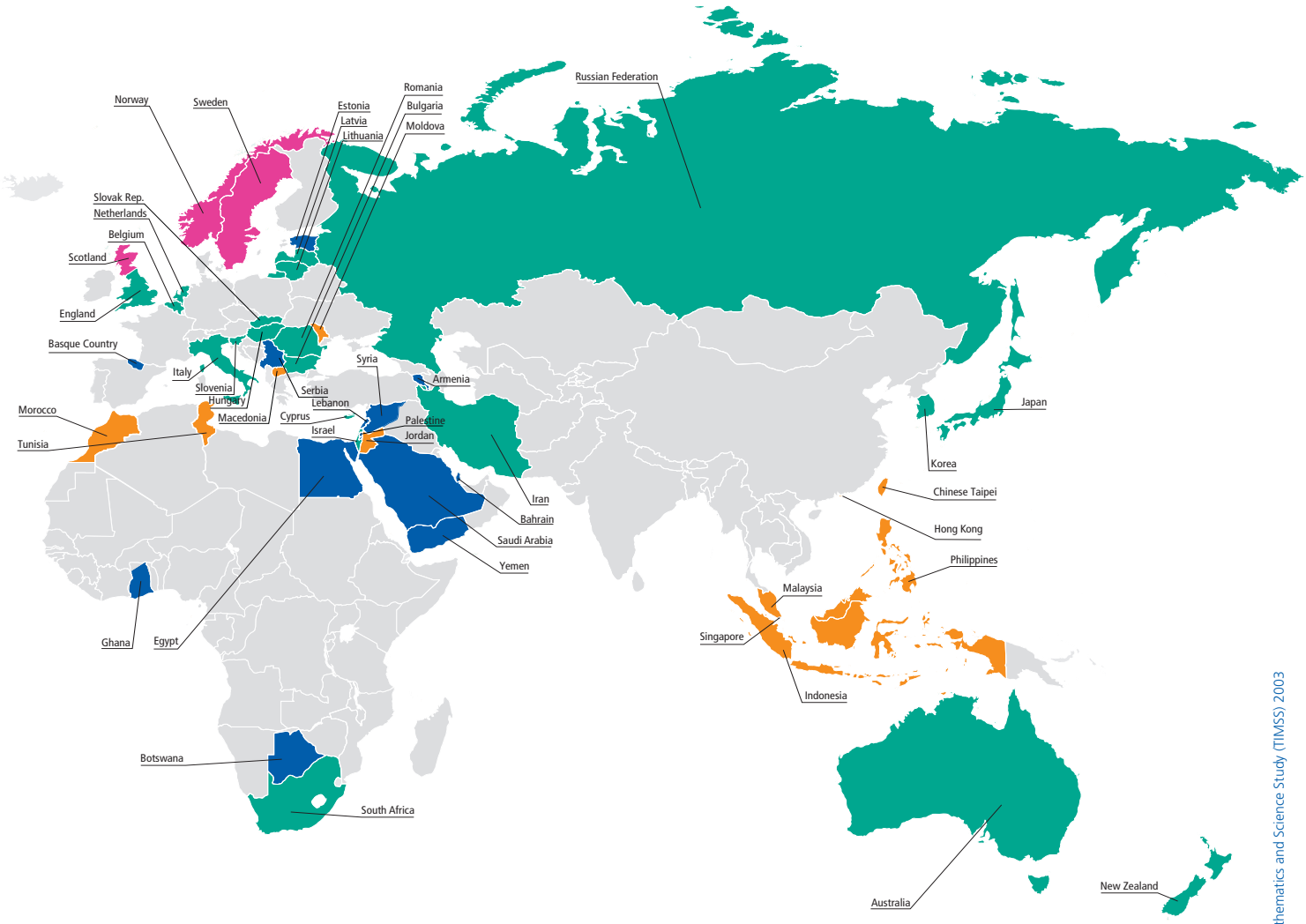
Argentina
Chile
Chinese Taipei
Indonesia
Jordan
Macedonia, Rep. of
Malaysia
Moldova, Rep. of
Morocco
Philippines
Tunisia
Indiana State, US

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.

for 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 affect 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 Grades 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 Grades 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 Grades 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 Grades 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 Grades 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
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 Mathematics 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. Topic areas are elaborated with objectives specific to the eighth and fourth grades. In general, the mathematics topic areas are number, algebra, measurement, geometry, and data.

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 mathematics 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 mathematics tests contained 194 items at the eighth grade and 161 items at the fourth grade.

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.

About one-third of the eighth-grade 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 about 40% of the testing time. At the fourth grade, more than two-fifths of the items were in constructed response format, accounting for almost half of the testing time. Chapter 2 of this report contains example items illustrating the range of mathematics 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's 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.

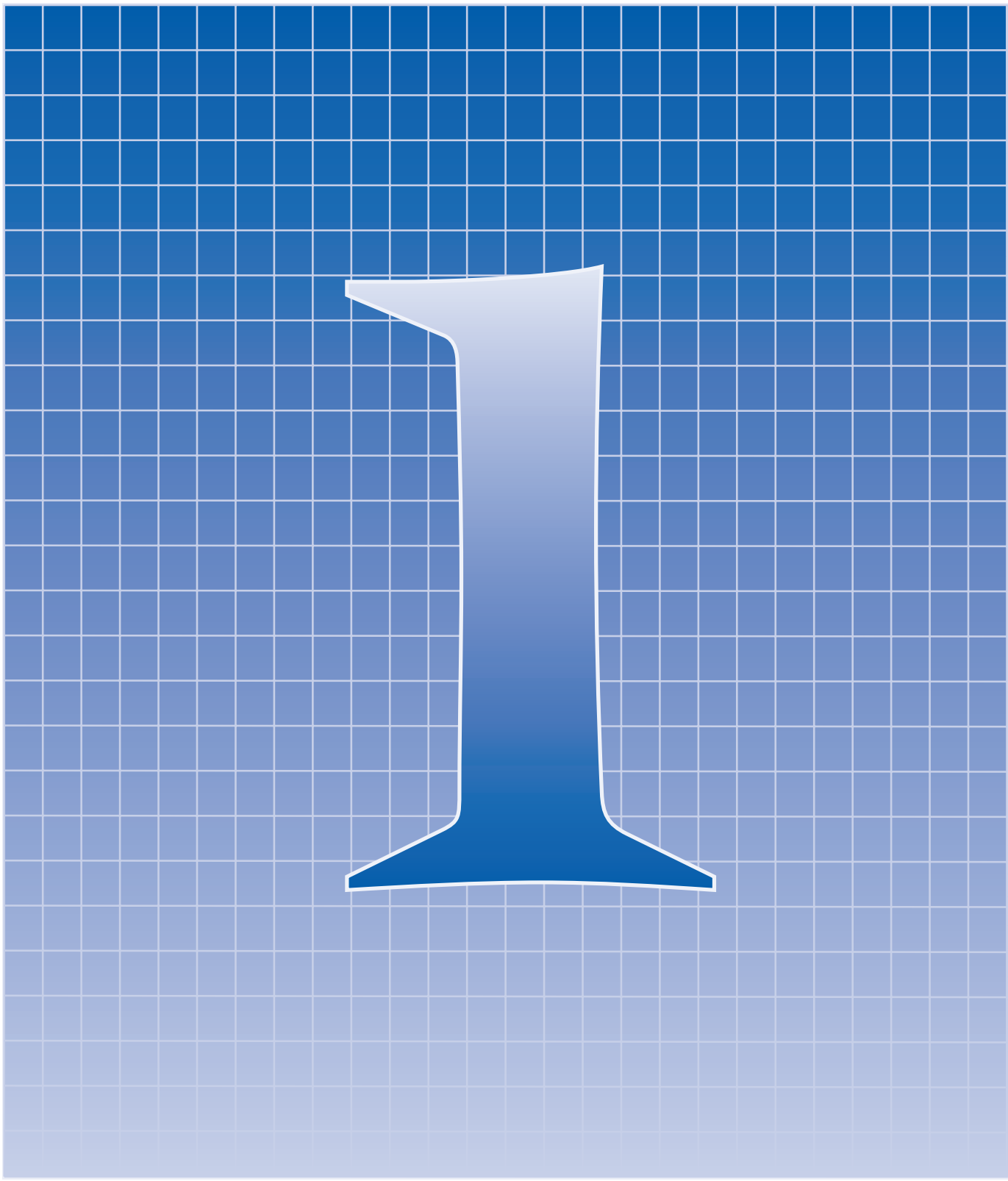
9 Data provided by the NRC of Chinese Taipei.

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 Mathematics

Chapter 1 summarizes achievement for eighth- and fourth-grade students on the TIMSS 2003 mathematics 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 are also provided.

How Do Countries Differ in Mathematics 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 significantly higher

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 mathematics 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.

or lower than the international average. The international average of 467 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 495 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 mathematics achievement between the highest- and lowest-performing countries, from an average of 605 for Singapore to 264 for South Africa. Twenty-six countries (including England) and the four benchmarking participants achieved average mathematics scores that were significantly above the international average and18 countries scored below the international average. Romania and Moldova performed about the same as the international average. At the fourth grade, the range in achievement was from 594 in Singapore to 339 in Tunisia. Fourteen countries and the three benchmarking participants performed above the international average. Moldova, Australia, New Zealand, and Scotland performed at about the international average. Seven countries achieved 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 percentage of students performing

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.

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 100 and 130 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 approximately 270 to 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 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, Saudi Arabia, Ghana, and South Africa. Similarly, at the fourth grade, average performance in Singapore exceeded performance at the 95th percentile in Iran, the Philippines, Morocco, and Tunisia. This means that only the most proficient students in the lower-performing countries approached the level of achievement of Singaporean students of average proficiency.

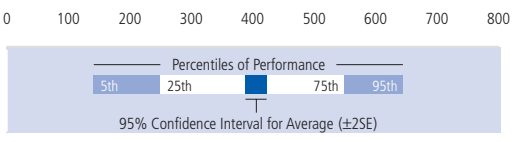
To aid in interpretation, Exhibit 1.1 also includes the years of formal schooling and average age of the students in each country. Equivalence of chronological age does not necessarily mean that students have received the same number of years of formal schooling or studied the same curriculum. For example,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

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 Mathematics Achievement

MATHEMATICS Grade 8

Countries	Years of Schooling*	Average Age	Mathematics Achievement Distribution	Average Scale Score	Human Development Index**
Singapore	8	14.3		605 (3.6) ▲	0.884
◆◆ Korea, Rep. of	8	14.6		589 (2.2) ▲	0.879
† Hong Kong, SAR	8	14.4		586 (3.3) ▲	0.889
Chinese Taipei	8	14.2		585 (4.6) ▲	–
Japan	8	14.4		570 (2.1) ▲	0.932
Belgium (Flemish)	8	14.1		537 (2.8) ▲	0.937
† Netherlands	8	14.3		536 (3.8) ▲	0.938
Estonia	8	15.2		531 (3.0) ▲	0.833
Hungary	8	14.5		529 (3.2) ▲	0.837
Malaysia	8	14.3		508 (4.1) ▲	0.790
Latvia	8	15.0		508 (3.2) ▲	0.811
Russian Federation	7 or 8	14.2		508 (3.7) ▲	0.779
Slovak Republic	8	14.3		508 (3.3) ▲	0.836
Australia	8 or 9	13.9		505 (4.6) ▲	0.939
‡ United States	8	14.2		504 (3.3) ▲	0.937
1 Lithuania	8	14.9		502 (2.5) ▲	0.824
Sweden	8	14.9		499 (2.6) ▲	0.941
† Scotland	9	13.7		498 (3.7) ▲	0.930
2 Israel	8	14.0		496 (3.4) ▲	0.905
New Zealand	8.5 - 9.5	14.1		494 (5.3) ▲	0.917
Slovenia	7 or 8	13.8		493 (2.2) ▲	0.881
Italy	8	13.9		484 (3.2) ▲	0.916
Armenia	8	14.9		478 (3.0) ▲	0.729
1 Serbia	8	14.9		477 (2.6) ▲	–
Bulgaria	8	14.9		476 (4.3) ▲	0.795
Romania	8	15.0		475 (4.8)	0.773
International Avg.	8	14.5		467 (0.5)	–
Norway	7	13.8		461 (2.5) ▼	0.944
Moldova, Rep. of	8	14.9		460 (4.0)	0.700
Cyprus	8	13.8		459 (1.7) ▼	0.891
2 Macedonia, Rep. of	8	14.6		435 (3.5) ▼	0.784
Lebanon	8	14.6		433 (3.1) ▼	0.752
Jordan	8	13.9		424 (4.1) ▼	0.743
Iran, Islamic Rep. of	8	14.4		411 (2.4) ▼	0.719
1 Indonesia	8	14.5		411 (4.8) ▼	0.682
Tunisia	8	14.8		410 (2.2) ▼	0.740
Egypt	8	14.4		406 (3.5) ▼	0.648
Bahrain	8	14.1		401 (1.7) ▼	0.839
Palestinian Nat'l Auth.	8	14.1		390 (3.1) ▼	0.731
Chile	8	14.2		387 (3.3) ▼	0.831
1 ‡ Morocco	8	15.2		387 (2.5) ▼	0.606
Philippines	8	14.8		378 (5.2) ▼	0.751
Botswana	8	15.1		366 (2.6) ▼	0.614
Saudi Arabia	8	14.1		332 (4.6) ▼	0.769
Ghana	8	15.5		276 (4.7) ▼	0.567
South Africa	8	15.1		264 (5.5) ▼	0.684
‡ England	9	14.3		498 (4.7) ▲	0.930
Benchmarking Participants					
Basque Country, Spain	8	14.1		487 (2.7) ▲	–
Indiana State, US	8	14.5		508 (5.2) ▲	–
Ontario Province, Can.	8	13.8		521 (3.1) ▲	–
Quebec Province, Can.	8	14.2		543 (3.0) ▲	–



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 Mathematics Achievement

MATHEMATICS Grade 4

Countries	Years of Schooling*	Average Age	Mathematics Achievement Distribution	Average Scale Score	Human Development Index**
Singapore	4	10.3		594 (5.6) ▲	0.884
† Hong Kong, SAR	4	10.2		575 (3.2) ▲	0.889
Japan	4	10.4		565 (1.6) ▲	0.932
Chinese Taipei	4	10.2		564 (1.8) ▲	–
Belgium (Flemish)	4	10.0		551 (1.8) ▲	0.937
† Netherlands	4	10.2		540 (2.1) ▲	0.938
Latvia	4	11.1		536 (2.8) ▲	0.811
1 Lithuania	4	10.9		534 (2.8) ▲	0.824
Russian Federation	3 or 4	10.6		532 (4.7) ▲	0.779
† England	5	10.3		531 (3.7) ▲	0.930
Hungary	4	10.5		529 (3.1) ▲	0.837
† United States	4	10.2		518 (2.4) ▲	0.937
Cyprus	4	9.9		510 (2.4) ▲	0.891
Moldova, Rep. of	4	11.0		504 (4.9)	0.700
Italy	4	9.8		503 (3.7) ▲	0.916
† Australia	4 or 5	9.9		499 (3.9)	0.939
International Avg.	4	10.3		495 (0.8)	–
New Zealand	4.5 - 5.5	10.0		493 (2.2)	0.917
† Scotland	5	9.7		490 (3.3)	0.930
Slovenia	3 or 4	9.8		479 (2.6) ▼	0.881
Armenia	4	10.9		456 (3.5) ▼	0.729
ø Norway	4	9.8		451 (2.3) ▼	0.944
Iran, Islamic Rep. of	4	10.4		389 (4.2) ▼	0.719
Philippines	4	10.8		358 (7.9) ▼	0.751
Morocco	4	11.0		347 (5.1) ▼	0.606
Tunisia	4	10.4		339 (4.7) ▼	0.740
Benchmarking Participants					
Indiana State, US	4	9.5		533 (2.8) ▲	–
Ontario Province, Can.	4	9.8		511 (3.8) ▲	–
Quebec Province, Can.	4	10.1		506 (2.4) ▲	–

0 100 200 300 400 500 600 700 800

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

▲ 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*, 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.

countries have different policies about the age at which 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 except Norway have average eighth-grade mathematics 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 mathematics 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 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.

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

Exhibit 1.2: Multiple Comparisons of Average Mathematics Achievement

MATHEMATICS 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	Korea, Rep. of	Hong Kong, SAR	Chinese Taipei	Japan	Belgium (Flemish)	Netherlands	Estonia	Hungary	Malaysia	Latvia	Russian Federation	Slovak Republic	Australia	United States	Lithuania	Sweden	England	Scotland	Israel	New Zealand	Slovenia	Italy	Armenia	Serbia	Bulgaria	Romania	Norway	Moldova, Rep. of	Cyprus
Singapore		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Korea, Rep. of	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong, SAR	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan	▼	▼	▼	▼		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Belgium (Flemish)	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Netherlands	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Estonia	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hungary	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Malaysia	▼	▼	▼	▼	▼	▼	▼	▼	▼											▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Latvia	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Russian Federation	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovak Republic	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Australia	▼	▼	▼	▼	▼	▼	▼	▼	▼													▲	▲	▲	▲	▲	▲	▲	▲	▲
United States	▼	▼	▼	▼	▼	▼	▼	▼	▼													▲	▲	▲	▲	▲	▲	▲	▲	▲
Lithuania	▼	▼	▼	▼	▼	▼	▼	▼	▼													▲	▲	▲	▲	▲	▲	▲	▲	▲
Sweden	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼	▼	▼										▲	▲	▲	▲	▲	▲	▲	▲
England	▼	▼	▼	▼	▼	▼	▼	▼	▼														▲	▲	▲	▲	▲	▲	▲	▲
Scotland	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼	▼	▼										▲	▲	▲	▲	▲	▲	▲	▲
Israel	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼										▲	▲	▲	▲	▲	▲	▲	▲
New Zealand	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼											▲	▲	▲	▲	▲	▲	▲
Slovenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲
Italy	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼						▲	▲	▲
Armenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲
Serbia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲
Bulgaria	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲
Romania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲
Norway	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			
Moldova, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			
Macedonia, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Lebanon	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Jordan	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Iran, Islamic Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Indonesia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Egypt	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Bahrain	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Palestinian Nat'l Auth.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Chile	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Botswana	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Saudi Arabia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
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 Mathematics Achievement

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

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

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

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

At both the eighth and fourth grades, Singapore was the top-performing country having significantly higher mean achievement than the rest of the participating countries. At the eighth grade, the Republic of Korea, Hong Kong SAR, and Chinese Taipei had significantly higher mean achievement than all of the other participating countries except Singapore. Japan also performed very well, with significantly higher achievement than most other participating countries, as did Belgium (Flemish), the Netherlands, Estonia, and Hungary. At the fourth grade, in addition to Singapore, Hong Kong SAR, Japan, and Chinese Taipei had significantly higher average achievement than most of the other participating countries as did Belgium (Flemish).

How Has Mathematics 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 assessments. Of these, 18 countries as well as Ontario and Quebec have trends in mathematics 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 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 US state of Indiana can monitor changes in performance between 1999 and 2003, and five countries between 1995 and 2003, including Australia, Sweden, Scotland, Slovenia, and Norway. At the fourth grade, 15 of the TIMSS 2003

Exhibit 1.3: Trends in Mathematics Achievement

MATHEMATICS Grade 8

Countries	Average Scale Score	1999 to 2003 Difference	1995 to 2003 Difference	Mathematics Achievement Distribution	Average Age
Singapore					
2003	605 (3.6)				14.3
1999	604 (6.3)	1 (7.2)			14.4
1995	609 (4.0)		-3 (5.4)		14.5
Korea, Rep. of					
2003	589 (2.2)				14.6
1999	587 (2.0)	2 (2.9)			14.4
1995	581 (2.0)		8 (3.0) ▲		14.2
Hong Kong, SAR					
2003	586 (3.3)				14.4
1999	582 (4.3)	4 (5.4)			14.2
1995	569 (6.1)		17 (7.0) ▲		14.2
Chinese Taipei					
2003	585 (4.6)				14.2
1999	585 (4.0)	0 (6.0)			14.2
Japan					
2003	570 (2.1)				14.4
1999	579 (1.7)	-9 (2.6) ▼			14.4
1995	581 (1.6)		-11 (2.6) ▼		14.4
Belgium (Flemish)					
2003	537 (2.8)				14.1
1999	558 (3.3)	-21 (4.1) ▼			14.1
1995	550 (5.9)		-13 (6.5) ▼		14.1
Netherlands					
2003	536 (3.8)				14.3
1999	540 (7.1)	-4 (8.1)			14.2
1995	529 (6.1)		7 (7.3)		14.4
Hungary					
2003	529 (3.2)				14.5
1999	532 (3.7)	-2 (4.9)			14.4
1995	527 (3.2)		3 (4.5)		14.3
Malaysia					
2003	508 (4.1)				14.3
1999	519 (4.4)	-11 (6.0)			14.4
Russian Federation					
2003	508 (3.7)				14.2
1999	526 (5.9)	-18 (7.1) ▼			14.1
1995	524 (5.3)		-16 (6.5) ▼		14.0
Slovak Republic					
2003	508 (3.3)				14.3
1999	534 (4.0)	-26 (5.1) ▼			14.3
1995	534 (3.1)		-26 (4.4) ▼		14.3
Latvia (LSS)					
2003	505 (3.8)				15.1
1999	505 (3.4)	0 (5.1)			14.5
1995	488 (3.6)		17 (5.2) ▲		14.3
Australia					
2003	505 (4.6)				13.9
1995	509 (3.7)		-4 (6.0)		13.9
United States					
2003	504 (3.3)				14.2
1999	502 (4.0)	3 (5.2)			14.2
1995	492 (4.7)		12 (5.8) ▲		14.2

▲ 2003 country average significantly higher than previous assessment year

▼ 2003 country average significantly lower than previous assessment year

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

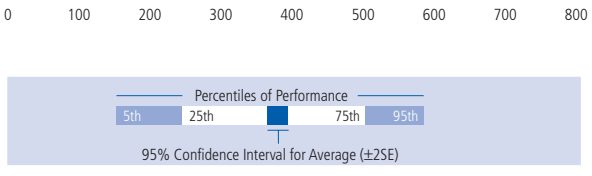
SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

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 Mathematics Achievement *(Continued...)*

Countries	Average Scale Score	1999 to 2003 Difference	1995 to 2003 Difference	Mathematics Achievement Distribution	Average Age
Lithuania					
2003	502 (2.5)				14.9
1999	482 (4.3)	20 (5.0) ▲			15.2
1995	472 (4.1)		30 (4.8) ▲		14.3
Sweden					
2003	499 (2.6)				14.9
1995	540 (4.3)		-41 (5.0) ▼		14.9
Scotland					
2003	498 (3.7)				13.7
1995	493 (5.7)		4 (6.7)		13.7
Israel					
2003	496 (3.4)				14.0
1999	466 (3.9)	29 (5.2) ▲			14.1
New Zealand					
2003	494 (5.3)				14.1
1999	491 (5.2)	3 (7.4)			14.0
1995	501 (4.7)		-7 (7.1)		14.0
Slovenia					
2003	493 (2.2)				13.8
1995	494 (2.9)		-2 (3.7)		13.8
Italy					
2003	484 (3.2)				13.9
1999	479 (3.8)	4 (4.9)			14.0
Bulgaria					
2003	476 (4.3)				14.9
1999	511 (5.8)	-34 (7.3) ▼			14.8
1995	527 (5.8)		-51 (7.2) ▼		14.0
Romania					
2003	475 (4.8)				15.0
1999	472 (5.8)	3 (7.5)			14.8
1995	474 (4.6)		2 (6.6)		14.6
Norway					
2003	461 (2.5)				13.8
1995	498 (2.2)		-37 (3.3) ▼		13.9
Moldova, Rep. of					
2003	460 (4.0)				14.9
1999	469 (3.9)	-9 (5.5)			14.4
Cyprus					
2003	459 (1.7)				13.8
1999	476 (1.8)	-17 (2.4) ▼			13.8
1995	468 (2.2)		-8 (3.0) ▼		13.7
Macedonia, Rep. of					
2003	435 (3.5)				14.6
1999	447 (4.2)	-12 (5.5) ▼			14.6
Jordan					
2003	424 (4.1)				13.9
1999	428 (3.6)	-3 (5.5)			14.0
Iran, Islamic Rep. of					
2003	411 (2.4)				14.4
1999	422 (3.4)	-11 (4.2) ▼			14.6
1995	418 (3.9)		-7 (4.5)		14.6



▲ 2003 country average significantly higher than previous assessment year

▼ 2003 country average significantly lower than previous assessment year

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.

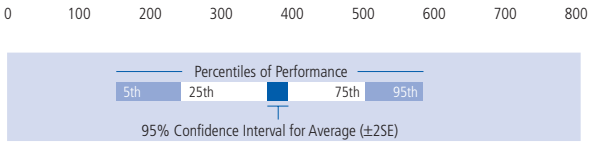
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

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

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

MATHEMATICS Grade 8

Countries	Average Scale Score	1999 to 2003 Difference	1995 to 2003 Difference	Mathematics Achievement Distribution	Average Age
Indonesia					
2003	411 (4.8)				14.5
1999	403 (4.9)	8 (6.8)			14.6
Tunisia					
2003	410 (2.2)				14.8
1999	448 (2.4)	-38 (3.4) ▼			14.8
Chile					
2003	387 (3.3)				14.2
1999	392 (4.4)	-6 (5.2)			14.4
Philippines					
2003	378 (5.2)				14.8
1999	345 (6.0)	33 (7.8) ▲			14.1
South Africa					
2003	264 (5.5)				15.1
1999	275 (6.8)	-11 (8.4)			15.5
‡ England					
2003	498 (4.7)				14.3
1999	496 (4.1)	2 (6.2)			14.2
1995	498 (3.0)		1 (5.6)		14.0
Benchmarking Participants					
Indiana State, US					
2003	508 (5.2)				14.5
1999	515 (7.2)	-6 (8.9)			14.4
Ontario Province, Can.					
2003	521 (3.1)				13.8
1999	517 (3.0)	4 (4.3)			13.9
1995	501 (2.9)		20 (4.3) ▲		14.0
Quebec Province, Can.					
2003	543 (3.0)				14.2
1999	566 (5.3)	-23 (6.1) ▼			14.3
1995	556 (5.9)		-13 (6.6) ▼		14.5



▲ 2003 country average significantly higher than previous assessment year

▼ 2003 country average significantly lower than previous assessment year

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

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

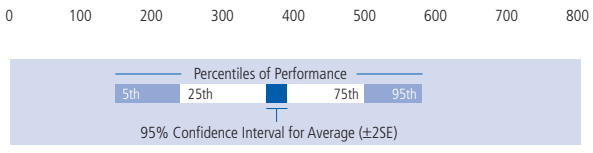
Trend notes: Because of differences in population coverage, 1999 data are not shown for Australia and Slovenia, and 1995 data are not shown for Israel, Italy, and South Africa. Korea tested later in 2003 than in 1999 and 1995, at the beginning of the next school year. Similarly, Lithuania tested later 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 Mathematics Achievement

MATHEMATICS Grade 4

Countries	Average Scale Score	1995 to 2003 Difference	Mathematics Achievement Distribution	Average Age
Singapore				
2003	594 (5.6)			10.3
1995	590 (4.5)	4 (7.2)		10.3
Hong Kong, SAR				
2003	575 (3.2)			10.2
1995	557 (4.0)	18 (5.0) ▲		10.1
Japan				
2003	565 (1.6)			10.4
1995	567 (1.9)	-3 (2.5)		10.4
Netherlands				
2003	540 (2.1)			10.2
1995	549 (3.0)	-9 (3.7) ▼		10.3
Latvia (LSS)				
2003	533 (3.1)			11.1
1995	499 (4.6)	34 (5.5) ▲		10.5
England				
2003	531 (3.7)			10.3
1995	484 (3.3)	47 (5.0) ▲		10.0
Hungary				
2003	529 (3.1)			10.5
1995	521 (3.6)	7 (4.8)		10.4
United States				
2003	518 (2.4)			10.2
1995	518 (2.9)	0 (3.8)		10.2
Cyprus				
2003	510 (2.4)			9.9
1995	475 (3.2)	35 (4.1) ▲		9.8
Australia				
2003	499 (3.9)			9.9
1995	495 (3.4)	4 (5.2)		9.9
New Zealand				
2003	496 (2.1)			10.0
1995	469 (4.4)	26 (4.9) ▲		10.0
Scotland				
2003	490 (3.3)			9.7
1995	493 (4.2)	-3 (5.3)		9.7
Slovenia				
2003	479 (2.6)			9.8
1995	462 (3.1)	17 (4.1) ▲		9.9
Norway				
2003	451 (2.3)			9.8
1995	476 (3.0)	-25 (3.7) ▼		9.9
Iran, Islamic Rep. of				
2003	389 (4.2)			10.4
1995	387 (5.0)	2 (6.5)		10.5
Benchmarking Participants				
Ontario Province, Can.				
2003	511 (3.8)			9.8
1995	489 (3.5)	23 (5.2) ▲		9.9
Quebec Province, Can.				
2003	506 (2.4)			10.1
1995	550 (4.2)	-44 (4.8) ▼		10.3



▲ 2003 country average significantly higher than previous assessment year

▼ 2003 country average significantly lower than previous assessment year

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.

countries and 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 compares average achievement between the years.[8] Countries are presented in descending order according to their average TIMSS 2003 achievements. At the eighth grade, a number of countries had significantly higher achievement in TIMSS 2003 than in previous assessments. Most notably, Korea, Hong Kong SAR, the US, Latvia (LSS), Lithuania, and Ontario have shown a pattern of improvement with significant change over the 8-year period. For Lithuania, the increase between 1995 and 1999 also was significant. Israel and the Philippines showed significant improvement from 1999 to 2003. Countries showing a decrease at the eighth grade in TIMSS 2003, from 1995, 1999, or both, included Japan, Belgium (Flemish), the Russian Federation, the Slovak Republic, Sweden, Bulgaria, Norway, Cyprus, Macedonia, Iran, Tunisia, and Quebec.

At the fourth grade, many countries had significant increases in average achievement between 1995 and 2003. Participants showing improved performance included Hong Kong SAR, Latvia (LSS), England, Cyprus, New Zealand, Slovenia, and Ontario. Several participants showed significant declines, including the Netherlands, Norway, and Quebec.

A number of countries showed remarkable changes in mathematics 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

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.

include Bulgaria, the Russian Federation, and the Slovak Republic, each of which show large decreases over the period.

What Are the Gender Differences in Mathematics 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).

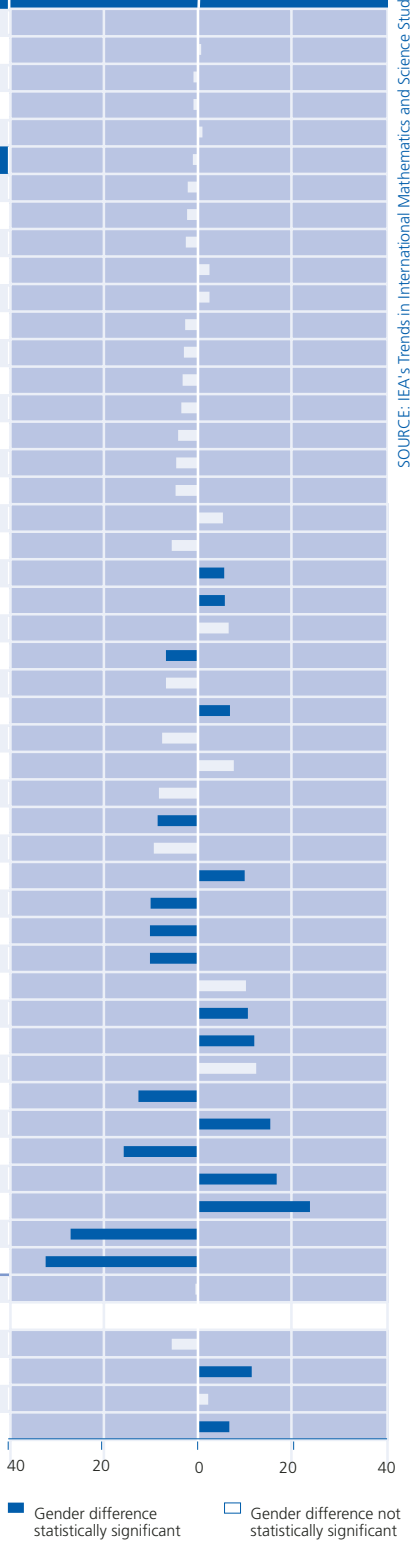
On average, across all countries, there was essentially no difference in achievement between boys and girls at either the eighth or fourth grade, although the situation varied from country to country. In many countries the results paralleled the international pattern and the gender difference was negligible. However, at the eighth grade, countries where girls had significantly higher achievement included Serbia, Macedonia, Armenia, Moldova, Singapore, the Philippines, Cyprus, Jordan, and Bahrain. Participants where boys had significantly higher achievement included the United States, Italy, Hungary, Lebanon, Belgium (Flemish), Morocco, Chile, Ghana, Tunisia, US state of Indiana and Quebec province. At the fourth grade, girls had significantly higher average achievement in Singapore, Moldova, the Philippines, and Armenia. Boys had higher average achievement in the Netherlands, the United States, Italy, Cyprus, Scotland, and in the two Canadian provinces.

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, both boys and girls had significantly higher achievement in 2003 in Israel, Lithuania, the Philippines, the United States, and Ontario. Girls showed improved performance compared to previous

Exhibit 1.4: Average Mathematics Achievement by Gender

MATHEMATICS 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
Slovak Republic	48 (1.3)	508 (3.4)	52 (1.3)	508 (4.0)	0 (3.5)	
Sweden	51 (0.9)	499 (3.0)	49 (0.9)	499 (2.7)	1 (2.2)	
1 Indonesia	50 (0.7)	411 (4.9)	50 (0.7)	410 (5.3)	1 (3.0)	
Egypt	46 (2.7)	407 (4.4)	54 (2.7)	406 (5.0)	1 (6.4)	
Bulgaria	48 (1.3)	476 (5.5)	52 (1.3)	477 (4.3)	1 (4.7)	
International Avg.	50 (0.2)	467 (0.6)	50 (0.2)	466 (0.6)	1 (0.6)	
† Hong Kong, SAR	50 (2.4)	587 (3.8)	50 (2.4)	585 (4.6)	2 (5.1)	
Estonia	50 (1.0)	532 (3.4)	50 (1.0)	530 (3.3)	2 (3.0)	
New Zealand	52 (1.7)	495 (4.8)	48 (1.7)	493 (7.0)	3 (5.7)	
Japan	49 (1.2)	569 (4.0)	51 (1.2)	571 (3.6)	3 (6.4)	
South Africa	51 (0.9)	262 (6.2)	49 (0.9)	264 (6.4)	3 (5.8)	
Norway	50 (0.8)	463 (2.7)	50 (0.8)	460 (3.0)	3 (2.8)	
Russian Federation	49 (1.2)	510 (3.5)	51 (1.2)	507 (4.4)	3 (2.8)	
Slovenia	50 (0.9)	495 (2.6)	50 (0.9)	491 (2.6)	3 (2.8)	
Botswana	51 (0.7)	368 (2.6)	49 (0.7)	365 (2.9)	3 (1.8)	
Romania	52 (0.9)	477 (5.1)	48 (0.9)	473 (5.0)	4 (3.3)	
1 Lithuania	50 (0.9)	503 (2.9)	50 (0.9)	499 (3.0)	5 (2.9)	
† Scotland	50 (1.3)	500 (4.3)	50 (1.3)	495 (3.8)	5 (3.5)	
◆◆ Korea, Rep. of	48 (2.8)	586 (2.7)	52 (2.8)	592 (2.6)	5 (3.1)	
Latvia	49 (0.8)	511 (3.3)	51 (0.8)	506 (3.7)	6 (2.9)	
‡ United States	52 (0.7)	502 (3.4)	48 (0.7)	507 (3.5)	6 (1.9)	
Italy	50 (0.9)	481 (3.0)	50 (0.9)	486 (3.9)	6 (2.8)	
† Netherlands	49 (1.2)	533 (4.1)	51 (1.2)	540 (4.5)	7 (3.6)	
1 Serbia	49 (0.8)	480 (2.9)	51 (0.8)	473 (2.9)	7 (2.8)	
Chinese Taipei	48 (1.0)	589 (4.9)	52 (1.0)	582 (5.2)	7 (4.2)	
Hungary	50 (1.0)	526 (3.7)	50 (1.0)	533 (3.5)	7 (3.2)	
Malaysia	50 (1.8)	512 (4.7)	50 (1.8)	505 (4.5)	8 (4.2)	
2 Israel	52 (1.6)	492 (3.3)	48 (1.6)	500 (4.5)	8 (4.0)	
Palestinian Nat'l Auth.	55 (2.4)	394 (3.9)	45 (2.4)	386 (4.7)	8 (5.9)	
2 Macedonia, Rep. of	49 (0.9)	439 (4.0)	51 (0.9)	431 (3.9)	9 (3.5)	
Iran, Islamic Rep. of	40 (4.1)	417 (4.3)	60 (4.1)	408 (4.2)	9 (7.2)	
Lebanon	57 (1.8)	429 (3.6)	43 (1.8)	439 (3.9)	10 (4.0)	
Armenia	53 (0.7)	483 (3.3)	47 (0.7)	473 (3.4)	10 (3.0)	
Moldova, Rep. of	51 (0.8)	465 (4.1)	49 (0.8)	455 (4.8)	10 (3.5)	
Singapore	49 (0.8)	611 (3.3)	51 (0.8)	601 (4.3)	10 (2.9)	
Saudi Arabia	43 (2.3)	326 (7.9)	57 (2.3)	336 (5.5)	10 (9.7)	
Belgium (Flemish)	54 (2.1)	532 (3.5)	46 (2.1)	542 (3.8)	11 (4.8)	
1 ‡ Morocco	50 (1.8)	381 (2.8)	50 (1.8)	393 (3.0)	12 (3.1)	
Australia	51 (2.2)	499 (5.8)	49 (2.2)	511 (5.8)	13 (7.0)	
Philippines	58 (0.9)	383 (5.2)	42 (0.9)	370 (5.8)	13 (3.4)	
Chile	48 (1.6)	379 (3.5)	52 (1.6)	394 (4.3)	15 (4.5)	
Cyprus	49 (0.6)	467 (1.9)	51 (0.6)	452 (2.3)	16 (2.7)	
Ghana	45 (0.9)	266 (5.1)	55 (0.9)	283 (4.9)	17 (3.1)	
Tunisia	53 (0.7)	399 (2.6)	47 (0.7)	423 (2.2)	24 (1.9)	
Jordan	49 (1.7)	438 (4.6)	51 (1.7)	411 (5.8)	27 (6.8)	
Bahrain	50 (0.4)	417 (2.4)	50 (0.4)	385 (2.4)	33 (3.3)	
‡ England	50 (2.4)	499 (5.3)	50 (2.4)	498 (5.8)	0 (6.0)	
Benchmarking Participants						
Basque Country, Spain	49 (1.7)	490 (2.5)	51 (1.7)	484 (3.7)	6 (3.1)	
Indiana State, US	49 (1.2)	502 (5.1)	51 (1.2)	514 (5.8)	12 (3.4)	
Ontario Province, Can.	51 (0.9)	520 (3.4)	49 (0.9)	522 (3.4)	2 (2.8)	
Quebec Province, Can.	50 (1.6)	540 (3.7)	50 (1.6)	546 (3.3)	7 (3.3)	



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).

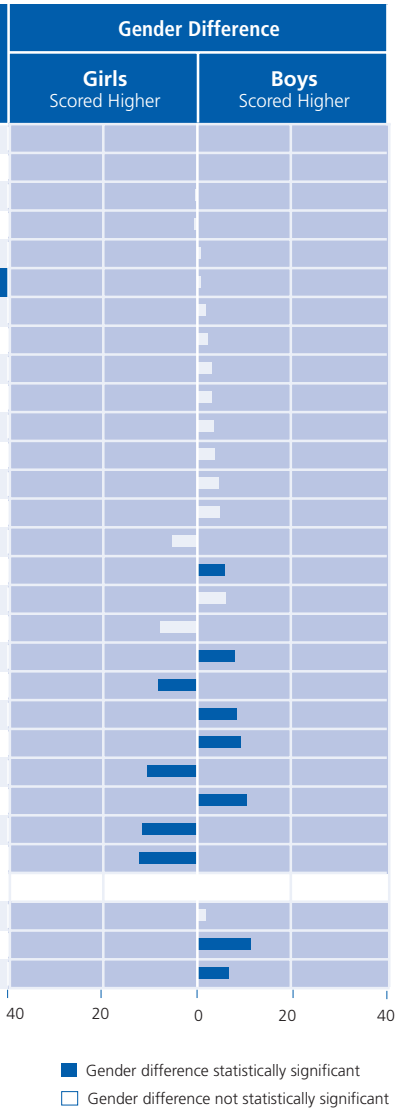
◆◆ Korea tested the same cohort of students as other countries, but later in 2003, at the beginning of the next school year.

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

Exhibit 1.4: Average Mathematics Achievement by Gender

MATHEMATICS Grade 4

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
† Hong Kong, SAR	47 (1.1)	575 (3.4)	53 (1.1)	575 (3.4)	0 (2.3)		
New Zealand	50 (1.1)	493 (2.7)	50 (1.1)	494 (2.4)	0 (2.9)		
Chinese Taipei	48 (0.5)	564 (1.7)	52 (0.5)	564 (2.1)	1 (1.7)		
Latvia	49 (0.9)	536 (2.9)	51 (0.9)	536 (3.5)	1 (2.9)		
1 Lithuania	49 (0.9)	535 (3.5)	51 (0.9)	536 (3.2)	1 (2.8)		
International Avg.	49 (0.2)	495 (0.8)	51 (0.2)	496 (0.8)	1 (0.7)		
† England	50 (0.9)	530 (3.9)	50 (0.9)	532 (4.5)	2 (4.0)		
Belgium (Flemish)	50 (1.0)	549 (1.8)	50 (1.0)	552 (2.5)	2 (2.5)		
Hungary	50 (0.9)	527 (3.8)	50 (0.9)	530 (3.3)	3 (3.4)		
† Australia	50 (1.0)	497 (4.5)	50 (1.0)	500 (4.3)	3 (4.0)		
Japan	49 (0.6)	563 (1.8)	51 (0.6)	566 (2.1)	4 (2.3)		
Russian Federation	50 (0.7)	530 (5.4)	50 (0.7)	534 (4.7)	4 (3.5)		
Norway	50 (0.8)	449 (2.7)	50 (0.8)	454 (2.7)	5 (2.8)		
Slovenia	48 (1.1)	477 (3.0)	52 (1.1)	481 (3.5)	5 (3.8)		
Tunisia	48 (0.9)	342 (5.0)	52 (0.9)	337 (4.9)	5 (2.8)		
† Netherlands	49 (1.1)	537 (2.7)	51 (1.1)	543 (2.2)	6 (2.4)		
Morocco	49 (1.1)	344 (6.1)	51 (1.1)	350 (5.1)	6 (4.7)		
Iran, Islamic Rep. of	39 (4.2)	394 (6.5)	61 (4.2)	386 (5.5)	8 (8.8)		
† United States	50 (0.5)	514 (2.4)	50 (0.5)	522 (2.7)	8 (1.6)		
Singapore	49 (1.4)	599 (5.5)	51 (1.4)	590 (6.2)	8 (3.9)		
Italy	48 (0.8)	498 (4.1)	52 (0.8)	507 (3.7)	9 (2.6)		
Cyprus	49 (0.7)	505 (2.7)	51 (0.7)	514 (2.9)	9 (2.8)		
Moldova, Rep. of	50 (0.8)	510 (5.2)	50 (0.8)	499 (5.1)	11 (3.5)		
† Scotland	51 (1.0)	485 (3.2)	49 (1.0)	496 (4.4)	11 (4.1)		
Philippines	51 (1.0)	364 (9.2)	49 (1.0)	352 (7.0)	12 (4.6)		
Armenia	49 (0.8)	462 (3.7)	51 (0.8)	450 (3.8)	12 (2.9)		
Benchmarking Participants							
Indiana State, US	52 (1.1)	532 (3.1)	48 (1.1)	534 (3.4)	2 (3.3)		
Ontario Province, Can.	48 (1.1)	505 (3.6)	52 (1.1)	517 (4.7)	11 (3.7)		
Quebec Province, Can.	50 (0.9)	502 (2.7)	50 (0.9)	509 (2.8)	7 (2.7)		



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 Mathematics Achievement by Gender

MATHEMATICS Grade 8

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	499 (5.8)	– –	-13 (7.1)	511 (5.8)	– –	4 (7.5)
Belgium (Flemish)	532 (3.5)	-28 (7.7) ▼	-21 (8.9) ▼	542 (3.8)	-13 (9.0)	-4 (9.5)
Bulgaria	476 (5.5)	-35 (8.1) ▼	-57 (8.0) ▼	477 (4.3)	-34 (8.2) ▼	-45 (7.5) ▼
Chile	379 (3.5)	-9 (5.4)	✧ ✧	394 (4.3)	-3 (7.0)	✧ ✧
Chinese Taipei	589 (4.9)	5 (6.2)	✧ ✧	582 (5.2)	-5 (7.4)	✧ ✧
Cyprus	467 (1.9)	-11 (2.7) ▼	-4 (3.3)	452 (2.3)	-23 (3.6) ▼	-13 (4.2) ▼
Hong Kong, SAR	587 (3.8)	4 (6.1)	28 (7.9) ▲	585 (4.6)	4 (7.5)	8 (8.5)
Hungary	526 (3.7)	-3 (5.4)	-1 (5.2)	533 (3.5)	-2 (5.6)	6 (5.1)
Indonesia	411 (4.9)	10 (7.2)	✧ ✧	410 (5.3)	5 (7.3)	✧ ✧
Iran, Islamic Rep. of	417 (4.3)	9 (6.0)	12 (7.5)	408 (4.2)	-24 (6.4) ▼	-21 (6.3) ▼
Israel	492 (3.3)	33 (5.4) ▲	– –	500 (4.5)	25 (6.7) ▲	– –
Italy	481 (3.0)	6 (5.3)	– –	486 (3.9)	2 (5.8)	– –
Japan	569 (4.0)	-6 (4.7)	-8 (4.5)	571 (3.6)	-11 (4.2) ▼	-14 (4.2) ▼
Jordan	438 (4.6)	7 (6.7)	✧ ✧	411 (5.8)	-14 (8.3)	✧ ✧
Korea, Rep. of	586 (2.7)	2 (4.1)	15 (4.1) ▲	592 (2.6)	2 (3.2)	3 (3.8)
Latvia (LSS)	509 (4.0)	6 (5.3)	22 (5.5) ▲	502 (4.4)	-6 (6.0)	11 (6.1)
Lithuania	503 (2.9)	23 (5.4) ▲	32 (5.5) ▲	499 (3.0)	16 (5.8) ▲	27 (5.5) ▲
Macedonia, Rep. of	439 (4.0)	-7 (6.5)	✧ ✧	431 (3.9)	-16 (5.8) ▼	✧ ✧
Malaysia	512 (4.7)	-9 (6.7)	✧ ✧	505 (4.5)	-12 (7.4)	✧ ✧
Moldova, Rep. of	465 (4.1)	-3 (5.8)	✧ ✧	455 (4.8)	-16 (6.7) ▼	✧ ✧
Netherlands	533 (4.1)	-4 (8.6)	11 (7.8)	540 (4.5)	-3 (8.4)	5 (7.9)
New Zealand	495 (4.8)	0 (7.4)	-1 (7.2)	493 (7.0)	5 (10.2)	-12 (9.3)
Norway	463 (2.7)	✧ ✧	-35 (3.8) ▼	460 (3.0)	✧ ✧	-39 (4.1) ▼
Philippines	383 (5.2)	31 (8.4) ▲	✧ ✧	370 (5.8)	34 (8.7) ▲	✧ ✧
Romania	477 (5.1)	2 (8.0)	5 (6.8)	473 (5.0)	3 (8.0)	-2 (7.3)
Russian Federation	510 (3.5)	-16 (6.9) ▼	-15 (6.1) ▼	507 (4.4)	-20 (7.7) ▼	-16 (7.5) ▼
Scotland	500 (4.3)	✧ ✧	14 (6.8) ▲	495 (3.8)	✧ ✧	-5 (7.9)
Singapore	611 (3.3)	7 (7.0)	1 (5.9)	601 (4.3)	-5 (8.6)	-7 (6.4)
Slovak Republic	508 (3.4)	-24 (5.3) ▼	-25 (4.7) ▼	508 (4.0)	-28 (6.0) ▼	-28 (5.3) ▼
Slovenia	495 (2.6)	– –	3 (3.9)	491 (2.6)	– –	-6 (4.4)
South Africa	262 (6.2)	-6 (9.4)	– –	264 (6.4)	-19 (9.7)	– –
Sweden	499 (3.0)	✧ ✧	-43 (5.5) ▼	499 (2.7)	✧ ✧	-39 (5.4) ▼
Tunisia	399 (2.6)	-37 (3.7) ▼	✧ ✧	423 (2.2)	-37 (3.8) ▼	✧ ✧
United States	502 (3.4)	3 (5.2)	12 (5.8) ▲	507 (3.5)	2 (5.9)	12 (6.3) ▲
‡ England	499 (5.3)	12 (7.6)	4 (6.7)	498 (5.8)	-7 (7.7)	-2 (7.9)
International Avg.	486 (0.7)	0 (1.2)	-5 (1.3) ▼	485 (0.8)	-6 (1.4) ▼	-9 (1.4) ▼
Benchmarking Participants						
Indiana State, US	502 (5.1)	-8 (8.6)	✧ ✧	514 (5.8)	-6 (10.0)	✧ ✧
Ontario Province, Can.	520 (3.4)	6 (4.7)	20 (4.5) ▲	522 (3.4)	3 (4.7)	18 (4.8) ▲
Quebec Province, Can.	540 (3.7)	-27 (6.8) ▼	-20 (7.7) ▼	546 (3.3)	-19 (6.5) ▼	-6 (7.2)

▲ 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 1.5: Trends in Average Mathematics Achievement by Gender

MATHEMATICS Grade 4

Countries	Girls		Boys	
	2003 Average Scale Score	1995 to 2003 Difference	2003 Average Scale Score	1995 to 2003 Difference
Australia	497 (4.5)	4 (5.9)	500 (4.3)	4 (6.0)
Cyprus	505 (2.7)	34 (4.5) ▲	514 (2.9)	35 (4.8) ▲
England	530 (3.9)	51 (5.7) ▲	532 (4.5)	44 (5.7) ▲
Hong Kong, SAR	575 (3.4)	17 (5.1) ▲	575 (3.4)	18 (5.5) ▲
Hungary	527 (3.8)	8 (5.5)	530 (3.3)	6 (5.1)
Iran, Islamic Rep. of	394 (6.5)	15 (8.9)	386 (5.5)	-8 (9.7)
Japan	563 (1.8)	-1 (2.6)	566 (2.1)	-5 (3.3)
Latvia (LSS)	535 (3.2)	30 (5.9) ▲	531 (3.9)	38 (6.9) ▲
Netherlands	537 (2.7)	-6 (4.4)	543 (2.2)	-13 (4.2) ▼
New Zealand	495 (2.8)	22 (5.1) ▲	496 (2.4)	31 (6.6) ▲
Norway	449 (2.7)	-25 (5.0) ▼	454 (2.7)	-24 (4.5) ▼
Scotland	485 (3.2)	-8 (5.2)	496 (4.4)	3 (6.5)
Singapore	599 (5.5)	4 (7.8)	590 (6.2)	4 (7.8)
Slovenia	477 (3.0)	19 (4.8) ▲	481 (3.5)	15 (4.9) ▲
United States	514 (2.4)	-2 (3.8)	522 (2.7)	3 (4.1)
International Avg.	512 (0.5)	11 (1.4) ▲	515 (1.0)	10 (1.5) ▲
Benchmarking Participants				
Ontario Province, Can.	505 (3.6)	19 (4.9) ▲	517 (4.7)	26 (6.4) ▲
Quebec Province, Can.	502 (2.7)	-46 (6.1) ▼	509 (2.8)	-42 (5.6) ▼

▲ 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.

assessments in Hong Kong SAR, Korea, Latvia (LSS), and Scotland. There was no country in which boys showed improvement and girls did not. Both boys and girls had significantly lower average achievement in TIMSS 2003 in Bulgaria, Cyprus, Norway, the Russian Federation, the Slovak Republic, Sweden, Tunisia, and Quebec. In Belgium (Flemish), the girls showed a significant decrease but the boys did not. In Iran, Japan, Macedonia, and Moldova the boys had the significant decrease. At the fourth grade, changes in achievement were very consistent for both boys and girls. Both genders improved in Cyprus, England, Hong Kong, Latvia (LSS), New Zealand, Slovenia, and Ontario. In Norway and Quebec, both boys and girls showed declines. Only in the Netherlands did the genders behave differently, with boys showing a decline but not girls.


2

Chapter 2

Performance at International Benchmarks

How Do Countries Compare with International Benchmarks of Mathematics Achievement?

The TIMSS mathematics 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 mathematics 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 using relatively complex algebraic and geometric concepts and relationships at the advanced

benchmark to having some basic mathematical knowledge at the low benchmark. At the fourth grade, students at the advanced benchmark showed the ability to solve a variety of problems whereas those at the low benchmark demonstrated an understanding of whole numbers, the properties of basic geometric shapes, and how to read simple bar graphs. 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 lesser percentages. Among the high performers at the eighth grade, for example, Singapore, Chinese Taipei, Korea, and Hong Kong SAR had about one-third or more of their students reaching the advanced benchmark, about two-thirds to three-fourths reaching the high benchmark, around 90 percent reaching the intermediate benchmark, and almost all (96 to 99 percent) reaching the low benchmark. In contrast, low-performing countries had almost no students reaching the advanced benchmark, from 0 to 4 percent reaching the high benchmark, less than 20 percent reaching the intermediate benchmark, and about half or fewer reaching the low benchmark. At the fourth grade, 38 percent of the Singaporean students performed at or above the advanced benchmark, followed by about one-fifth of the students from Hong Kong, SAR and Japan. In all three of these top-performing countries, nearly all fourth-grade students, from 97 to 99 percent, reached the low benchmark. For the lowest-performing countries, Tunisia and Morocco, very few, if any, fourth-grade students reached the advanced benchmark, about 1 percent reached the high benchmark, 8 to 9 percent the intermediate benchmark, and 28 to 29 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 (10 percent at eighth grade and 5 percent at fourth grade), it appears to do an excellent job of educating all of its students, since 97 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, a number of countries, as well as three of the benchmarking participants, have less than 6 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 or in Bulgaria is also apparent at all four benchmarks, implying a decrease (at most levels) of the proficiency distribution. In Japan, however, the decrease is reflected at the three top benchmarks but not at the low benchmark. In contrast, the increase for Korea appears mainly at the two middle benchmarks, and for the Philippines at the two lower benchmarks. At the fourth grade, the general improvements between 1995 and 2003 also are reflected generally at the benchmarks. However, the pattern across the countries indicates more improvement at the lower parts of the distributions than at the advanced benchmark.

To help interpret the achievement results, the remaining sections of the chapter first describe eighth-grade mathematics achievement at each of the international benchmarks together with examples of the types of items typically answered correctly by students performing at the benchmark. It 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 mathematics suggests that three primary factors appeared to differentiate performance among the four levels:

- The mathematical operation required;
- The complexity of the numbers or number system;
- The nature of the problem situation.

For example, there is evidence that students performing at the lower end of the scale could add, subtract, and multiply whole numbers. In contrast, students performing at the higher end of the scale solved non-routine problems involving relationships among fractions, decimals, and percents; various geometric properties; and algebraic rules.

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.

How Should the Descriptions Be Interpreted?

In general, the parts of the descriptions that relate to the mathematical concepts or familiarity with 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

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.

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 mathematics domains prescribed for this study, neither the set of items nor the descriptions based on them purport to be comprehensive. There are undoubtedly other mathematics 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, ability to carry out routine procedures, and ability to solve routine and non-routine problems. The TIMSS 2003 results support the premise that successful problem solving 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 Mathematics Achievement**

MATHEMATICS Grade 8

Advanced International Benchmark – 625

Students can organize information, make generalizations, solve non-routine problems, and draw and justify conclusions from data. They can compute percent change and apply their knowledge of numeric and algebraic concepts and relationships to solve problems. Students can solve simultaneous linear equations and model simple situations algebraically. They can apply their knowledge of measurement and geometry in complex problem situations. They can interpret data from a variety of tables and graphs, including interpolation and extrapolation.

High International Benchmark – 550

Students can apply their understanding and knowledge in a wide variety of relatively complex situations. They can order, relate, and compute with fractions and decimals to solve word problems, operate with negative integers, and solve multi-step word problems involving proportions with whole numbers. Students can solve simple algebraic problems including evaluating expressions, solving simultaneous linear equations, and using a formula to determine the value of a variable. Students can find areas and volumes of simple geometric shapes and use knowledge of geometric properties to solve problems. They can solve probability problems and interpret data in a variety of graphs and tables.

Intermediate International Benchmark – 475

Students can apply basic mathematical knowledge in straightforward situations. They can add, subtract, or multiply to solve one-step word problems involving whole numbers and decimals. They can identify representations of common fractions and relative sizes of fractions. They understand simple algebraic relationships and solve linear equations with one variable. They demonstrate understanding of properties of triangles and basic geometric concepts including symmetry and rotation. They recognize basic notions of probability. They can read and interpret graphs, tables, maps, and scales.

Low International Benchmark – 400

Students have some basic mathematical knowledge.

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

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

MATHEMATICS Grade 4

Advanced International Benchmark – 625

Students can apply their understanding and knowledge in a wide variety of relatively complex situations. They demonstrate a developing understanding of fractions and decimals and the relationship between them. They can select appropriate information to solve multi-step word problems involving proportions. They can formulate or select a rule for a relationship. They show understanding of area and can use measurement concepts to solve a variety of problems. They show some understanding of rotation. They can organize, interpret, and represent data to solve problems.

High International Benchmark – 550

Student can apply their knowledge and understanding to solve problems. Student can solve multi-step word problems involving addition, multiplication, and division. They can use their understanding of place value and simple fractions to solve problems. They can identify a number sentence that represents situations. Students show understanding of three-dimensional objects, how shapes can make other shapes, and simple transformation in a plane. They demonstrate a variety of measurement skills and can interpret and use data in tables and graphs to solve problems.

Intermediate International Benchmark – 475

Students can apply basic mathematical knowledge in straightforward situations. They can read, interpret, and use different representations of numbers. They can perform operations with three- and four-digit numbers and decimals. They can extend simple patterns. They are familiar with a range of two-dimensional shapes and read and interpret different representations of the same data.

Low International Benchmark – 400

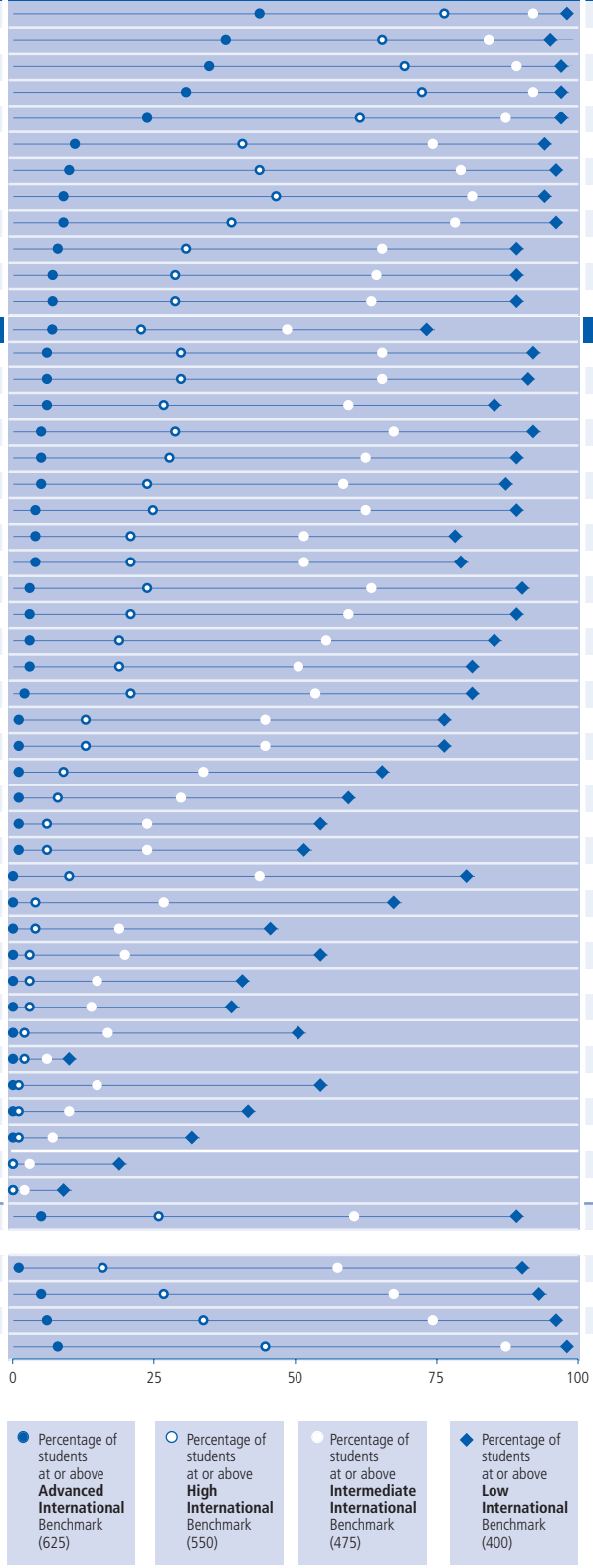
Students have some basic mathematical knowledge. Students demonstrate an understanding of whole numbers and can do simple computations with them. They demonstrate familiarity with the basic properties of triangles and rectangles. They can read information from simple bar graphs.

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

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

MATHEMATICS 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		44 (2.0)	77 (2.0)	93 (1.0)	99 (0.2)
Chinese Taipei		38 (2.0)	66 (1.8)	85 (1.2)	96 (0.6)
◆◆ Korea, Rep. of		35 (1.3)	70 (1.0)	90 (0.5)	98 (0.3)
† Hong Kong, SAR		31 (1.6)	73 (1.8)	93 (1.3)	98 (0.6)
Japan		24 (1.0)	62 (1.2)	88 (0.6)	98 (0.2)
Hungary		11 (1.0)	41 (1.9)	75 (1.6)	95 (0.8)
† Netherlands		10 (1.5)	44 (2.5)	80 (2.0)	97 (0.8)
Belgium (Flemish)		9 (0.9)	47 (1.9)	82 (1.2)	95 (0.9)
Estonia		9 (0.8)	39 (1.9)	79 (1.4)	97 (0.5)
Slovak Republic		8 (0.8)	31 (1.7)	66 (1.7)	90 (1.1)
Australia		7 (1.1)	29 (2.4)	65 (2.3)	90 (1.4)
‡ United States		7 (0.7)	29 (1.6)	64 (1.6)	90 (1.0)
International Avg.		7 (0.1)	23 (0.2)	49 (0.2)	74 (0.2)
Malaysia		6 (1.0)	30 (2.4)	66 (2.1)	93 (0.9)
Russian Federation		6 (0.8)	30 (1.8)	66 (1.8)	92 (0.9)
2 Israel		6 (0.6)	27 (1.5)	60 (1.8)	86 (1.2)
Latvia		5 (0.7)	29 (1.5)	68 (1.7)	93 (0.8)
1 Lithuania		5 (0.6)	28 (1.2)	63 (1.4)	90 (0.8)
New Zealand		5 (1.3)	24 (2.7)	59 (2.5)	88 (1.7)
† Scotland		4 (0.6)	25 (2.1)	63 (2.4)	90 (1.1)
Romania		4 (0.6)	21 (1.8)	52 (2.2)	79 (1.7)
1 Serbia		4 (0.4)	21 (1.1)	52 (1.4)	80 (0.9)
Sweden		3 (0.5)	24 (1.2)	64 (1.5)	91 (1.0)
Slovenia		3 (0.5)	21 (1.0)	60 (1.3)	90 (0.9)
Italy		3 (0.6)	19 (1.5)	56 (1.7)	86 (1.2)
Bulgaria		3 (0.7)	19 (1.8)	51 (2.1)	82 (1.6)
Armenia		2 (0.3)	21 (1.3)	54 (1.5)	82 (1.0)
Cyprus		1 (0.2)	13 (0.7)	45 (1.0)	77 (1.0)
Moldova, Rep. of		1 (0.3)	13 (1.2)	45 (2.1)	77 (1.7)
2 Macedonia, Rep. of		1 (0.2)	9 (1.0)	34 (1.7)	66 (1.7)
Jordan		1 (0.2)	8 (1.0)	30 (1.9)	60 (1.9)
1 Indonesia		1 (0.2)	6 (0.7)	24 (1.7)	55 (2.4)
Egypt		1 (0.2)	6 (0.5)	24 (1.2)	52 (1.7)
Norway		0 (0.2)	10 (0.6)	44 (1.6)	81 (1.2)
Lebanon		0 (0.1)	4 (0.6)	27 (1.8)	68 (1.9)
Palestinian Nat'l Auth.		0 (0.1)	4 (0.4)	19 (1.2)	46 (1.5)
Iran, Islamic Rep. of		0 (0.2)	3 (0.4)	20 (1.1)	55 (1.4)
Chile		0 (0.1)	3 (0.4)	15 (1.2)	41 (1.8)
Philippines		0 (0.1)	3 (0.6)	14 (1.7)	39 (2.7)
Bahrain		0 (0.0)	2 (0.2)	17 (0.7)	51 (1.1)
South Africa		0 (0.1)	2 (0.6)	6 (1.3)	10 (1.8)
Tunisia		0 (0.0)	1 (0.3)	15 (1.1)	55 (1.6)
1 ‡ Morocco		0 (0.0)	1 (0.2)	10 (0.9)	42 (1.6)
Botswana		0 (0.0)	1 (0.2)	7 (0.7)	32 (1.5)
Saudi Arabia		0 (0.1)	0 (0.1)	3 (0.6)	19 (1.7)
Ghana		0 (0.0)	0 (0.0)	2 (0.5)	9 (1.3)
‡ England		5 (1.0)	26 (2.8)	61 (2.9)	90 (1.5)
Benchmarking Participants					
Basque Country, Spain		1 (0.3)	16 (1.5)	58 (2.2)	91 (1.0)
Indiana State, US		5 (1.5)	27 (3.2)	68 (2.5)	94 (1.0)
Ontario Province, Can.		6 (0.7)	34 (1.8)	75 (1.7)	97 (0.5)
Quebec Province, Can.		8 (1.4)	45 (2.2)	88 (1.1)	99 (0.2)



† 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.

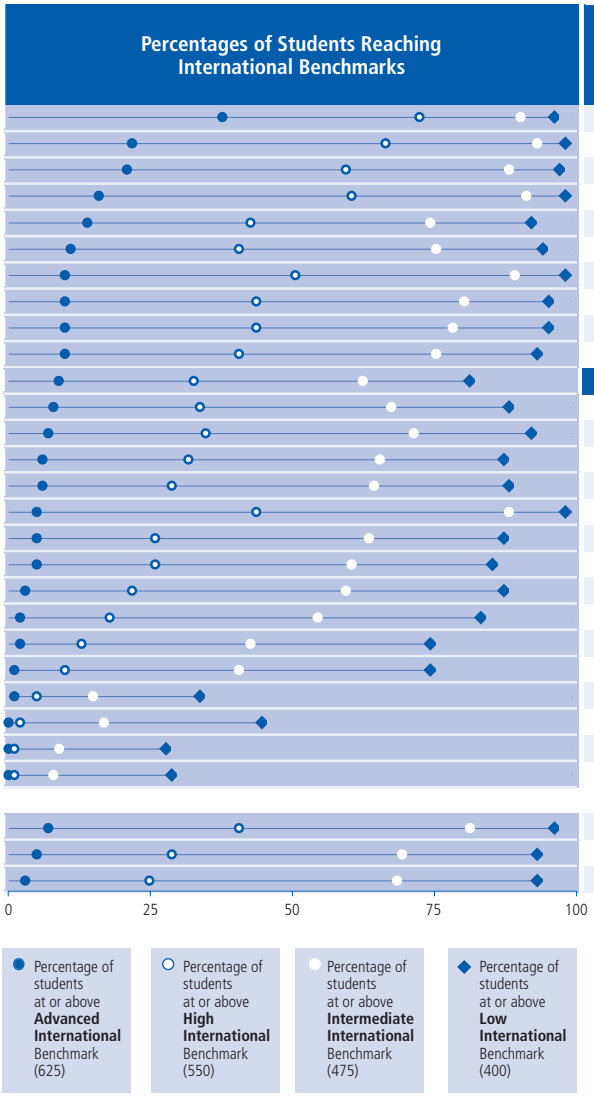
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number,

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

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

MATHEMATICS Grade 4

Countries	Advanced International Benchmark (625)	High International Benchmark (550)	Intermediate International Benchmark (475)	Low International Benchmark (400)
Singapore	38 (2.9)	73 (2.4)	91 (1.3)	97 (0.6)
† Hong Kong, SAR	22 (1.7)	67 (2.0)	94 (0.7)	99 (0.2)
Japan	21 (0.8)	60 (1.0)	89 (0.7)	98 (0.3)
Chinese Taipei	16 (0.9)	61 (1.1)	92 (0.7)	99 (0.2)
† England	14 (1.4)	43 (1.8)	75 (1.6)	93 (0.8)
Russian Federation	11 (1.6)	41 (2.6)	76 (2.0)	95 (0.8)
Belgium (Flemish)	10 (0.6)	51 (1.3)	90 (0.8)	99 (0.3)
Latvia	10 (0.9)	44 (1.9)	81 (1.3)	96 (0.7)
1 Lithuania	10 (1.1)	44 (1.7)	79 (1.3)	96 (0.7)
Hungary	10 (1.0)	41 (1.6)	76 (1.6)	94 (0.8)
International Avg.	9 (0.2)	33 (0.3)	63 (0.3)	82 (0.2)
Cyprus	8 (0.7)	34 (1.2)	68 (1.2)	89 (0.7)
† United States	7 (0.7)	35 (1.3)	72 (1.2)	93 (0.5)
Moldova, Rep. of	6 (1.0)	32 (2.1)	66 (2.1)	88 (1.5)
Italy	6 (1.0)	29 (1.8)	65 (1.7)	89 (1.1)
† Netherlands	5 (0.8)	44 (1.5)	89 (1.2)	99 (0.4)
† Australia	5 (0.7)	26 (1.7)	64 (1.9)	88 (1.3)
New Zealand	5 (0.5)	26 (1.2)	61 (1.3)	86 (1.0)
† Scotland	3 (0.4)	22 (1.4)	60 (1.6)	88 (1.2)
Slovenia	2 (0.4)	18 (1.0)	55 (1.5)	84 (1.0)
Armenia	2 (0.3)	13 (1.2)	43 (1.7)	75 (1.5)
Norway	1 (0.2)	10 (1.0)	41 (1.3)	75 (1.2)
Philippines	1 (0.7)	5 (2.1)	15 (2.7)	34 (2.6)
Iran, Islamic Rep. of	0 (0.1)	2 (0.3)	17 (1.3)	45 (2.2)
Tunisia	0 (0.1)	1 (0.3)	9 (1.0)	28 (1.7)
Morocco	0 (0.0)	1 (0.2)	8 (0.8)	29 (2.2)
Benchmarking Participants				
Indiana State, US	7 (1.2)	41 (1.6)	82 (1.5)	97 (0.6)
Ontario Province, Can.	5 (1.1)	29 (2.2)	70 (1.7)	94 (0.9)
Quebec Province, Can.	3 (0.4)	25 (1.5)	69 (1.4)	94 (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 the TIMSS 2003 International Benchmarks of Mathematics Achievement in 1995, 1999, and 2003

MATHEMATICS 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	44 (2.0)	42 (3.5)	40 (2.9)	77 (2.0)	77 (2.6)	84 (1.8) ▼
Chinese Taipei	38 (2.0)	37 (1.6)	✧ ✧	66 (1.8)	67 (1.5)	✧ ✧
Korea, Rep. of	35 (1.3)	32 (0.9)	31 (1.1) ▲	70 (1.0)	70 (1.0)	67 (1.0)
Hong Kong, SAR	31 (1.6)	28 (2.1)	23 (2.4) ▲	73 (1.8)	70 (2.3)	65 (3.2) ▲
Japan	24 (1.0)	29 (0.9) ▼	29 (1.0) ▼	62 (1.2)	66 (1.0) ▼	67 (0.8) ▼
Hungary	11 (1.0)	13 (1.2)	10 (0.8)	41 (1.9)	43 (1.9)	40 (1.6)
Netherlands	10 (1.5)	11 (2.0)	9 (1.9)	44 (2.5)	47 (4.1)	41 (3.1)
Belgium (Flemish)	9 (0.9)	19 (1.5) ▼	15 (1.5) ▼	47 (1.9)	57 (1.7) ▼	54 (3.0) ▼
Slovak Republic	8 (0.8)	11 (1.2) ▼	11 (1.2) ▼	31 (1.7)	42 (2.3) ▼	43 (1.6) ▼
Australia	7 (1.1)	– –	7 (1.0)	29 (2.4)	– –	33 (1.8)
United States	7 (0.7)	7 (1.0)	4 (0.7) ▲	29 (1.6)	30 (1.6)	26 (2.0)
Russian Federation	6 (0.8)	12 (1.6) ▼	9 (1.2) ▼	30 (1.8)	39 (2.8) ▼	38 (3.1) ▼
Israel	6 (0.6)	4 (0.5) ▲	– –	27 (1.5)	19 (1.3) ▲	– –
Malaysia	6 (1.0)	10 (1.2) ▼	✧ ✧	30 (2.4)	36 (2.4)	✧ ✧
Lithuania	5 (0.6)	3 (0.6) ▲	2 (0.5) ▲	28 (1.2)	18 (2.0) ▲	17 (1.5) ▲
New Zealand	5 (1.3)	6 (1.1)	6 (1.0)	24 (2.7)	26 (2.4)	28 (2.2)
Latvia (LSS)	5 (0.9)	6 (0.8)	4 (0.7)	27 (1.7)	28 (1.8)	22 (1.4) ▲
Romania	4 (0.6)	4 (0.9)	4 (0.6)	21 (1.8)	20 (2.0)	21 (1.6)
Scotland	4 (0.6)	✧ ✧	5 (1.4)	25 (2.1)	✧ ✧	24 (2.7)
Bulgaria	3 (0.7)	9 (2.1) ▼	17 (2.0) ▼	19 (1.8)	32 (3.0) ▼	40 (2.8) ▼
Sweden	3 (0.5)	✧ ✧	12 (1.1) ▼	24 (1.2)	✧ ✧	46 (2.4) ▼
Slovenia	3 (0.5)	– –	4 (0.7)	21 (1.0)	– –	22 (1.3)
Italy	3 (0.6)	4 (0.6)	– –	19 (1.5)	21 (1.5)	– –
Cyprus	1 (0.2)	2 (0.4) ▼	3 (0.4) ▼	13 (0.7)	19 (0.9) ▼	19 (1.0) ▼
Moldova, Rep. of	1 (0.3)	3 (0.6) ▼	✧ ✧	13 (1.2)	18 (1.6) ▼	✧ ✧
Macedonia, Rep. of	1 (0.2)	2 (0.4) ▼	✧ ✧	9 (1.0)	13 (1.0) ▼	✧ ✧
Jordan	1 (0.2)	3 (0.5) ▼	✧ ✧	8 (1.0)	12 (1.0) ▼	✧ ✧
Indonesia	1 (0.2)	2 (0.3) ▼	✧ ✧	6 (0.7)	8 (0.9)	✧ ✧
Norway	0 (0.2)	✧ ✧	4 (0.4) ▼	10 (0.6)	✧ ✧	26 (1.3) ▼
Iran, Islamic Rep. of	0 (0.2)	1 (0.2)	0 (0.2)	3 (0.4)	6 (0.9) ▼	4 (0.6)
Chile	0 (0.1)	1 (0.4)	✧ ✧	3 (0.4)	4 (1.1)	✧ ✧
South Africa	0 (0.1)	0 (0.1)	– –	2 (0.6)	1 (0.5)	– –
Philippines	0 (0.1)	0 (0.1)	✧ ✧	3 (0.6)	1 (0.6)	✧ ✧
Tunisia	0 (0.0)	0 (0.1)	✧ ✧	1 (0.3)	5 (0.5) ▼	✧ ✧
‡ England	5 (1.0)	6 (0.8)	6 (1.0)	26 (2.8)	25 (2.0)	27 (1.5)
International Avg.	8 (0.2)	10 (0.2) ▼	11 (0.3) ▼	28 (0.3)	31 (0.3) ▼	37 (0.4) ▼
Benchmarking Participants						
Indiana State, US	5 (1.5)	7 (1.6)	✧ ✧	27 (3.2)	32 (3.9)	✧ ✧
Ontario Province, Can.	6 (0.7)	6 (0.8)	3 (0.4) ▲	34 (1.8)	32 (1.8)	26 (1.7) ▲
Quebec Province, Can.	8 (1.4)	18 (4.4) ▼	14 (2.8)	45 (2.2)	60 (3.5) ▼	54 (4.2)

▲ 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 the TIMSS 2003 International Benchmarks of Mathematics Achievement in 1995, 1999, and 2003

MATHEMATICS 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	93 (1.0)	94 (1.2)	98 (0.4) ▼	99 (0.2)	99 (0.3)	100 (0.0) ▼
Chinese Taipei	85 (1.2)	85 (1.0)	✧ ✧	96 (0.6)	95 (0.5)	✧ ✧
Korea, Rep. of	90 (0.5)	91 (0.5)	89 (0.7) ▲	98 (0.3)	99 (0.2)	97 (0.4)
Hong Kong, SAR	93 (1.3)	92 (1.3)	88 (2.1)	98 (0.6)	98 (0.6)	96 (1.1)
Japan	88 (0.6)	90 (0.5) ▼	91 (0.5) ▼	98 (0.2)	98 (0.2)	98 (0.2)
Hungary	75 (1.6)	75 (1.5)	74 (1.6)	95 (0.8)	93 (1.0)	94 (0.9)
Netherlands	80 (2.0)	82 (3.4)	78 (2.9)	97 (0.8)	96 (1.5)	95 (1.6)
Belgium (Flemish)	82 (1.2)	86 (1.2) ▼	85 (2.7)	95 (0.9)	97 (0.6) ▼	96 (1.2)
Slovak Republic	66 (1.7)	79 (1.7) ▼	79 (1.3) ▼	90 (1.1)	96 (0.6) ▼	96 (0.6) ▼
Australia	65 (2.3)	– –	68 (1.7)	90 (1.4)	– –	90 (1.0)
United States	64 (1.6)	62 (1.8)	61 (2.4)	90 (1.0)	87 (1.1) ▲	86 (1.5) ▲
Russian Federation	66 (1.8)	73 (2.7) ▼	73 (2.4) ▼	92 (0.9)	93 (1.4)	93 (1.1)
Israel	60 (1.8)	49 (1.9) ▲	– –	86 (1.2)	76 (2.0) ▲	– –
Malaysia	66 (2.1)	70 (2.1)	✧ ✧	93 (0.9)	93 (0.9)	✧ ✧
Lithuania	63 (1.4)	53 (2.3) ▲	50 (2.3) ▲	90 (0.8)	85 (1.8) ▲	81 (1.7) ▲
New Zealand	59 (2.5)	57 (2.5)	64 (2.2)	88 (1.7)	84 (1.5)	89 (1.4)
Latvia (LSS)	66 (2.2)	65 (1.9)	57 (1.8) ▲	92 (1.1)	91 (0.9)	87 (1.4) ▲
Romania	52 (2.2)	51 (2.6)	52 (2.2)	79 (1.7)	79 (2.1)	79 (1.6)
Scotland	63 (2.4)	✧ ✧	60 (2.6)	90 (1.1)	✧ ✧	87 (1.4)
Bulgaria	51 (2.1)	67 (2.5) ▼	69 (2.4) ▼	82 (1.6)	90 (1.2) ▼	90 (1.1) ▼
Sweden	64 (1.5)	✧ ✧	81 (1.8) ▼	91 (1.0)	✧ ✧	96 (0.8) ▼
Slovenia	60 (1.3)	– –	60 (1.8)	90 (0.9)	– –	90 (0.9)
Italy	56 (1.7)	53 (2.1)	– –	86 (1.2)	82 (1.6)	– –
Cyprus	45 (1.0)	53 (1.2) ▼	51 (1.3) ▼	77 (1.0)	82 (0.9) ▼	77 (1.0)
Moldova, Rep. of	45 (2.1)	47 (2.1)	✧ ✧	77 (1.7)	79 (1.7)	✧ ✧
Macedonia, Rep. of	34 (1.7)	40 (1.9) ▼	✧ ✧	66 (1.7)	70 (1.8)	✧ ✧
Jordan	30 (1.9)	33 (1.6)	✧ ✧	60 (1.9)	61 (1.4)	✧ ✧
Indonesia	24 (1.7)	23 (1.4)	✧ ✧	55 (2.4)	50 (2.1)	✧ ✧
Norway	44 (1.6)	✧ ✧	64 (1.3) ▼	81 (1.2)	✧ ✧	90 (0.9) ▼
Iran, Islamic Rep. of	20 (1.1)	26 (1.9) ▼	24 (1.9) ▼	55 (1.4)	61 (1.6) ▼	59 (1.8) ▼
Chile	15 (1.2)	16 (1.9)	✧ ✧	41 (1.8)	46 (1.9)	✧ ✧
South Africa	6 (1.3)	6 (1.1)	– –	10 (1.8)	13 (2.0)	– –
Philippines	14 (1.7)	9 (1.5) ▲	✧ ✧	39 (2.7)	29 (2.5) ▲	✧ ✧
Tunisia	15 (1.1)	34 (1.5) ▼	✧ ✧	55 (1.6)	78 (1.2) ▼	✧ ✧
‡ England	61 (2.9)	60 (2.2)	61 (1.5)	90 (1.5)	88 (1.2)	87 (1.0)
International Avg.	56 (0.3)	57 (0.3) ▼	69 (0.4) ▼	80 (0.3)	80 (0.2)	89 (0.3) ▼
Benchmarking Participants						
Indiana State, US	68 (2.5)	71 (3.5)	✧ ✧	94 (1.0)	93 (1.4)	✧ ✧
Ontario Province, Can.	75 (1.7)	72 (1.6)	65 (1.7) ▲	97 (0.5)	96 (0.6)	91 (1.0) ▲
Quebec Province, Can.	88 (1.1)	93 (1.1) ▼	90 (2.6)	99 (0.2)	99 (0.4)	99 (0.5)

▲ 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, 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.

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

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

MATHEMATICS 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	38 (2.9)	38 (2.2)		73 (2.4)	70 (1.6)		91 (1.3)	89 (1.0)		97 (0.6)	96 (0.4)	▲
Hong Kong, SAR	22 (1.7)	17 (1.7)		67 (2.0)	56 (2.2)	▲	94 (0.7)	87 (1.3)	▲	99 (0.2)	97 (0.6)	▲
Japan	21 (0.8)	22 (1.0)		60 (1.0)	61 (1.1)		89 (0.7)	89 (0.7)		98 (0.3)	98 (0.2)	
England	14 (1.4)	7 (0.8)	▲	43 (1.8)	24 (1.5)	▲	75 (1.6)	54 (1.6)	▲	93 (0.8)	82 (1.1)	▲
Hungary	10 (1.0)	11 (1.0)		41 (1.6)	38 (1.8)		76 (1.6)	72 (1.5)	▲	94 (0.8)	91 (0.9)	▲
Latvia (LSS)	9 (0.9)	6 (1.3)		43 (2.1)	27 (2.1)	▲	80 (1.4)	61 (1.9)	▲	96 (0.8)	88 (1.1)	▲
Cyprus	8 (0.7)	5 (0.6)	▲	34 (1.2)	21 (1.3)	▲	68 (1.2)	52 (1.5)	▲	89 (0.7)	79 (1.3)	▲
United States	7 (0.7)	9 (0.9)		35 (1.3)	37 (1.6)		72 (1.2)	71 (1.3)		93 (0.5)	92 (0.7)	
Netherlands	5 (0.8)	12 (1.1)	▼	44 (1.5)	50 (1.9)	▼	89 (1.2)	87 (1.4)		99 (0.4)	99 (0.4)	
Australia	5 (0.7)	6 (0.6)		26 (1.7)	27 (1.4)		64 (1.9)	61 (1.6)		88 (1.3)	86 (1.1)	
New Zealand	5 (0.5)	4 (0.6)		27 (1.2)	19 (1.4)	▲	62 (1.3)	51 (1.9)	▲	86 (1.0)	78 (1.7)	▲
Scotland	3 (0.4)	7 (0.9)	▼	22 (1.4)	27 (1.7)	▼	60 (1.6)	60 (1.9)		88 (1.2)	85 (1.2)	
Slovenia	2 (0.4)	2 (0.4)		18 (1.0)	14 (1.1)	▲	55 (1.5)	45 (2.0)	▲	84 (1.0)	77 (1.4)	▲
Norway	1 (0.2)	2 (0.4)	▼	10 (1.0)	16 (1.2)	▼	41 (1.3)	53 (2.0)	▼	75 (1.2)	84 (1.2)	▼
Iran, Islamic Rep. of	0 (0.1)	0 (0.2)		2 (0.3)	3 (0.7)		17 (1.3)	15 (1.9)		45 (2.2)	44 (2.5)	
International Avg.	10 (0.3)	10 (0.3)		36 (0.4)	33 (0.4)	▲	69 (0.4)	63 (0.4)	▲	88 (0.3)	85 (0.3)	▲
Benchmarking Participants												
Ontario Province, Can.	5 (1.1)	4 (0.5)		29 (2.2)	22 (1.5)	▲	70 (1.7)	59 (1.9)	▲	94 (0.9)	86 (1.3)	▲
Quebec Province, Can.	3 (0.4)	13 (1.9)	▼	25 (1.5)	50 (3.4)	▼	69 (1.4)	87 (1.7)	▼	94 (0.8)	98 (0.7)	▼

▲ 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 the ability to organize information in problem-solving situations, make generalizations, solve non-routine problems, and draw and justify conclusions from data. 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 algebra problem an eighth-grade student performing at the advanced benchmark generally answered correctly. The eighth-grade students reaching the advanced benchmark typically were able to apply a generalization in order to solve a sequence problem like the one shown in Exhibit 2.6. More specifically, they were asked to generalize from the first of several terms of a sequence growing in two dimensions to find a specified term. The problem was presented in three parts, A, B, and C. For parts A and B, students were given a geometric pattern and then asked to indicate how many triangles would be in the 3rd, 4th, and 7th figures, respectively, if the pattern were extended. In part C, students were asked to explain a way to find the number of triangles in the 50th figure that did not involve drawing or counting it. The achievement results are shown for part C.

To receive full credit for Part C, students had to show or explain how their answer was obtained by providing a general expression or an equation and by calculating the correct number of triangles for the 50th figure. Internationally, this was among the most difficult items in the assessment. On average, 14 percent of the students received full credit for their responses.

Unlike students performing at lower benchmarks, students reaching the advanced benchmark typically could correctly answer multi-step word problems. Example Item 2 from the data content area presented in Exhibit 2.7 requires students to select relevant infor-

mation from a table, calculate which of the two phone plans would be less expensive for Betty, and justify their answer in terms of the monthly fee and free minutes. With an international average of 21 percent correct (for full credit), this item was a challenge for many of the eighth-grade students participating in TIMSS 2003. In no country did the majority of eighth-grade students answer the item correctly, although Japan came very close with 49 percent. In Australia, Estonia, Korea and Singapore, from 40 to 44 percent of the eighth-grade students answered the item correctly.

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

MATHEMATICS Grade 8

Advanced International Benchmark – 625

Summary

Students can organize information, make generalizations, solve non-routine problems, and draw and justify conclusions from data. They can compute percent change and apply their knowledge of numeric and algebraic concepts and relationships to solve problems. Students can solve simultaneous linear equations and model simple situations algebraically. They can apply their knowledge of measurement and geometry in complex problem situations. They can interpret data from a variety of tables and graphs, including interpolation and extrapolation.

Students can organize information, make generalizations, and solve non-routine problems. Students can solve multi-step problems involving computations with whole numbers, decimals, and rounding. They can use the distributive property of the product to identify different representations of a number. They can compute with integers using order of operations.

Students can solve problems involving operations with proper and improper fractions, including fractions with unlike denominators. Given two points on a number line representing unspecified fractions, students can identify the point that represents their product. They can convert mixed numbers to decimal fractions. They can solve word problems involving inverse operations, decimal place value, and a fraction of a whole number of currency units. They can order integers, decimals, and common fractions.

Given a number and the ratio of two of its parts, students can find the value of one part. They can, given the dimensions of two rectangles, express the ratio of their areas. They can identify equivalent ratios and determine the ratio of two parts of a whole. They can find the percent change, given the original and final quantities, and, given the original and reduced prices, determine the percent reduction. They also can solve a multi-step non-routine problem involving percents.

Students can extend number patterns to identify the numbers common to two different arithmetic sequences and identify the row in a table whose entries are used to solve a problem. Students can make generalizations to find terms in number patterns and can explain the process used to find those terms.

They can add three simple rational expressions with unlike numerical denominators, identify the sum of three consecutive whole numbers given the middle number in general terms, and evaluate an algebraic equation by using an equivalent form and substituting given values. They can identify algebraic expressions that model situations, a diagram that models an addition of two like algebraic terms, and what the variable represents in an equation for a given situation. They can solve a pair of linear, simultaneous equations, and given a linear equation in which y is expressed in terms of x, they can solve for x.

Students can apply their knowledge of measurement in complex problem situations. They can solve area problems in which they have to find the length of a side, the perimeter of a figure, the area between two rectangles when one is inside the other, and the area of a trapezoid inscribed in a rectangle. They can draw a new rectangle based on a given rectangle and find its area. They can use their knowledge of the area of a circle and of average rate to solve a problem. They can apply their knowledge of number of milliliters in a liter to solve a word problem and solve a problem that involves filling a rectangular prism with spheres. Students can combine information about lengths of segments on a line to solve a distance problem. They can solve multi-step problems involving time, distance, and speed, and can relate different units of time to solve a problem. They can use knowledge of time, clocks, and angles to solve a problem.

Students can combine knowledge of geometric figures to solve problems that involve more than one step. This knowledge involves congruent triangles, the sum of angles in a triangle, interior and exterior angles, angle bisectors, and regular hexagons. They recognize that arcs of equal radii generate an equilateral triangle. Students can select coordinates on a line in a plane given the coordinates of two other points on the line. Students can justify that a triangle is a right triangle using the Pythagorean relationship.

Students can predict outcomes from data and use their understanding of probability to draw a spinner that could have produced the data in a given table. Students can interpret data from a variety of tables and graphs, including interpolation and extrapolation. They can derive information from given timetables to complete a table for a specified journey and check that it meets given conditions. They can draw and justify conclusions based on data.

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

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

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

MATHEMATICS Grade 8

Content Area: Algebra

Description: Part C–Generalizing from the first several terms of a sequence growing in two dimensions, explains a way to find a specified term, e.g. the 50th.

The three figures below are divided into small congruent triangles.

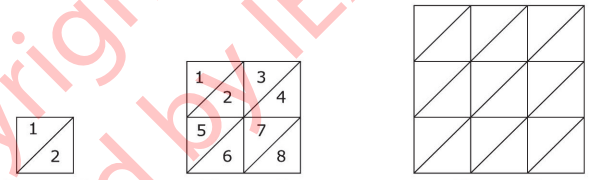


Figure 1 Figure 2 Figure 3

A. Complete the table below. First, fill in how many small triangles make up Figure 3. Then, find the number of small triangles that would be needed for the 4th figure if the sequence of figures is extended.

Figure	Number of Small Triangles
1	2
2	8
3	18
4	32

B. The sequence of figures is extended to the 7th figure. How many small triangles would be needed for Figure 7?

Answer: 98

$7^2 \times 2$

49×2

C. The sequence of figures is extended to the 50th figure. Explain a way to find the number of small triangles in the 50th figure that does not involve drawing it and counting the number of triangles.

$50^2 \times 2$

2500×2

5000

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

Country	Percent Full Credit	
Chinese Taipei	49 (2.0)	▲
◆◆ Korea, Rep. of	48 (1.8)	▲
† Hong Kong, SAR	45 (2.0)	▲
Singapore	44 (2.0)	▲
Japan	44 (2.1)	▲
† Netherlands	36 (2.4)	▲
Australia	26 (2.7)	▲
Hungary	24 (2.1)	▲
† Scotland	22 (2.2)	▲
Belgium (Flemish)	21 (1.3)	▲
‡ United States	19 (1.5)	▲
Sweden	17 (1.6)	
New Zealand	16 (2.1)	
Estonia	15 (1.3)	
Slovak Republic	14 (1.5)	
International Avg.	14 (0.2)	
Italy	14 (1.5)	
Latvia	13 (1.5)	
Slovenia	13 (1.6)	
1 Serbia	11 (1.2)	▼
1 Lithuania	11 (1.3)	▼
Romania	11 (1.6)	▼
Malaysia	10 (1.0)	▼
2 Israel	10 (1.3)	▼
Cyprus	10 (1.1)	▼
Norway	9 (1.3)	▼
Russian Federation	9 (1.2)	▼
Armenia	8 (1.2)	▼
1 Indonesia	7 (0.9)	▼
Chile	6 (0.8)	▼
Jordan	5 (0.9)	▼
Egypt	5 (0.8)	▼
Palestinian Nat'l Auth.	5 (0.7)	▼
2 Macedonia, Rep. of	4 (0.9)	▼
Philippines	4 (0.9)	▼
Bulgaria	4 (0.8)	▼
Bahrain	4 (0.8)	▼
Iran, Islamic Rep. of	3 (0.6)	▼
1 ‡ Morocco	2 (0.8)	▼
Botswana	2 (0.5)	▼
South Africa	1 (0.5)	▼
Tunisia	1 (0.3)	▼
Lebanon	1 (0.3)	▼
Ghana	1 (0.3)	▼
Saudi Arabia	0 (0.1)	▼
Moldova, Rep. of	0 (0.1)	▼
‡ England	20 (2.0)	▲
Benchmarking Participants		
Basque Country, Spain	16 (2.0)	
Indiana State, US	16 (1.9)	
Ontario Province, Can.	26 (2.3)	▲
Quebec Province, Can.	28 (2.7)	▲

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

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

* 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.

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

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

MATHEMATICS Grade 8

Content Area: Data

Description: Interpret data from a table, draws and justifies conclusions.

Betty, Frank, and Darlene have just moved to Zedland. They each need to get phone service. They received the following information from the telephone company about the two different phone plans it offers.

They must pay a set fee each month and there are different rates for each minute they talk. These rates depend on the time of the day or night they use the phone, and on which payment plan they choose. Both plans include time for which phone calls are free. Details of the two plans are shown in the table below.

Plan	Monthly Fee	Rate per minute		Free minutes per month
		Day (8 am – 6 pm)	Night (6 pm – 8 am)	
Plan A	20 zeds	3 zeds	1 zed	180
Plan B	15 zeds	2 zeds	2 zeds	120

Betty talks for less than 2 hours per month. Which plan would be less expensive for her?

Less expensive plan Plan B

Explain your answer in terms of both the monthly fee and free minutes.

she talks for less than 2 hours and Plan B has less monthly fees

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

Country	Percent Full Credit	
Japan	49 (2.2)	▲
Australia	44 (2.2)	▲
Estonia	44 (2.1)	▲
◆◆ Korea, Rep. of	40 (1.7)	▲
Singapore	40 (1.7)	▲
Hungary	39 (2.2)	▲
Belgium (Flemish)	38 (1.9)	▲
1 Lithuania	37 (1.7)	▲
‡ United States	37 (1.7)	▲
† Scotland	36 (2.7)	▲
2 Israel	33 (2.1)	▲
New Zealand	30 (2.4)	▲
† Netherlands	28 (2.5)	▲
† Hong Kong, SAR	28 (2.0)	▲
Slovenia	27 (2.2)	▲
Sweden	27 (1.9)	▲
Malaysia	27 (1.7)	▲
Chinese Taipei	27 (1.8)	▲
Slovak Republic	26 (2.0)	▲
Italy	23 (1.8)	
Latvia	22 (1.8)	
International Avg.	21 (0.3)	
Jordan	20 (1.8)	
Bahrain	18 (1.4)	▼
Norway	18 (1.4)	▼
Romania	16 (1.8)	▼
Russian Federation	15 (2.0)	▼
Egypt	14 (1.2)	▼
Cyprus	13 (1.4)	▼
1 Indonesia	12 (1.4)	▼
1 Serbia	12 (1.3)	▼
Chile	12 (1.1)	▼
Bulgaria	12 (1.7)	▼
Lebanon	11 (1.4)	▼
Philippines	11 (1.2)	▼
2 Macedonia, Rep. of	10 (1.5)	▼
Saudi Arabia	8 (1.8)	▼
1 ‡ Morocco	7 (1.2)	▼
South Africa	6 (1.2)	▼
Palestinian Nat'l Auth.	5 (0.7)	▼
Iran, Islamic Rep. of	4 (0.7)	▼
Tunisia	4 (0.6)	▼
Ghana	3 (1.0)	▼
Botswana	2 (0.8)	▼
Armenia	2 (0.6)	▼
Moldova, Rep. of	1 (0.5)	▼
‡ England	45 (2.5)	▲
Benchmarking Participants		
Basque Country, Spain	19 (2.1)	
Indiana State, US	34 (3.3)	▲
Ontario Province, Can.	36 (2.4)	▲
Quebec Province, Can.	24 (2.1)	

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

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

* 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.

Grade 8: Achievement at the High International Benchmark

Exhibit 2.8 describes performance at the high benchmark. Eighth-grade students performing at this level applied their mathematical knowledge and understanding in a wide variety of relatively complex situations. For example, they demonstrated facility with fractions in a variety of formats, as illustrated by Example Item 3 shown in Exhibit 2.9. This item required students to divide or reason with a unit fraction to solve a one-step word problem. Internationally, 38 percent of the students, on average, were able to provide a correct response. About three-fourths or more of the students in Singapore, Hong Kong SAR, Chinese Taipei, and the Netherlands answered the question correctly.

Eighth-grade students reaching the high benchmark generally were able to apply knowledge of geometric properties. In Example Item 4 in Exhibit 2.10, students needed to use their knowledge of the properties of congruent triangles to find the measure of an angle. About four-fifths or more of the students in Korea, Hong Kong SAR, Japan, and Singapore answered the item correctly. Internationally, however, just under half the eighth-grade students (46 percent, on average) did so.

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

MATHEMATICS Grade 8

High International Benchmark – 550

Summary

Students can apply their understanding and knowledge in a wide variety of relatively complex situations. They can order, relate, and compute with fractions and decimals to solve word problems, operate with negative integers, and solve multi-step word problems involving proportions with whole numbers. Students can solve simple algebraic problems including evaluating expressions, solving simultaneous linear equations, and using a formula to determine the value of a variable. Students can find areas and volumes of simple geometric shapes and use knowledge of geometric properties to solve problems. They can solve probability problems and interpret data in a variety of graphs and tables.

Students can apply their understanding and knowledge in a wide variety of relatively complex situations. Students can solve word problems by determining a number between two given numbers that is divisible by only one of two other numbers, and by estimating the product of whole numbers. They can identify the prime factorization of a given number. Students can solve word problems by using the patterns in a two-column table to determine the number in the second column that corresponds to a number midway between two entries in the first column. They demonstrate understanding of the effects of operations involving negative integers by identifying the largest number produced. They can identify the number that gives a specified result when divided by a given negative integer.

Students demonstrate some facility with fractions and decimals through computation, ordering, rounding, and use in word problems. They can identify the fraction of an hour representing a given time interval and three fractions with denominators less than 10. Students can solve one-step word problems involving division of a whole number by a unit fraction and multi-step word problems involving multiplication of whole numbers by fractions. They can select a fraction representing the comparison of parts to a whole, given each of two parts, and identify the percent equivalent of a given fraction with a denominator that is a factor of 100. They can round four-place decimals to the nearest hundredth. They can multiply two-place decimal numbers by three-place decimal numbers without calculators.

Students can identify one proportional share of an amount divided into three unequal parts. They can solve word problems by finding the missing term in a proportion. They can select the statement that describes the effect of adding the same amount to both terms of a ratio, and can determine the simplified ratio of the shaded to unshaded parts of a shape. They can calculate the new price of an item given the percent increase in price.

Given the first several terms of a sequence in numeric and pictorial form, students can extend the sequence to find specified terms. Students can solve simple algebraic problems. They can simplify an algebraic expression by combining like terms, and can find the value of an expression involving multiplication of negative integers. Students can identify an algebraic expression that corresponds to a situation, subtract algebraic expressions with the same numeric denominators, and recognize the product of two algebraic expressions in one variable that involves exponents.

Students can solve a linear equation with parentheses, solve simple, simultaneous linear equations, and identify the quantity that satisfies two inequalities represented using a balance. They can identify the linear equation that describes the relationship between the first and second terms in a set of ordered pairs. They can use a formula to determine the value of one variable given the value of the other.

Students can compare volumes by visualizing and counting cubes, find the number of cubes needed to a fill a hole in a given shape, and calculate the volume of a rectangular prism given its net. Students can solve a variety of problems involving area. For example, they can find the perimeter of a square given its area, find the area of a rectangle enclosing two touching circles with a given radius, find the area of an irregular figure formed by rectangles, and find the area of a triangle, on the same base and with the same height as a square, when the length of a side of the square is known. From a set of times expressed variously in days, hours, minutes, and seconds, students can determine which is least. Given the start time and the duration of an event expressed as a fraction of an hour, students can determine the end time. They can solve word problems involving average speed, distance, and time.

Students can use properties of lines and angles to solve routine problems that involve supplementary, adjacent, and vertical angles and measures of angles. They can use properties of triangles to find the measure of an angle. Students can produce a drawing that meets specific angle specifications. They can identify a pair of similar triangles given the length of their sides and identify a false statement about congruent triangles. They show understanding of transformations (rotations and reflections) in a plane. They can select a center of rotation when given a figure and its image. Students can visualize a figure cut from a folded piece of paper.

Students understand elementary concepts of probability, including estimating outcomes from sample data. They can solve simple problems involving the relationship between successful and unsuccessful outcomes and probabilities. They also recognize that when outcomes are expressed as fractions of a whole, the least likely outcome corresponds to a smallest fraction. They can read and interpret data in pie graphs, line graphs, and frequency tables to solve problems. They can compare and integrate several sets of data to determine which meet given conditions.

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

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

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

MATHEMATICS Grade 8

Content Area: Number

Description: Solves a one-step word problem involving division of a whole number by a unit fraction.

A scoop holds $\frac{1}{5}$ kg of flour. How many scoops of flour are needed to fill a bag with 6 kg of flour?

Answer: $6 \div \frac{1}{5}$

6×5

30 scoops

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

Country	Percent Full Credit	
Singapore	79 (1.9)	▲
† Hong Kong, SAR	76 (1.8)	▲
Chinese Taipei	75 (1.9)	▲
† Netherlands	74 (2.1)	▲
◆◆ Korea, Rep. of	68 (1.5)	▲
Japan	62 (1.8)	▲
Belgium (Flemish)	62 (2.2)	▲
Sweden	60 (1.9)	▲
Australia	53 (2.6)	▲
‡ United States	52 (1.7)	▲
† Scotland	51 (2.7)	▲
Estonia	51 (2.0)	▲
Latvia	51 (2.7)	▲
Hungary	51 (2.1)	▲
Russian Federation	49 (2.7)	▲
2 Israel	48 (2.3)	▲
Malaysia	47 (2.2)	▲
New Zealand	46 (3.2)	▲
Slovenia	46 (2.1)	▲
Armenia	45 (2.2)	▲
1 Lithuania	43 (2.3)	▲
Slovak Republic	43 (2.0)	▲
Norway	39 (2.1)	
Romania	39 (2.8)	
International Avg.	38 (0.3)	
1 Serbia	38 (2.0)	
Bulgaria	38 (3.0)	
Cyprus	37 (1.8)	
Moldova, Rep. of	37 (2.7)	
Italy	34 (2.1)	▼
1 Indonesia	26 (1.5)	▼
2 Macedonia, Rep. of	22 (2.0)	▼
Iran, Islamic Rep. of	20 (1.9)	▼
Tunisia	18 (1.4)	▼
Egypt	17 (1.4)	▼
Jordan	16 (1.5)	▼
Lebanon	15 (1.4)	▼
Chile	13 (1.1)	▼
Philippines	13 (1.3)	▼
Bahrain	11 (1.3)	▼
Botswana	11 (1.1)	▼
Palestinian Nat'l Auth.	10 (1.2)	▼
1 ‡ Morocco	8 (1.5)	▼
South Africa	7 (1.3)	▼
Saudi Arabia	7 (1.9)	▼
Ghana	6 (1.0)	▼
‡ England	50 (3.1)	▲
Benchmarking Participants		
Basque Country, Spain	42 (2.5)	
Indiana State, US	56 (4.0)	▲
Ontario Province, Can.	53 (2.2)	▲
Quebec Province, Can.	61 (2.9)	▲

▲ 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

* 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.

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

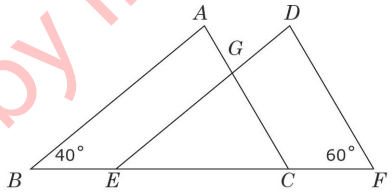
An Item That Students Reaching the High International Benchmark Are Likely to Answer Correctly*

MATHEMATICS Grade 8

Content Area: Geometry

Description: Uses properties of congruent triangles to find the measure of an angle.

In this figure, triangles ABC and DEF are congruent with $BC = EF$.



What is the measure of angle EGC ?

Ⓐ 20°
Ⓑ 40°
Ⓒ 60°
● 80°
Ⓔ 100°

Country	Percent Full Credit
⧓ Korea, Rep. of	84 (1.4) ▲
† Hong Kong, SAR	81 (1.6) ▲
Japan	80 (1.4) ▲
Singapore	79 (1.6) ▲
Chinese Taipei	73 (1.9) ▲
Estonia	67 (2.0) ▲
Belgium (Flemish)	66 (1.7) ▲
Latvia	63 (2.2) ▲
Bulgaria	60 (2.6) ▲
2 Israel	57 (2.7) ▲
Russian Federation	55 (2.7) ▲
Lebanon	55 (2.2) ▲
† Scotland	54 (2.7) ▲
Slovak Republic	54 (2.5) ▲
1 Lithuania	51 (2.3) ▲
Hungary	50 (2.4)
Australia	47 (2.1)
Egypt	47 (1.7)
Malaysia	47 (2.4)
International Avg.	46 (0.3)
Armenia	45 (2.4)
Moldova, Rep. of	45 (3.0)
Cyprus	44 (2.2)
† Netherlands	44 (2.5)
1 Serbia	43 (1.9)
New Zealand	42 (3.6)
Jordan	42 (1.8) ▼
Italy	42 (2.3)
Tunisia	41 (1.6) ▼
Bahrain	41 (2.4) ▼
Sweden	40 (2.1) ▼
Palestinian Nat'l Auth.	39 (1.7) ▼
Iran, Islamic Rep. of	37 (2.1) ▼
Slovenia	37 (2.5) ▼
‡ United States	36 (1.7) ▼
2 Macedonia, Rep. of	33 (2.4) ▼
Norway	32 (2.1) ▼
1 Indonesia	31 (1.7) ▼
1 ‡ Morocco	31 (2.2) ▼
Chile	30 (1.8) ▼
Saudi Arabia	26 (2.5) ▼
South Africa	21 (1.5) ▼
Ghana	20 (1.6) ▼
Botswana	20 (1.5) ▼
Romania	18 (1.7) ▼
Philippines	15 (1.3) ▼
‡ England	47 (2.8)
Benchmarking Participants	
Basque Country, Spain	32 (2.5) ▼
Indiana State, US	30 (2.6) ▼
Ontario Province, Can.	50 (2.6)
Quebec Province, Can.	69 (1.8) ▲

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

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

* 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 Intermediate International Benchmark

Eighth-grade students at the intermediate benchmark demonstrated the ability to apply basic mathematical knowledge in straightforward situations (see Exhibit 2.11). For example, as shown by Example Item 5 in Exhibit 2.12, students showed that they could subtract a two-place decimal number from another. The international average percent correct for this item was 61 percent. Singapore and Korea outperformed other countries with 87 to 88 percent correct.

Example Item 6 shown in Exhibit 2.13 illustrates students' emerging familiarity with algebraic representation. Internationally, on average, nearly two-thirds of the eighth-grade students were able to solve the equation for a missing number in a proportion. About three-fourths or more of the students were able to do so in 13 countries up to and including 93 percent in Singapore.

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

Intermediate International Benchmark – 475

Summary

Students can apply basic mathematical knowledge in straightforward situations. They can add, subtract, or multiply to solve one-step word problems involving whole numbers and decimals. They can identify representations of common fractions and relative sizes of fractions. They understand simple algebraic relationships and solve linear equations with one variable. They demonstrate understanding of properties of triangles and basic geometric concepts including symmetry and rotation. They recognize basic notions of probability. They can read and interpret graphs, tables, maps, and scales.

Students can apply basic mathematical knowledge in straightforward situations. They can arrange four given digits in descending and ascending order to form the largest and smallest possible numbers, and find the difference between those two numbers. They can solve word problems involving addition and multiplication of two-digit whole numbers. Students can approximate the quantity remaining after an amount is reduced by a given percent. They can select the statement that describes the effect of adding the same amount to both terms of a ratio. They can use knowledge of exponent notation to select approximations to two squared whole numbers.

Students show some understanding of decimals and fractions. They can solve word problems involving addition of numbers with up to three decimal places, and subtraction with up to two decimal places. They can select a two-place decimal closest to a given whole number and round two-place decimals to whole numbers. Students can identify the decimal number that is equivalent to the sum of two fractions whose denominators are powers of 10. They can select the smallest fraction from a set of commonly used fractions and can also write a fraction less than a given fraction. They can identify a circular model of a fraction that best approximates a given rectangular model of the same fraction.

Students at this level know the meaning of simple algebraic expressions involving multiplication and addition and can identify the expression that represents a situation. They can solve linear equations with one variable. Using the properties of a balance, they can reason to find an unknown weight. Students are able to recognize and extend number patterns. Given two straight line graphs, they can select the one that models a situation described in words, and interpret the graphs and use their intersection to solve a problem.

Students can identify a value of unlabeled marks on circular and linear scales. They can solve problems by comparing distances on a map drawn to scale.

Students can use knowledge of basic geometric properties to identify corresponding parts of congruent figures and to divide an isosceles triangle into congruent triangles. They can use properties of triangles to locate points on a grid. They can relate two-dimensional representations to three-dimensional objects and identify a three-dimensional figure after a rotation. Students can use the concept of line symmetry to complete geometric patterns and they can locate points in the Cartesian plane.

Students can locate and interpret data presented in bar graphs, pie graphs, and line graphs. They can construct a pie chart representing given data. Given a table of values for two variables, they can select the graph that represents the given data. They can calculate and compare averages, and have some understanding of the likelihood of an event.

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

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

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

MATHEMATICS Grade 8

Content Area: Number

Description: Solves a word problem involving subtraction of a two-place decimal number from another.

Alice ran a race in 49.86 seconds. Betty ran the same race in 52.30 seconds. How much longer did it take Betty to run the race than Alice?

● 2.44 seconds

Ⓑ 2.54 seconds

Ⓒ 3.56 seconds

Ⓓ 3.76 seconds

Country	Percent Full Credit	
Singapore	88 (1.0)	▲
◆◆ Korea, Rep. of	87 (1.1)	▲
Malaysia	81 (1.4)	▲
† Netherlands	81 (2.0)	▲
Hungary	80 (1.9)	▲
Chinese Taipei	80 (1.6)	▲
Japan	78 (1.6)	▲
Russian Federation	76 (1.8)	▲
† Hong Kong, SAR	75 (1.6)	▲
Slovak Republic	74 (2.1)	▲
‡ United States	74 (1.7)	▲
Slovenia	73 (2.3)	▲
Estonia	72 (1.8)	▲
Belgium (Flemish)	71 (1.8)	▲
† Scotland	71 (2.0)	▲
Moldova, Rep. of	69 (2.3)	▲
1 Serbia	68 (2.1)	▲
Latvia	67 (2.4)	▲
Bulgaria	66 (2.5)	
1 Lithuania	65 (2.3)	
Romania	64 (2.4)	
Tunisia	63 (2.0)	
Australia	63 (2.4)	
Sweden	63 (2.0)	
Italy	62 (2.1)	
Botswana	61 (1.7)	
International Avg.	61 (0.3)	
Lebanon	61 (2.3)	
Armenia	60 (2.2)	
2 Macedonia, Rep. of	59 (2.1)	
Cyprus	59 (1.8)	
Egypt	58 (1.7)	
2 Israel	58 (1.9)	
1 Indonesia	55 (2.0)	▼
New Zealand	53 (2.4)	▼
Jordan	46 (2.2)	▼
Norway	46 (2.5)	▼
Philippines	45 (2.2)	▼
1 ‡ Morocco	45 (2.6)	▼
Bahrain	45 (2.0)	▼
Iran, Islamic Rep. of	44 (1.9)	▼
Chile	42 (1.8)	▼
Palestinian Nat'l Auth.	37 (1.7)	▼
Ghana	32 (2.0)	▼
South Africa	29 (1.8)	▼
Saudi Arabia	19 (2.3)	▼
‡ England	54 (2.5)	▼
Benchmarking Participants		
Basque Country, Spain	64 (3.0)	
Indiana State, US	77 (2.2)	▲
Ontario Province, Can.	73 (2.4)	▲
Quebec Province, Can.	76 (1.9)	▲

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

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

* 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 Mathematics Achievement – Example Item 6

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

MATHEMATICS Grade 8

Content Area: Algebra

Description: Solves equation for missing number in a proportion.

If $\frac{12}{n} = \frac{36}{21}$, then n equals

(A) 3

● 7

(C) 36

(D) 63

Country	Percent Full Credit	
Singapore	93 (0.7)	▲
◆◆ Korea, Rep. of	89 (0.9)	▲
† Hong Kong, SAR	88 (1.2)	▲
Belgium (Flemish)	86 (1.4)	▲
† Netherlands	85 (1.8)	▲
Malaysia	83 (1.5)	▲
Chinese Taipei	83 (1.5)	▲
‡ United States	80 (1.1)	▲
Japan	79 (1.6)	▲
Hungary	79 (1.7)	▲
† Scotland	79 (1.9)	▲
Australia	76 (1.9)	▲
Slovak Republic	74 (2.0)	▲
Slovenia	72 (2.3)	▲
2 Israel	72 (2.0)	▲
Lebanon	71 (2.6)	▲
Russian Federation	71 (1.9)	▲
Estonia	71 (2.2)	▲
Latvia	70 (2.1)	▲
New Zealand	68 (2.3)	
Sweden	66 (2.1)	
Iran, Islamic Rep. of	66 (1.7)	
Italy	65 (2.1)	
Cyprus	65 (1.8)	
International Avg.	65 (0.3)	
Tunisia	64 (1.7)	
1 Lithuania	64 (2.1)	
1 Serbia	63 (2.1)	
Moldova, Rep. of	61 (2.5)	
Romania	61 (2.2)	▼
Bulgaria	59 (2.0)	▼
Norway	59 (2.1)	▼
1 Indonesia	58 (1.9)	▼
Egypt	58 (2.2)	▼
Armenia	54 (2.6)	▼
1 ‡ Morocco	54 (3.0)	▼
Jordan	53 (1.9)	▼
Palestinian Nat'l Auth.	52 (1.6)	▼
Philippines	52 (2.1)	▼
2 Macedonia, Rep. of	50 (2.3)	▼
Bahrain	44 (2.2)	▼
Chile	44 (2.0)	▼
Botswana	41 (1.7)	▼
Saudi Arabia	30 (2.2)	▼
Ghana	28 (1.6)	▼
South Africa	26 (1.5)	▼
‡ England	74 (2.6)	▲
Benchmarking Participants		
Basque Country, Spain	77 (2.3)	▲
Indiana State, US	83 (1.7)	▲
Ontario Province, Can.	86 (1.8)	▲
Quebec Province, Can.	88 (1.4)	▲

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

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

* 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, the very few items anchoring at the low benchmark provided evidence that students performing at this level have some basic mathematical knowledge. Essentially, however, students performing at the 400 level or lower had considerable difficulty with many of the TIMSS 2003 items. The one example item that is available for public release is presented in Exhibit 2.15. Students answering Example Item 7 demonstrated some understanding of decimal place values, by correctly selecting 9.99 as the two-place decimal closest to 10. The international average was 77 percent correct, and 15 countries as well as three benchmarking participants had 90 percent or more of their students choosing the correct answer. In five countries – the Netherlands, Sweden, Estonia, Singapore, and Lithuania – 95 percent or more of the students gave the correct response.

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

MATHEMATICS Grade 8

Low International Benchmark – 400

Summary

Students have some basic mathematical knowledge.

The few items at this level provide some evidence that students can do basic computations with whole numbers without a calculator. They can select the two-place decimal closest to a whole number. They can multiply two-place decimal numbers by three-place decimal numbers with calculators available. They recognize some basic terminology and read information from a line on a graph.

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

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

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

MATHEMATICS Grade 8

Content Area: Number

Description: Selects two-place decimal closest to a given whole number.

Which of these numbers is closest to 10?

Ⓐ 0.10

● 9.99

Ⓒ 10.10

Ⓓ 10.90

Country	Percent Full Credit	
† Netherlands	97 (1.0)	▲
Sweden	96 (1.1)	▲
Estonia	96 (1.2)	▲
Singapore	95 (1.1)	▲
1 Lithuania	95 (1.0)	▲
Belgium (Flemish)	94 (1.4)	▲
◆◆ Korea, Rep. of	94 (1.2)	▲
Malaysia	93 (1.4)	▲
Japan	92 (1.4)	▲
1 Serbia	91 (1.6)	▲
Norway	91 (1.3)	▲
Russian Federation	91 (1.2)	▲
Latvia	90 (1.9)	▲
Slovak Republic	90 (2.0)	▲
Italy	90 (1.9)	▲
† Hong Kong, SAR	89 (1.6)	▲
† Scotland	89 (2.0)	▲
Chinese Taipei	89 (1.5)	▲
Cyprus	88 (2.0)	▲
Hungary	88 (2.0)	▲
Australia	88 (1.8)	▲
‡ United States	87 (1.1)	▲
Slovenia	87 (2.2)	▲
New Zealand	86 (2.0)	▲
Bulgaria	85 (2.7)	▲
Moldova, Rep. of	82 (2.5)	
2 Israel	81 (2.3)	
Romania	79 (2.5)	
2 Macedonia, Rep. of	78 (2.7)	
International Avg.	77 (0.3)	
Tunisia	76 (2.3)	
1 ‡ Morocco	75 (3.1)	
1 Indonesia	74 (2.7)	
Iran, Islamic Rep. of	69 (2.4)	▼
Chile	67 (1.9)	▼
Lebanon	67 (2.7)	▼
Armenia	66 (2.6)	▼
Jordan	55 (2.7)	▼
Palestinian Nat'l Auth.	50 (2.7)	▼
Bahrain	49 (3.2)	▼
Egypt	48 (2.5)	▼
Philippines	42 (2.8)	▼
Botswana	40 (2.6)	▼
Saudi Arabia	35 (2.6)	▼
South Africa	30 (2.7)	▼
Ghana	24 (2.4)	▼
‡ England	82 (2.5)	▲
Benchmarking Participants		
Basque Country, Spain	92 (2.0)	▲
Indiana State, US	84 (3.2)	▲
Ontario Province, Can.	91 (1.8)	▲
Quebec Province, Can.	91 (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

* 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 4: Achievement at the Advanced International Benchmark

At the fourth grade, students reaching the advanced benchmark demonstrated that they could apply their understanding and knowledge in a wide variety of relatively complex situations (see Exhibit 2.16). In the content area of number, fourth-grade students reaching the advanced level exhibited a developing understanding of fractions and decimals and the relationship between them. For example, as illustrated by Example Item 1 in Exhibit 2.17, students at this level were able to identify "0.7" as the decimal representation for a fraction with a denominator of 10. Internationally, on average, 43 percent of the fourth-grade students answered this item correctly. By far the best performance was in Singapore, where 95 percent of the students answered correctly. The next highest achievement was in Hong Kong, SAR with 78 percent answering correctly.

In measurement, fourth-grade students reaching the advanced level were able to determine the area of a figure composed of squares and half squares (see Example Item 2 in Exhibit 2.18). Further, the students had to draw the irregular figure on a grid so that it had the correct area. This was relatively difficult for the fourth-grade students in TIMSS 2003, with 29 percent answering correctly, on average, internationally. About two-thirds of the fourth-grade students in Japan and Chinese Taipei responded correctly.

Exhibit 2.16: **Description of TIMSS 2003 Advanced International Benchmark (625) of Mathematics Achievement**

Advanced International Benchmark – 625

Summary

Students can apply their understanding and knowledge in a wide variety of relatively complex situations. They demonstrate a developing understanding of fractions and decimals and the relationship between them. They can select appropriate information to solve multi-step word problems involving proportions. They can formulate or select a rule for a relationship. They show understanding of area and can use measurement concepts to solve a variety of problems. They show some understanding of rotation. They can organize, interpret, and represent data to solve problems.

Students at this level demonstrate a developing understanding of fractions and decimals and the relationship between them. They can determine the fraction of a figure that is shaded. Given a fraction, they can identify a larger fraction with a different denominator. They can use tiles to represent one half. They can identify the decimal representation of fractions with denominators of 10 and subtract a one-place decimal from a two-place decimal. They can solve simple ratio problems and problems that involve halving whole numbers and fractions. They can select appropriate information to solve multi-step word problems involving proportions.

Students can identify the number that satisfies a number sentence with two terms on each side involving addition or division. They can identify a two-step rule for a linear relationship between the first and second numbers in a set of ordered pairs and between adjacent terms in a sequence of numbers. They can formulate a rule for a multiplicative relationship between the first and second numbers in a set of ordered pairs.

Students can use their knowledge of measurement to solve problems including conversion of metric units for capacity and time units. They can solve simple problems involving distance, time, and speed and problems involving two operations. They can estimate the length of a curved line next to the middle of a ruler. Students can use maps drawn to scale to solve problems, including locating a point between two specified points and estimating distance. Students show an understanding of area in that they can determine the area of a figure composed of squares and half squares. Students also can complete an irregular figure on a grid so that it has a given area, and recognize that area does not change when a figure is cut into parts and rearranged.

Student can draw angles greater than 90 degrees. They show some understanding of rotation in a plane and in space. For example, they can identify the position of a shape after a half-turn rotation in a plane and recognize the equivalent three-dimensional figure after rotation.

Students can organize, interpret, and represent data to solve problems. They can organize data and complete a tally chart to represent the data. They can solve problems that involve relating and interpreting values from two sets of data from a graph.

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

Exhibit 2.17: TIMSS 2003 Advanced International Benchmark (625) of Mathematics Achievement – Example Item 1

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

MATHEMATICS Grade 4

Content Area: Number

Description: Identifies the decimal representation for a fraction with a denominator of 10.

Which of these means $\frac{7}{10}$?

Ⓐ 70

Ⓑ 7

● 0.7

Ⓓ 0.07

Country	Percent Full Credit	
Singapore	95 (0.8)	▲
† Hong Kong, SAR	78 (1.8)	▲
Chinese Taipei	74 (1.8)	▲
Belgium (Flemish)	73 (2.4)	▲
Cyprus	65 (2.2)	▲
† United States	62 (1.8)	▲
Japan	60 (2.2)	▲
Italy	58 (2.4)	▲
Moldova, Rep. of	52 (2.6)	▲
Philippines	49 (2.7)	▲
1 Lithuania	48 (2.6)	▲
† England	46 (2.5)	
International Avg.	43 (0.4)	
† Australia	42 (3.0)	
Armenia	42 (2.5)	
Russian Federation	39 (2.7)	
New Zealand	37 (2.0)	▼
† Netherlands	29 (2.0)	▼
Morocco	23 (2.2)	▼
† Scotland	22 (2.1)	▼
Norway	17 (1.6)	▼
Hungary	17 (1.6)	▼
Iran, Islamic Rep. of	16 (1.6)	▼
Tunisia	15 (1.5)	▼
Latvia	12 (1.6)	▼
Slovenia	8 (1.8)	▼
Benchmarking Participants		
Indiana State, US	59 (3.6)	▲
Ontario Province, Can.	47 (3.3)	
Quebec Province, Can.	26 (2.6)	▼

▲ 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).

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.

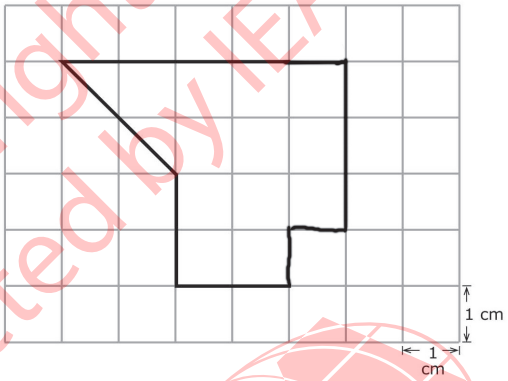
Exhibit 2.18: TIMSS 2003 Advanced International Benchmark (625) of Mathematics Achievement – Example Item 2

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

MATHEMATICS Grade 4

Content Area: Measurement

Description: Completes an irregular figure on a grid so that it has a given area.



The squares in the grid above have areas of 1 square centimeter. Draw lines to complete the figure so that it has an area of 13 square centimeters.

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

Country	Percent Full Credit
Japan	68 (2.1) ▲
Chinese Taipei	66 (1.8) ▲
† Hong Kong, SAR	52 (2.8) ▲
Singapore	43 (2.2) ▲
Latvia	43 (2.9) ▲
1 Lithuania	40 (2.5) ▲
† Netherlands	37 (2.6) ▲
Moldova, Rep. of	35 (2.3) ▲
Cyprus	34 (2.3) ▲
Russian Federation	30 (2.4)
International Avg.	29 (0.4)
† Scotland	29 (2.4)
† England	29 (2.3)
† Australia	29 (2.2)
Belgium (Flemish)	28 (2.2)
Hungary	26 (2.0)
Armenia	25 (2.3)
† United States	24 (1.7) ▼
Italy	22 (2.0) ▼
New Zealand	15 (1.6) ▼
Iran, Islamic Rep. of	11 (1.6) ▼
Slovenia	11 (1.7) ▼
Norway	10 (1.6) ▼
Morocco	9 (1.9) ▼
Tunisia	9 (1.2) ▼
Philippines	5 (1.5) ▼
Benchmarking Participants	
Indiana State, US	17 (2.2) ▼
Ontario Province, Can.	38 (2.6) ▲
Quebec Province, Can.	35 (2.6) ▲

▲ 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).

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 2.19, fourth-grade students reaching the high benchmark were able to apply their knowledge and understanding to solve problems. For example, Exhibit 2.20 containing Example Item 3 shows that these fourth-grade students were able to select the expression that represented the situation in a word problem involving multiplication. The international average was 58 percent, with Singaporean students having the highest achievement (86%) followed by Chinese Taipei (81%).

In geometry, students used the simple properties of triangles and rectangles to solve problems. Example Item 4 presented in Exhibit 2.21 shows that students can compose triangles to make other shapes, including a larger triangle and a square. Students were given square tiles divided diagonally into one white and one black triangle and ask to use the tiles in answering a set a of questions. In part A, students were asked to make a large triangle and in part B to make a black square. The achievement results are presented for part B. Forty-two percent of the fourth-grade students, on average, internationally performed this task correctly. Japan had the best performance, with 71 percent correct. The next highest performance was in the Netherlands with 60 percent correct.

Exhibit 2.19: **Description of TIMSS 2003 High International Benchmark (550) of Mathematics Achievement**

High International Benchmark – 550

Summary

Student can apply their knowledge and understanding to solve problems. Student can solve multi-step word problems involving addition, multiplication, and division. They can use their understanding of place value and simple fractions to solve problems. They can identify a number sentence that represents situations. Students show understanding of three-dimensional objects, how shapes can make other shapes, and simple transformation in a plane. They demonstrate a variety of measurement skills and can interpret and use data in tables and graphs to solve problems.

Students at this level can solve multi-step word problems involving addition, multiplication, and division. They can solve word problem involving division of three-digit by one-digit whole numbers. They can use their understanding of place value to solve problems. For example, they can arrange single digits to create the largest and smallest possible numbers and to create sums and differences of numbers that meet specified criteria (i.e., sum closest to a given value, largest sum, and largest difference). They can round three-digit whole numbers to the nearest hundred, select the two-place decimal closest to a given whole number, and estimate the product of two two-digit numbers.

Students can solve problems involving 1/2 and 3/4 and by finding a fractional part of a set of objects. They can recognize the figure illustrating a simple ratio and select appropriate information to solve a simple proportional problem.

Students can extend entries in a table according to numeric rules described in a situation. They can select an expression that represents a situation involving multiplication. They can identify a number sentence that represents a situation involving division and can identify a number that satisfies such a number sentence. Students can identify the result of a specified sequence of operations on a given number and identify the missing number in a square whose rows and columns have the same sum.

Students can calculate the volume of a rectangular solid given the volume of one layer and the number of layers. Students can locate a point on a map drawn to scale between two given distances and can read scales when the interval scale represents more than one unit (e.g., 5 units). Students can solve multi-step problems involving time and temperature. They can solve a word problem involving conversion between hours and minutes and read a thermometer to solve problems involving change in temperatures. Students can select an appropriate type of metric unit to measure weight (mass).

Students can use simple properties of triangles and rectangles to solve problems. They can compose and decompose shapes to make other simple shapes. They can identify two triangles that have the same shape but different sizes in a complex figure. Students have basic knowledge of transformations in a plane. For example, they can draw the reflection of a figure on a grid and identify a figure in which a line of symmetry is shown. Students demonstrate some familiarity with three-dimensional objects. They can identify a solid with curved and flat surfaces and recognize a net of a triangular prism.

Students can interpret and use data in tables and graphs to solve problems. They can use data from bar graphs, tally charts, and tables. They can compare data from two tables to draw conclusions. They can identify the label for a bar graph based on data in a tally chart.

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

Exhibit 2.20: TIMSS 2003 High International Benchmark (550) of Mathematics Achievement – Example Item 3

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

MATHEMATICS Grade 4

Content Area: Patterns and Relationships

Description: Selects the expression that represents a situation involving multiplication.

☐ represents the number of magazines that Lina reads each week.
Which of these represents the total number of magazines that Lina reads in 6 weeks?

Ⓐ $6 + \square$

● $6 \times \square$

Ⓒ $\square + 6$

Ⓓ $(\square + \square) \times 6$

Country	Percent Full Credit	
Singapore	86 (1.4)	▲
Chinese Taipei	81 (1.5)	▲
† Hong Kong, SAR	76 (1.9)	▲
† United States	72 (1.2)	▲
† Netherlands	72 (2.7)	▲
Belgium (Flemish)	67 (1.6)	▲
Japan	67 (2.0)	▲
Russian Federation	66 (2.6)	▲
Latvia	66 (2.3)	▲
† England	66 (2.5)	▲
Cyprus	65 (2.0)	▲
Moldova, Rep. of	64 (2.4)	▲
1 Lithuania	62 (2.3)	
Hungary	61 (2.2)	
Slovenia	60 (2.2)	
† Scotland	60 (2.2)	
International Avg.	58 (0.4)	
† Australia	56 (2.3)	
New Zealand	54 (1.7)	▼
Italy	50 (2.3)	▼
Armenia	46 (2.4)	▼
Philippines	38 (2.3)	▼
Norway	37 (2.1)	▼
Iran, Islamic Rep. of	34 (2.3)	▼
Morocco	29 (2.2)	▼
Tunisia	20 (2.0)	▼
Benchmarking Participants		
Indiana State, US	74 (2.0)	▲
Ontario Province, Can.	61 (2.5)	
Quebec Province, Can.	60 (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).

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 2.21: TIMSS 2003 High International Benchmark (550) of Mathematics Achievement – Example Item 4 (Part B)

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

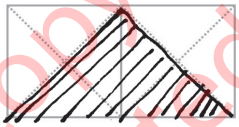
MATHEMATICS Grade 4

Content Area: Geometry

Description: Part B–Makes and draws one square from four triangle tiles (square tiles divided diagonally into one white and one black triangle).

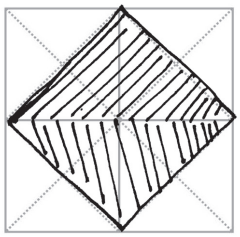
A. Use 2 of the triangle tiles to make one large black triangle. Then show what you did with your tiles by shading in your triangle below.

Shade in Your Triangle Here



B. Use all 4 triangle tiles to make a black square. Then show what you did with your tiles by shading in your square below.

Shade in Your Square Here



C. What fraction of the figure is shaded in part B above?

Answer: 1/2

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

Country	Percent Full Credit	
Japan	71 (2.0)	▲
† Netherlands	60 (3.2)	▲
Russian Federation	57 (2.3)	▲
1 Lithuania	57 (2.3)	▲
Belgium (Flemish)	55 (2.0)	▲
Chinese Taipei	54 (1.5)	▲
† England	54 (2.4)	▲
† Australia	52 (3.0)	▲
New Zealand	52 (2.3)	▲
Italy	51 (2.9)	▲
† Scotland	48 (2.9)	▲
Norway	47 (3.1)	
Cyprus	47 (2.3)	▲
† Hong Kong, SAR	46 (2.0)	▲
Singapore	45 (2.3)	
Hungary	45 (2.1)	
Slovenia	44 (2.6)	
† United States	42 (1.7)	
International Avg.	42 (0.5)	
Moldova, Rep. of	37 (2.9)	
Latvia	33 (2.2)	▼
Tunisia	15 (1.5)	▼
Iran, Islamic Rep. of	13 (2.0)	▼
Armenia	10 (1.3)	▼
Philippines	7 (1.0)	▼
Morocco	5 (1.7)	▼
Benchmarking Participants		
Indiana State, US	42 (3.4)	
Ontario Province, Can.	49 (2.4)	▲
Quebec Province, Can.	49 (2.9)	▲

▲ 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

* 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 2.22 presents the description of student achievement at the intermediate benchmark. At the intermediate benchmark, fourth-grade students could apply basic mathematical knowledge in straightforward situations. In comparison to the high benchmark, the mathematics and the problem situations were less complex.

In the number content area, students demonstrated the ability to recognize and translate between different representations of whole numbers, including number line, pictorial representations, and expanded notation. As illustrated by Example Item 5 in Exhibit 2.23, fourth-grade students reaching the intermediate benchmark recognized which figure had two-thirds shaded parts. Fifty-seven percent of the fourth-grade students, on average, internationally answered the question correctly. In Singapore, 93 percent answered correctly followed by 86 percent in Hong Kong, SAR.

In the data content area, the fourth-grade students completed a bar graph based on the solution of a word problem (see Example Item 6 in Exhibit 2.24). Indeed fourth-grade students in many of the participating countries performed this task successfully. In 15 countries and three benchmarking participants, 80 percent or more of the students answered correctly.

Exhibit 2.22: **Description of TIMSS 2003 Intermediate International Benchmark (475) of Mathematics Achievement**

Intermediate International Benchmark – 475

Summary

Students can apply basic mathematical knowledge in straightforward situations. They can read, interpret, and use different representations of numbers. They can perform operations with three- and four-digit numbers and decimals. They can extend simple patterns. They are familiar with a range of two-dimensional shapes and read and interpret different representations of the same data.

Students at this level demonstrate an understanding of and can order and operate with whole numbers. They can recognize and translate between different representations of whole numbers, including number line, pictorial representations, and expanded notation. They can identify the appropriate operations to solve multiplication and division problems. They can solve problems that involve the addition of four-digit numbers, multiplication of a three-digit by a one-digit whole number, multiplication of two two-digit numbers, and division of a three-digit by a one-digit whole number. Students can add and subtract two-place decimals. They can recognize the fractional part of a set of objects or a region, can identify the fraction that represents a given part-whole situation, and select information to solve a simple proportion problem.

Students show understanding of patterns. They can generalize from the first several terms of a numeric sequence to select another number (e.g., the tenth) that is also in the sequence. They can extend sequences based on geometric patterns or patterns involving time. They can identify the next terms in an alternating number pattern involving counting forward and backward by ones. Students can identify an expression that represents a situation involving multiplication and a number sentence that represents a situation involving subtraction.

Students have some basic knowledge of area. For example, they recognize that area does not change when parts of a figure are rearranged and the inverse relationship between the size and number of units needed to cover an area. They can read a one-month calendar and use the fact that a week has seven days to solve a problem. They can select a reasonable weight, given in metric units, for an adult.

Students are familiar with a range of two-dimensional shapes. They can draw a line to divide a rectangle into two triangles and can name common geometrical shapes in a picture. They also can identify a three-dimensional object given the pictorial representation of its faces. They can locate position on a grid and describe the movement from one position to another. Students can draw a line parallel to an oblique line on a grid, and identify a pattern generated by a quarter-turn clockwise.

Students can read and interpret different representations of the same data. For example, they can match data in pie charts to tables and bar graphs. Given verbal descriptions of data or problem situations, they can use that information to complete bar graphs and a two-by-two table. They can also use information to identify the number of symbols needed to complete a pictograph when the symbol represents more than one unit.

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

Exhibit 2.23: TIMSS 2003 Intermediate International Benchmark (475) of Mathematics Achievement – Example Item 5

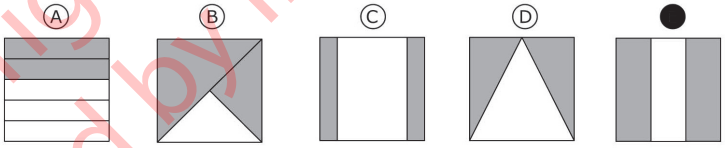
An Item That Students Reaching the Intermediate International Benchmark Are Likely to Answer Correctly*

MATHEMATICS Grade 4

Content Area: Number

Description: Recognizes a familiar fraction represented by a figure with shaded parts (region model).

Which shows $\frac{2}{3}$ of the square shaded?



Country	Percent Full Credit
Singapore	93 (1.0) ▲
† Hong Kong, SAR	86 (1.7) ▲
† United States	82 (1.1) ▲
Chinese Taipei	81 (1.5) ▲
Belgium (Flemish)	79 (1.8) ▲
Japan	76 (1.5) ▲
Cyprus	75 (1.8) ▲
† Netherlands	73 (2.1) ▲
† England	67 (2.2) ▲
† Australia	62 (2.2) ▲
Latvia	60 (2.8)
New Zealand	59 (2.2)
International Avg.	57 (0.4)
Hungary	56 (2.7)
1 Lithuania	56 (2.2)
Italy	55 (2.4)
† Scotland	52 (2.2) ▼
Philippines	50 (2.3) ▼
Russian Federation	49 (2.8) ▼
Iran, Islamic Rep. of	47 (2.7) ▼
Moldova, Rep. of	43 (2.7) ▼
Slovenia	34 (2.5) ▼
Armenia	29 (2.2) ▼
Norway	29 (2.0) ▼
Morocco	13 (1.7) ▼
Tunisia	12 (1.6) ▼
Benchmarking Participants	
Indiana State, US	89 (2.2) ▲
Ontario Province, Can.	69 (2.8) ▲
Quebec Province, Can.	67 (2.6) ▲

▲ 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).

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 2.24: TIMSS 2003 Intermediate International Benchmark (475) of Mathematics Achievement – Example Item 6

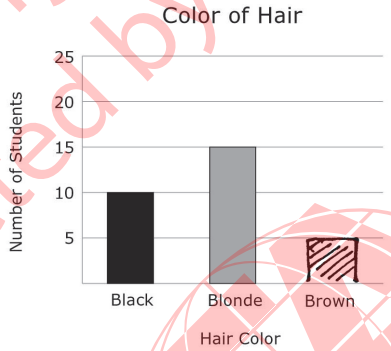
An Item That Students Reaching the Intermediate International Benchmark Are Likely to Answer Correctly*

MATHEMATICS Grade 4

Content Area: Data

Description: Completes a bar graph based on the solution of a word problem.

In a class of 30 students, 10 have black hair, 15 have blonde hair, and the rest have brown hair. Complete the graph below to show the number of students with brown hair.



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

Country	Percent Full Credit	
Belgium (Flemish)	93 (1.1)	▲
† Netherlands	93 (1.1)	▲
† Hong Kong, SAR	92 (1.0)	▲
Chinese Taipei	92 (1.1)	▲
Singapore	90 (1.2)	▲
Japan	90 (1.3)	▲
Latvia	88 (1.4)	▲
1 Lithuania	87 (1.8)	▲
† England	86 (1.7)	▲
Hungary	84 (1.7)	▲
† Scotland	83 (1.8)	▲
Russian Federation	82 (2.4)	▲
† United States	82 (1.3)	▲
Cyprus	80 (1.3)	▲
New Zealand	80 (1.7)	▲
Slovenia	79 (2.3)	▲
† Australia	76 (2.1)	
Norway	75 (1.9)	
International Avg.	73 (0.4)	
Italy	71 (1.8)	
Moldova, Rep. of	67 (2.2)	▼
Armenia	50 (2.2)	▼
Philippines	29 (2.5)	▼
Iran, Islamic Rep. of	28 (2.3)	▼
Morocco	24 (3.1)	▼
Tunisia	21 (2.1)	▼
Benchmarking Participants		
Indiana State, US	84 (1.7)	▲
Ontario Province, Can.	85 (2.0)	▲
Quebec Province, Can.	83 (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

* 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 2.25, fourth-grade students reaching the low benchmark have some basic mathematical knowledge. For example, they demonstrate an understanding of computation with whole numbers as shown in Exhibit 2.26. In Example Item 7, fourth-grade students were asked to multiply a two-digit whole number (15) by a one-digit whole number (9). Students in many of the participating countries and benchmarking entities answered this open-ended question correctly. The international average was 72 percent, and 90 percent or more of the fourth-graders answered correctly in Chinese Taipei, Singapore, Hong Kong SAR, and the Russian Federation.

Exhibit 2.27 contains Example Item 8 asking the fourth-grade students to draw a triangle on a grid such that the line AB is the base and the two new sides are the same length as each other. Two-thirds of the fourth-grade students, on average, internationally completed this task correctly. Ninety-five percent of the students in Hong Kong, SAR did so, as did 80 to 84 percent of the fourth-graders in Latvia, Japan, and New Zealand.

Exhibit 2.25: **Description of TIMSS 2003 Low International Benchmark (400) of Mathematics Achievement**

Low International Benchmark – 400

Summary

Students have some basic mathematical knowledge. Students demonstrate an understanding of whole numbers and can do simple computations with them. They demonstrate familiarity with the basic properties of triangles and rectangles. They can read information from simple bar graphs.

Students at this level demonstrate an understanding of whole numbers. They are familiar with numbers into the thousands They demonstrate understanding of place value and can translate between representations of whole numbers. They can add a four-digit and a three-digit whole number, multiply a two-digit by a one-digit whole number, and subtract two fractions with the same denominator. They can solve problems involving addition. Students can find the missing number in a number sentence involving multiplication by a one-digit whole number.

Students can compare areas by counting squares, identify two figures with the same shape, and draw a line to divide a rectangle into two rectangles. Students demonstrate familiarity with triangles. For example, they can identify two triangles with the same size and shape in a complex figure, recognize triangles in a set of polygons, and identify that a triangle has three sides. Given the base on a grid, students can draw a triangle whose other two sides are each the same length. Students can read information from simple bar graphs.

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

Exhibit 2.26: TIMSS 2003 Low International Benchmark (400) of Mathematics Achievement – Example Item 7

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

MATHEMATICS Grade 4

Content Area: Number

Description: Multiply a two-digit by a one-digit whole number.

$15 \times 9 =$

Answer: 135

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

Country	Percent Full Credit	
Chinese Taipei	94 (1.0)	▲
Singapore	93 (1.0)	▲
† Hong Kong, SAR	91 (1.0)	▲
Russian Federation	90 (1.3)	▲
Moldova, Rep. of	88 (1.2)	▲
1 Lithuania	87 (1.7)	▲
Japan	86 (1.6)	▲
† Netherlands	86 (1.5)	▲
Latvia	86 (1.9)	▲
Hungary	85 (1.6)	▲
Armenia	85 (1.4)	▲
Belgium (Flemish)	84 (1.4)	▲
Cyprus	76 (1.6)	▲
Italy	75 (2.0)	
† United States	73 (1.2)	
International Avg.	72 (0.4)	
Tunisia	68 (2.0)	
Slovenia	67 (2.6)	
Iran, Islamic Rep. of	61 (2.5)	▼
† England	59 (2.7)	▼
Philippines	59 (2.5)	▼
† Scotland	54 (2.2)	▼
† Australia	45 (2.4)	▼
New Zealand	41 (2.0)	▼
Morocco	36 (3.1)	▼
Norway	30 (1.9)	▼
Benchmarking Participants		
Indiana State, US	78 (2.3)	▲
Ontario Province, Can.	54 (2.7)	▼
Quebec Province, Can.	66 (2.3)	▼

▲ 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

* 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.

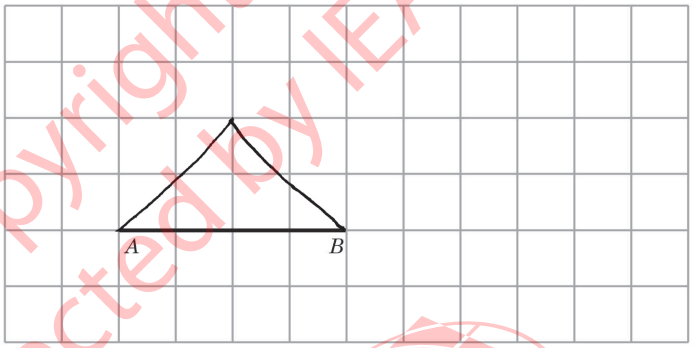
Exhibit 2.27: TIMSS 2003 Low International Benchmark (400) of Mathematics Achievement – Example Item 8

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

MATHEMATICS Grade 4

Content Area: Measurement

Description: Given the base draws a triangle on a grid with the other two sides the same length.



Draw a triangle in the grid so that the line *AB* is the base of the triangle and the two new sides are the same length as each other.

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

Country	Percent Full Credit	
† Hong Kong, SAR	95 (0.9)	▲
Latvia	84 (1.4)	▲
Japan	80 (1.8)	▲
New Zealand	80 (1.8)	▲
Singapore	77 (1.8)	▲
Russian Federation	77 (2.3)	▲
Belgium (Flemish)	77 (1.8)	▲
† Australia	77 (2.1)	▲
Italy	77 (1.9)	▲
1 Lithuania	74 (1.9)	▲
† England	73 (2.1)	▲
Hungary	72 (2.0)	▲
† Scotland	71 (2.2)	
Chinese Taipei	70 (1.5)	
Moldova, Rep. of	67 (2.8)	
International Avg.	67 (0.4)	
Slovenia	64 (2.7)	
† United States	63 (1.4)	▼
Norway	58 (2.3)	▼
Cyprus	57 (2.1)	▼
Armenia	56 (2.0)	▼
Iran, Islamic Rep. of	48 (2.7)	▼
Philippines	45 (2.7)	▼
Morocco	42 (2.6)	▼
Tunisia	28 (1.7)	▼
Benchmarking Participants		
Indiana State, US	64 (2.9)	
Ontario Province, Can.	76 (2.2)	▲
Quebec Province, Can.	68 (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

* 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.

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 generalize and solve non-routine or contextualized problems to the lower-performing students being able primarily to use routine, mainly numeric procedures. The fact that, even at the intermediate benchmark, students demonstrate only limited achievement in problem solving beyond straightforward one-step problems may suggest a need to reconsider the role, or priority, of problem solving in mathematics curricula.

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 (15) 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 Mathematics Content Areas

Chapter 3 presents results by the major content areas in mathematics to provide information about the possible effects of curricular variation on average achievement. Average performance is provided for five content areas at the eighth and fourth grades: number, algebra (patterns and relationships at the fourth grade), measurement, geometry, and data. 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 mathematics 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 mathematics 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 the particular topics and subtopics to be assessed at each grade within each content area. Following on the framework

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.

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. 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 mathematics tests for the eighth and fourth grades were designed to enable reporting by five content areas in accordance with the TIMSS mathematics framework. These areas, with their main topics, are:

Number

1. whole numbers
2. fractions and decimals
3. integers
4. ratio, proportion, and percent.

   At grade 4, integers are not included and the last topic includes only simple proportional reasoning

Algebra

1. patterns
2. algebraic expressions
3. equations and formulas
4. relationships

At grade 4, algebraic expressions is not included.

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.

Measurement

1. attributes and units
2. tools, techniques, and formula

Geometry

1. lines and angles
2. two- and three-dimensional shapes
3. congruence and similarity
4. locations and spatial relationships
5. symmetry and transformations.

Data

1. data collection and organization
2. data representation
3. data interpretation
4. uncertainty and probability.

At grade 4, uncertainty and probability is not included.

How Does Achievement Differ Across Mathematics Content Areas?

Exhibit 3.1 presents average achievement in each of the five mathematics content areas at the eighth grade and 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 467, the same as the overall international average.

Exhibit 3.1: Average Achievement in Mathematics Content Areas

MATHEMATICS Grade 8

▲ Country average significantly higher than international average

▼ Country average significantly lower than international average

Countries	Average Scale Scores for Mathematics Content Areas				
	Number	Algebra	Measurement	Geometry	Data
Armenia	473 (3.1) ▲	489 (2.6) ▲	488 (3.3) ▲	481 (3.1) ▲	419 (2.7) ▼
Australia	498 (4.6) ▲	499 (4.4) ▲	511 (4.3) ▲	491 (4.8) ▲	531 (3.8) ▲
Bahrain	380 (1.9) ▼	411 (2.5) ▼	388 (2.1) ▼	438 (2.1) ▼	414 (2.1) ▼
Belgium (Flemish)	539 (2.7) ▲	523 (2.8) ▲	535 (2.5) ▲	527 (3.1) ▲	546 (2.9) ▲
Botswana	382 (2.2) ▼	377 (2.7) ▼	377 (2.0) ▼	335 (3.9) ▼	375 (2.7) ▼
Bulgaria	477 (4.1) ▲	481 (4.0) ▲	473 (4.6)	484 (4.5) ▲	458 (3.9) ▼
Chile	390 (3.1) ▼	384 (3.1) ▼	404 (2.9) ▼	378 (3.3) ▼	412 (3.4) ▼
Chinese Taipei	585 (4.6) ▲	585 (4.9) ▲	574 (4.4) ▲	588 (5.1) ▲	568 (3.4) ▲
Cyprus	464 (1.5) ▼	455 (1.7) ▼	459 (2.2) ▼	457 (2.4) ▼	458 (1.7) ▼
Egypt	421 (3.0) ▼	408 (3.9) ▼	401 (3.3) ▼	408 (3.6) ▼	393 (3.2) ▼
Estonia	523 (3.1) ▲	528 (2.6) ▲	528 (3.0) ▲	540 (2.6) ▲	535 (2.8) ▲
Ghana	289 (5.1) ▼	288 (4.8) ▼	262 (3.7) ▼	278 (4.3) ▼	293 (4.1) ▼
† Hong Kong, SAR	586 (3.2) ▲	580 (3.2) ▲	584 (3.3) ▲	588 (3.6) ▲	566 (3.0) ▲
Hungary	529 (3.6) ▲	534 (3.1) ▲	525 (3.1) ▲	515 (3.1) ▲	526 (2.9) ▲
1 Indonesia	421 (4.6) ▼	418 (4.5) ▼	394 (4.9) ▼	413 (4.6) ▼	418 (4.0) ▼
Iran, Islamic Rep. of	416 (2.3) ▼	412 (3.1) ▼	399 (2.6) ▼	437 (3.1) ▼	404 (2.6) ▼
2 Israel	504 (3.3) ▲	498 (3.2) ▲	480 (3.4) ▲	488 (3.7) ▲	492 (3.3) ▲
Italy	480 (3.2) ▲	477 (3.4) ▲	500 (3.2) ▲	469 (3.5)	490 (3.0) ▲
Japan	557 (2.3) ▲	568 (2.0) ▲	559 (2.0) ▲	587 (2.1) ▲	573 (1.9) ▲
Jordan	413 (4.4) ▼	434 (4.4) ▼	418 (4.4) ▼	446 (4.0) ▼	430 (3.5) ▼
◆◆ Korea, Rep. of	586 (2.1) ▲	597 (2.2) ▲	577 (2.0) ▲	598 (2.6) ▲	569 (2.0) ▲
Latvia	507 (3.2) ▲	508 (3.2) ▲	500 (3.0) ▲	515 (3.3) ▲	506 (3.8) ▲
Lebanon	430 (3.3) ▼	448 (3.1) ▼	430 (3.7) ▼	459 (3.0) ▼	394 (4.0) ▼
1 Lithuania	500 (2.7) ▲	501 (2.4) ▲	492 (3.0) ▲	506 (2.5) ▲	502 (2.5) ▲
2 Macedonia, Rep. of	438 (3.5) ▼	442 (3.6) ▼	434 (3.6) ▼	442 (3.7) ▼	419 (3.6) ▼
Malaysia	524 (4.0) ▲	495 (3.9) ▲	504 (4.5) ▲	495 (4.8) ▲	505 (3.2) ▲
Moldova, Rep. of	463 (3.8)	464 (4.2)	468 (4.0)	463 (4.7)	428 (3.4) ▼
1 ‡ Morocco	384 (2.7) ▼	400 (2.8) ▼	376 (3.4) ▼	415 (2.3) ▼	374 (2.5) ▼
† Netherlands	539 (3.6) ▲	514 (4.0) ▲	549 (3.7) ▲	513 (4.1) ▲	560 (3.1) ▲
New Zealand	481 (6.0) ▲	490 (5.2) ▲	500 (4.8) ▲	488 (4.6) ▲	526 (5.1) ▲
Norway	456 (2.3) ▼	428 (2.7) ▼	481 (2.9) ▲	461 (2.8) ▼	498 (2.5) ▲
Palestinian Nat'l Auth.	385 (3.6) ▼	392 (3.5) ▼	386 (2.8) ▼	423 (3.1) ▼	390 (2.8) ▼
Philippines	393 (5.1) ▼	400 (5.2) ▼	372 (4.8) ▼	344 (5.3) ▼	390 (4.5) ▼
Romania	474 (4.9)	480 (4.7) ▲	485 (4.7) ▲	476 (4.9) ▲	445 (4.6) ▼
Russian Federation	505 (4.0) ▲	516 (3.2) ▲	507 (3.9) ▲	515 (4.2) ▲	484 (3.2) ▲
Saudi Arabia	307 (5.3) ▼	331 (4.7) ▼	338 (3.4) ▼	382 (4.3) ▼	339 (3.8) ▼
† Scotland	484 (4.2) ▲	488 (3.9) ▲	508 (3.6) ▲	491 (3.3) ▲	531 (3.7) ▲
1 Serbia	477 (2.8) ▲	488 (2.5) ▲	475 (2.5) ▲	471 (3.0)	456 (2.6) ▼
Singapore	618 (3.5) ▲	590 (3.5) ▲	611 (3.6) ▲	580 (3.7) ▲	579 (3.2) ▲
Slovak Republic	514 (3.3) ▲	505 (3.3) ▲	508 (3.7) ▲	501 (3.6) ▲	495 (2.9) ▲
Slovenia	498 (2.0) ▲	487 (2.3) ▲	496 (2.3) ▲	483 (2.5) ▲	494 (2.3) ▲
South Africa	274 (5.4) ▼	275 (5.1) ▼	298 (4.7) ▼	247 (5.4) ▼	296 (5.3) ▼
Sweden	496 (2.6) ▲	480 (3.0) ▲	512 (2.6) ▲	467 (3.4)	539 (2.9) ▲
Tunisia	419 (2.3) ▼	405 (2.4) ▼	407 (2.2) ▼	427 (2.0) ▼	387 (2.2) ▼
‡ United States	508 (3.4) ▲	510 (3.1) ▲	495 (3.2) ▲	472 (3.1)	527 (3.2) ▲
‡ England	485 (5.0) ▲	492 (4.5) ▲	505 (4.3) ▲	492 (4.5) ▲	535 (4.1) ▲
International Avg.	467 (0.5)	467 (0.5)	467 (0.5)	467 (0.5)	467 (0.5)
Benchmarking Participants					
Basque Country, Spain	490 (2.6) ▲	490 (2.7) ▲	488 (2.4) ▲	456 (3.2) ▼	499 (2.7) ▲
Indiana State, US	516 (5.8) ▲	510 (5.3) ▲	503 (5.5) ▲	468 (5.1)	528 (4.9) ▲
Ontario Province, Can.	516 (3.4) ▲	515 (2.6) ▲	520 (2.8) ▲	513 (3.2) ▲	538 (2.7) ▲
Quebec Province, Can.	546 (3.4) ▲	529 (3.2) ▲	541 (3.6) ▲	542 (3.3) ▲	544 (2.6) ▲

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 3.1: Average Achievement in Mathematics Content Areas

MATHEMATICS Grade 4

Countries	Average Scale Scores for Mathematics Content Areas									
	Number		Patterns and Relationships		Measurement		Geometry		Data	
Armenia	473 (3.0)	▼	461 (4.1)	▼	465 (3.1)	▼	431 (3.8)	▼	417 (3.6)	▼
† Australia	479 (4.3)	▼	495 (3.7)		514 (3.7)	▲	524 (3.7)	▲	525 (3.6)	▲
Belgium (Flemish)	549 (1.9)	▲	542 (1.9)	▲	550 (1.4)	▲	533 (1.8)	▲	548 (2.2)	▲
Chinese Taipei	568 (1.8)	▲	555 (2.4)	▲	557 (1.6)	▲	553 (2.5)	▲	564 (2.3)	▲
Cyprus	514 (2.7)	▲	519 (2.4)	▲	506 (2.3)	▲	505 (2.3)	▲	509 (2.3)	▲
† England	519 (4.1)	▲	523 (3.9)	▲	535 (3.3)	▲	542 (3.7)	▲	552 (3.4)	▲
† Hong Kong, SAR	574 (3.3)	▲	568 (3.5)	▲	563 (2.7)	▲	557 (2.9)	▲	562 (2.3)	▲
Hungary	524 (2.9)	▲	545 (3.7)	▲	532 (2.7)	▲	514 (3.3)	▲	513 (3.2)	▲
Iran, Islamic Rep. of	410 (3.7)	▼	394 (3.9)	▼	398 (3.2)	▼	416 (3.9)	▼	356 (4.4)	▼
Italy	502 (3.6)	▲	496 (4.3)		504 (3.4)	▲	522 (3.5)	▲	497 (3.0)	
Japan	556 (2.0)	▲	554 (1.4)	▲	568 (1.6)	▲	559 (1.9)	▲	593 (1.6)	▲
Latvia	531 (2.6)	▲	532 (3.4)	▲	545 (2.6)	▲	523 (2.2)	▲	526 (2.7)	▲
1 Lithuania	535 (2.9)	▲	531 (3.0)	▲	540 (2.7)	▲	524 (2.2)	▲	517 (2.5)	▲
Moldova, Rep. of	507 (4.7)	▲	521 (5.1)	▲	505 (4.0)	▲	501 (4.9)		477 (4.3)	▼
Morocco	359 (4.7)	▼	360 (4.7)	▼	345 (5.5)	▼	362 (4.9)	▼	355 (5.0)	▼
† Netherlands	536 (2.2)	▲	527 (2.4)	▲	545 (2.2)	▲	521 (3.2)	▲	553 (2.4)	▲
New Zealand	475 (2.3)	▼	495 (2.9)		503 (2.0)	▲	517 (1.8)	▲	522 (2.0)	▲
Norway	440 (2.2)	▼	439 (2.7)	▼	475 (2.2)	▼	478 (2.2)	▼	479 (2.3)	▼
Philippines	380 (7.4)	▼	382 (7.0)	▼	330 (7.8)	▼	335 (8.8)	▼	384 (7.5)	▼
Russian Federation	532 (4.6)	▲	531 (5.0)	▲	538 (3.8)	▲	528 (4.8)	▲	505 (4.1)	▲
† Scotland	475 (3.3)	▼	495 (2.9)		499 (3.1)		511 (2.5)	▲	516 (2.7)	▲
Singapore	612 (6.0)	▲	579 (5.4)	▲	566 (4.6)	▲	570 (5.5)	▲	575 (3.9)	▲
Slovenia	461 (2.7)	▼	490 (2.7)	▼	497 (2.8)		498 (2.2)		486 (2.7)	▼
Tunisia	360 (4.1)	▼	330 (4.7)	▼	308 (5.5)	▼	346 (5.1)	▼	308 (4.7)	▼
† United States	516 (2.6)	▲	524 (2.7)	▲	500 (2.1)		518 (2.2)	▲	549 (2.0)	▲
International Avg.	495 (0.7)		495 (0.7)		495 (0.7)		495 (0.7)		495 (0.6)	
Benchmarking Participants										
Indiana State, US	531 (3.4)	▲	535 (3.4)	▲	515 (3.0)	▲	525 (3.5)	▲	557 (2.9)	▲
Ontario Province, Can.	494 (5.0)		513 (3.4)	▲	512 (3.8)	▲	535 (3.8)	▲	544 (3.5)	▲
Quebec Province, Can.	508 (2.5)	▲	499 (2.6)		504 (2.1)	▲	522 (2.3)	▲	506 (2.3)	▲

▲ 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

† 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.

At both grades, the countries scoring highest in the overall mathematics assessments also tended 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 tests tended to have low-average performance across all five content areas.

At the eighth grade, the differences in average achievement between the highest- and lowest-performing countries were greatest for geometry and measurement (351 and 349 scale-score points, respectively), next for number (344), then algebra (322), and least for data (286). 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, Armenia performed significantly above the international average in all the content areas except data, where, in contrast, it performed below the international average.

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. Interestingly, the largest difference by far – 285 scale-score points – was in data (which had the least difference at the eighth grade). Countries did report considerable differences in instructional emphasis given to this content area, especially at the fourth grade. For the other four content areas, the differences were 260 for measurement, 253 for number, 249 for patterns and relationships, and 245 for geometry.

In Appendix B, Exhibits B.1 through B.5 for the eighth grade and Exhibits B.6 through B.10 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?

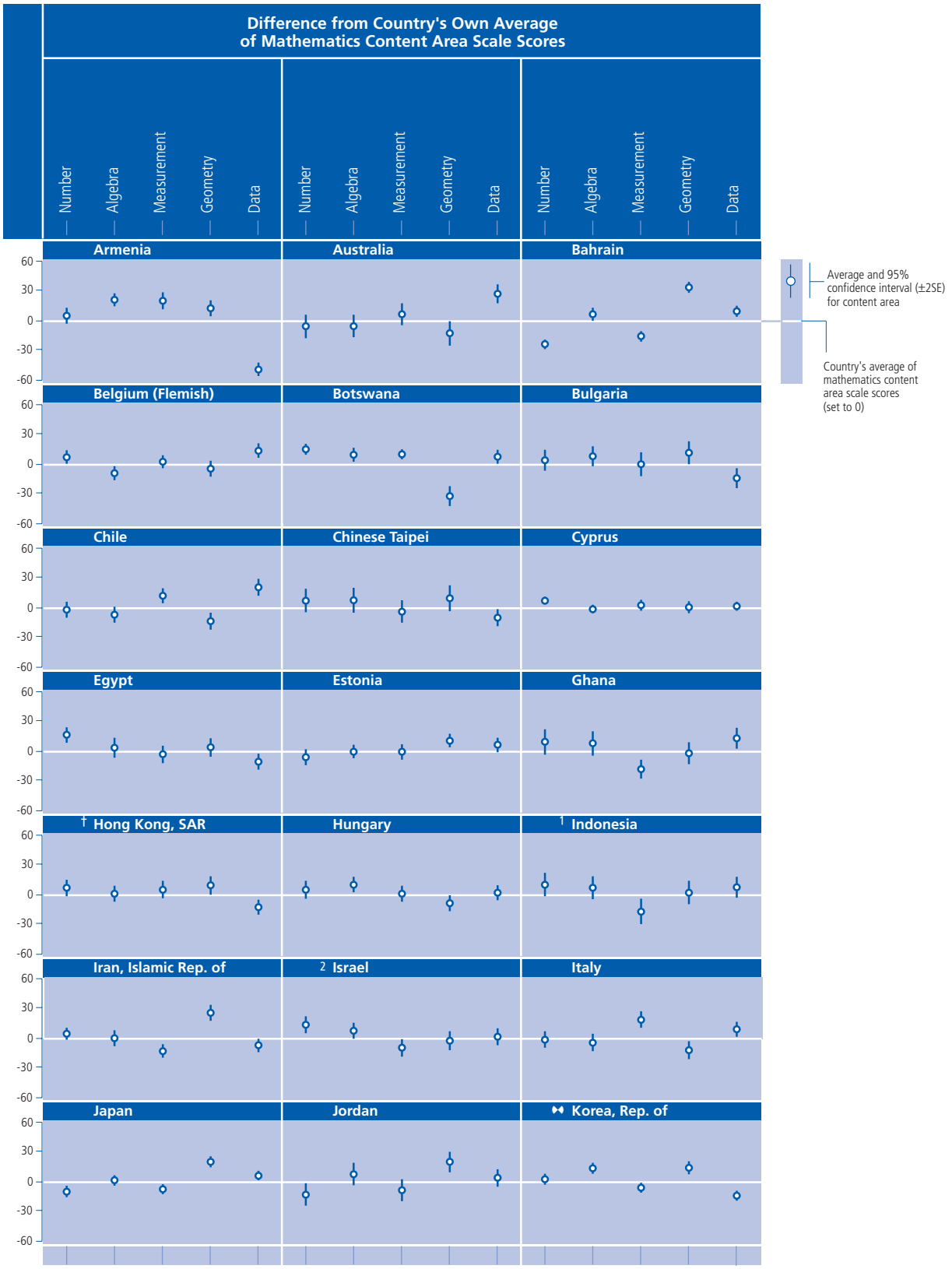
To highlight relative strengths and weaknesses within each country, Exhibit 3.2 profiles the relative average achievement in mathematics content areas within each country at the eighth and fourth grades. For each country, Exhibit 3.2 displays the difference between average performance in each content area and average performance overall. The profiles reveal that many countries performed relatively better or worse in several content areas than they did overall. At the eighth grade, for example, it can be seen that Botswana performed relatively worse in geometry than in the other four content areas. At the fourth grade, Norway performed relatively less well in number and in patterns and relationships, and relatively better in the areas of measurement, geometry, and data.

Differences in relative performance may be related to one or more of a number of 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 several countries. For example, at the eighth grade, considerable variation of 60 or more scale-score points (one area at least 30 above and one 30 below) was found in Lebanon, Norway, Saudi Arabia, Sweden, and the US state of Indiana. At the fourth grade, no countries had such large differences even though several had a particular strength or weakness. 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, with the best example being Cyprus at both grades. For the latter countries, the TIMSS 2003 data indicate a greater balance in mathematics content covered through the grades.

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

MATHEMATICS 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).

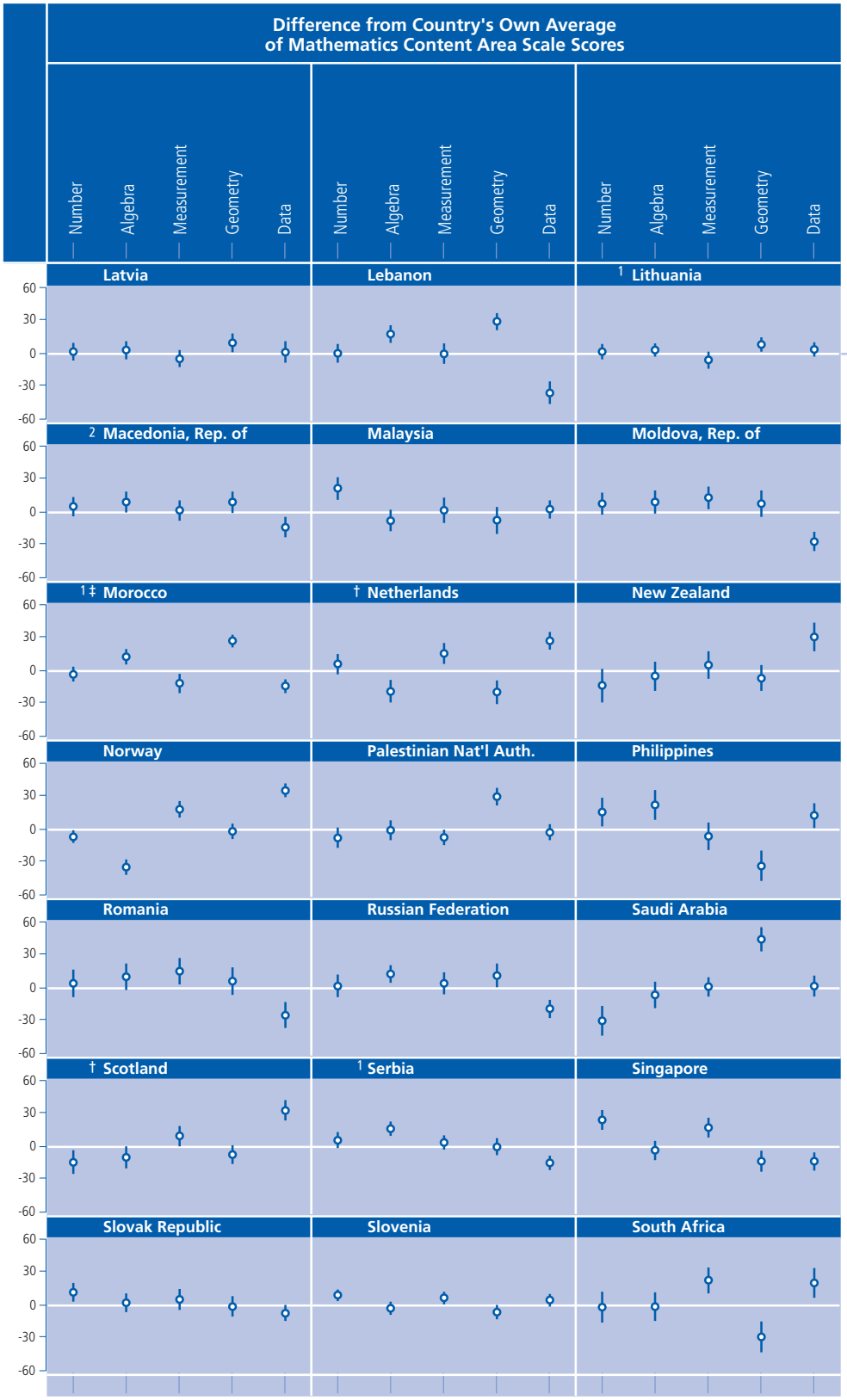
1 National Desired Population does not cover all of International Desired Population (see Exhibit A.6).

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 Mathematics Content Areas
(Continued...)

MATHEMATICS 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).

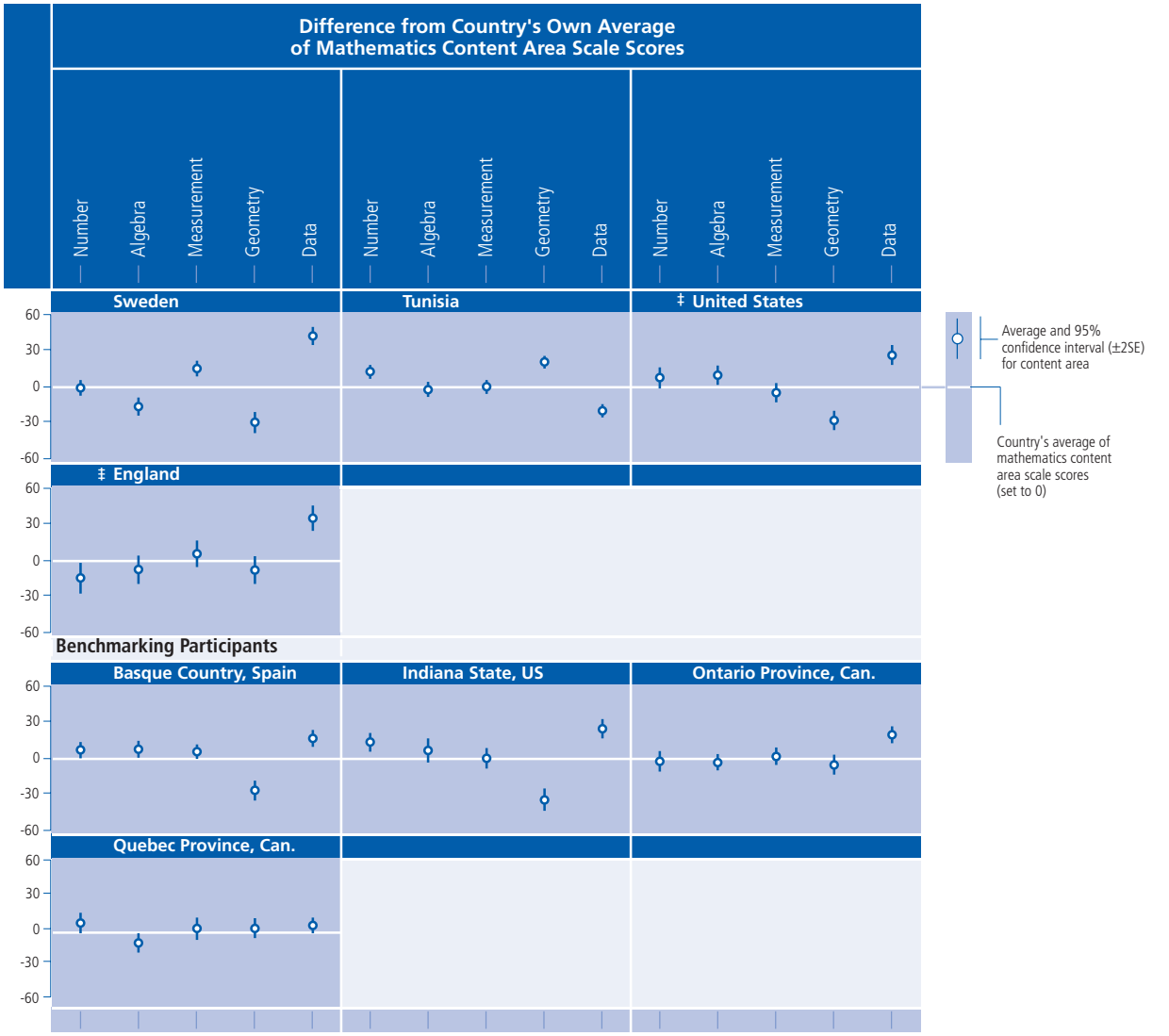
‡ Nearly satisfied guidelines for sample participation rates only after replacement schools were included (see Exhibit A.9).

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 Mathematics Content Areas
(…Continued)

MATHEMATICS Grade 8



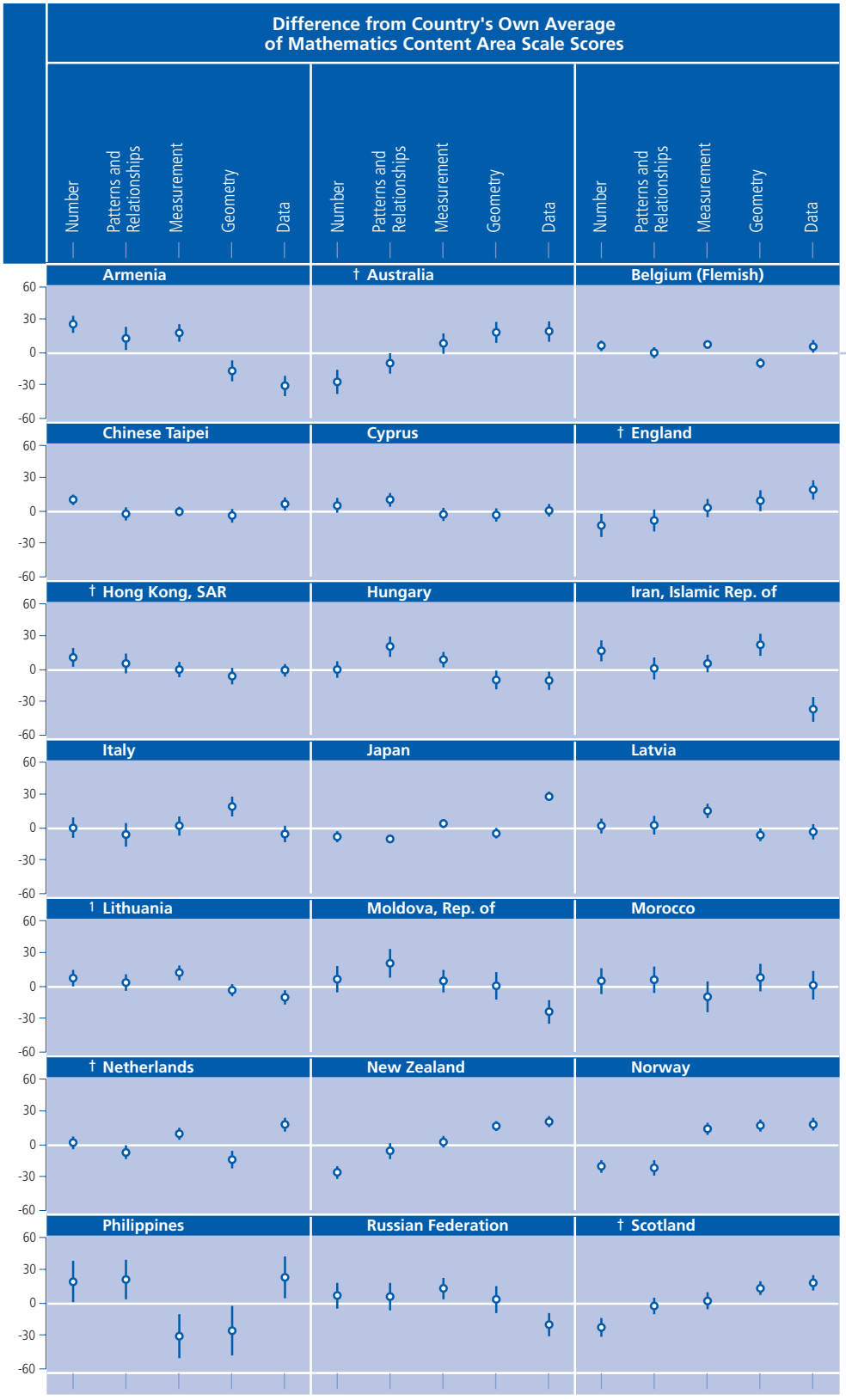
SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

‡ 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 Mathematics Content Areas
(Continued...)

MATHEMATICS Grade 4



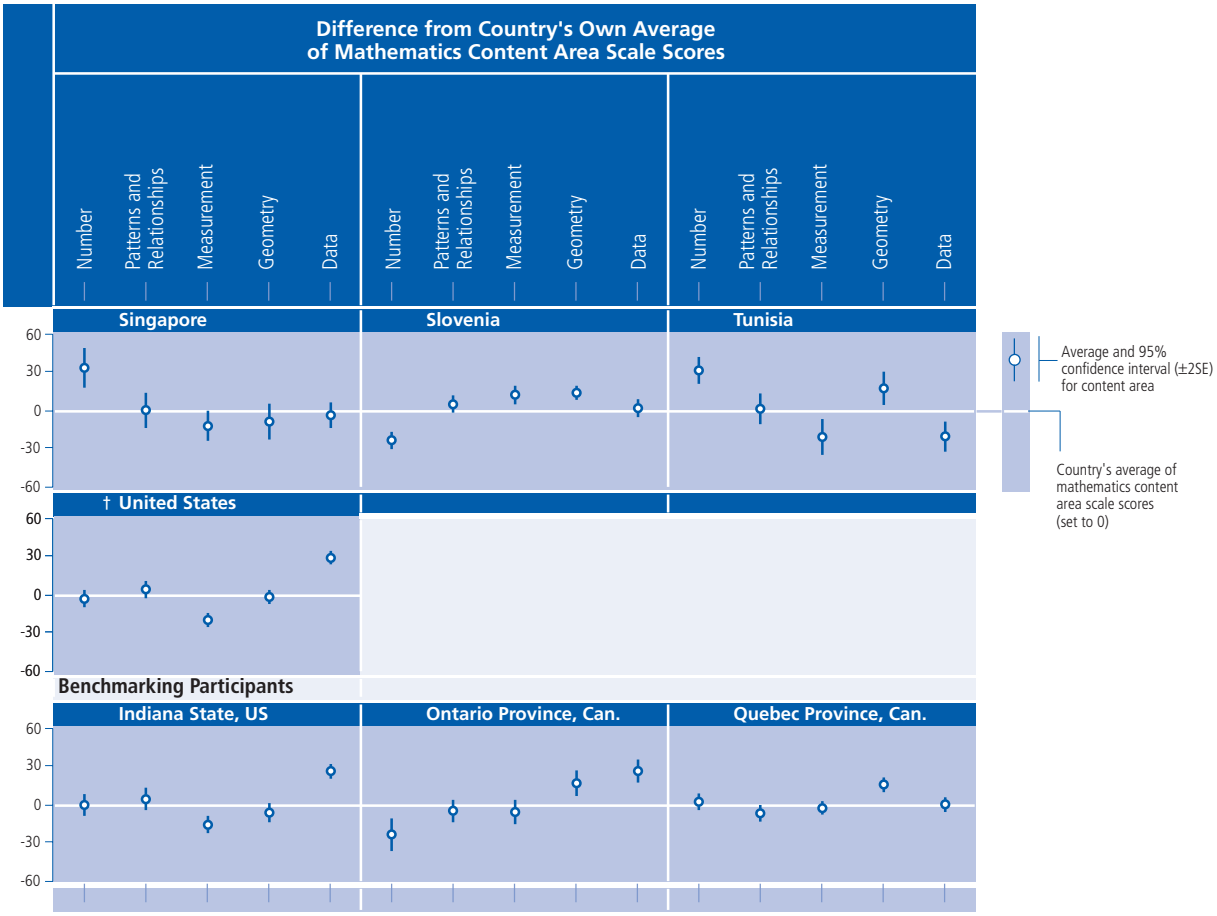
SOURCE: IEA's Trends in International Mathematics and Science Study (TIMSS) 2003

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

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 Mathematics Content Areas
(…Continued)

MATHEMATICS 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 mathematics content areas by gender for the eighth and fourth grades. The most striking results at the eighth grade were the large number of significant differences favoring girls in algebra compared to those in measurement favoring boys.[3] In algebra, girls had higher average achievement than boys in 22 countries and one benchmarking participant compared to the boys having higher achievement in only 3 countries. On average internationally, the girls had an advantage of 9 points. In measurement, boys had higher average achievement than the girls in 13 countries and 2 benchmarking participants compared to the girls having higher achievement in only 2 countries. The overall difference was 6 points higher for boys, on average. 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. For the other three content areas, there were essentially no gender differences, on average, internationally, even though there were differences within particular countries. In number, girls performed significantly higher in 10 countries and boys in 12 countries and 2 benchmarking participants. Girls had significantly higher achievement in 8 countries in both geometry and data, whereas boys had the better performance in 13 and 9 entities, respectively.

At the fourth grade, the gender pattern was the same as the eighth grade in measurement. Boys had significantly higher achievement than girls in 12 countries and 2 benchmarking participants, whereas girls did not outperform boys in any country. The difference in achievement across countries was 5 points higher for boys. However, for patterns and relationships (the fourth grade equivalent for algebra), the results did not mirror those at eighth grade. Essentially, girls had higher achievement in 3 participating entities and so did boys. At the fourth grade, interestingly, the content area in which girls did better

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

Exhibit 3.3: Average Achievement in Mathematics Content Areas by Gender

MATHEMATICS Grade 8

Countries	Average Scale Scores for Mathematics Content Areas											
	Number				Algebra				Measurement			
	Girls		Boys		Girls		Boys		Girls		Boys	
Armenia	478 (3.5)	▲	468 (3.6)		496 (3.0)	▲	482 (3.8)		489 (3.5)		488 (4.1)	
Australia	490 (5.5)		507 (5.9)	▲	496 (5.5)		501 (5.4)		504 (5.3)		518 (5.7)	▲
Bahrain	392 (3.6)	▲	369 (2.8)		434 (3.2)	▲	387 (3.3)		394 (3.2)	▲	383 (2.5)	
Belgium (Flemish)	532 (3.1)		547 (3.6)	▲	521 (3.5)		526 (4.2)		529 (3.2)		541 (3.6)	▲
Botswana	386 (2.3)	▲	378 (3.2)		382 (3.2)	▲	371 (2.8)		376 (2.8)		379 (3.0)	
Bulgaria	477 (5.2)		476 (4.3)		485 (4.8)		477 (4.3)		471 (5.9)		474 (4.7)	
Chile	381 (3.7)		398 (3.9)	▲	380 (3.7)		389 (3.9)	▲	393 (3.7)		414 (3.6)	▲
Chinese Taipei	588 (5.1)		582 (5.2)		592 (5.4)	▲	579 (5.3)		573 (5.1)		576 (4.7)	
Cyprus	471 (2.2)	▲	457 (2.5)		469 (2.1)	▲	442 (2.6)		463 (3.1)		455 (2.9)	
Egypt	420 (3.8)		421 (4.5)		413 (4.7)		403 (5.6)		396 (4.3)		405 (4.7)	
Estonia	525 (3.5)		520 (3.5)		529 (3.1)		528 (3.2)		530 (3.9)		526 (3.7)	
Ghana	282 (5.3)		295 (5.4)	▲	281 (4.7)		293 (5.8)	▲	256 (4.8)		267 (5.4)	
† Hong Kong, SAR	587 (3.7)		585 (4.3)		582 (3.5)		578 (4.3)		583 (3.9)		585 (4.4)	
Hungary	524 (4.1)		533 (4.0)	▲	535 (3.7)		532 (3.5)		517 (3.6)		532 (3.6)	▲
1 Indonesia	424 (4.9)		418 (5.2)		422 (5.1)		414 (4.7)		394 (5.3)		394 (5.4)	
Iran, Islamic Rep. of	420 (4.2)		414 (3.9)		429 (4.3)	▲	400 (4.4)		393 (5.0)		402 (3.8)	
2 Israel	498 (3.9)		509 (4.3)	▲	499 (3.4)		496 (4.2)		473 (3.3)		488 (4.7)	▲
Italy	477 (3.3)		483 (4.0)		478 (3.4)		475 (3.9)		494 (3.0)		506 (3.9)	▲
Japan	554 (4.5)		560 (4.0)		570 (3.9)		566 (3.4)		559 (4.0)		559 (3.3)	
Jordan	426 (5.5)	▲	401 (6.3)		452 (4.8)	▲	417 (6.4)		426 (5.7)	▲	410 (5.5)	
◆◆ Korea, Rep. of	582 (2.9)		589 (2.5)	▲	596 (3.3)		598 (2.9)		575 (3.1)		579 (2.1)	
Latvia	508 (3.3)		506 (3.7)		515 (3.1)	▲	501 (3.8)		497 (3.6)		504 (3.6)	
Lebanon	427 (3.7)		434 (4.3)		448 (3.7)		447 (4.2)		420 (4.1)		442 (4.6)	▲
1 Lithuania	500 (3.0)		497 (3.2)		508 (2.6)	▲	494 (3.0)		490 (4.1)		493 (3.9)	
2 Macedonia, Rep. of	441 (3.8)	▲	434 (3.7)		452 (4.5)	▲	432 (4.5)		433 (4.0)		435 (4.1)	
Malaysia	529 (4.7)	▲	519 (4.4)		501 (4.6)	▲	488 (4.2)		505 (5.7)		503 (4.9)	
Moldova, Rep. of	468 (3.8)	▲	457 (4.4)		473 (4.4)	▲	455 (4.8)		468 (4.4)		468 (4.4)	
1 ‡ Morocco	377 (3.6)		394 (3.4)	▲	400 (3.0)		402 (4.1)		369 (3.1)		385 (7.1)	
† Netherlands	534 (4.0)		544 (4.1)	▲	515 (4.4)		513 (4.7)		542 (4.0)		555 (4.3)	▲
New Zealand	480 (5.5)		483 (7.6)		494 (4.5)		485 (7.4)		498 (4.6)		503 (6.2)	
Norway	457 (2.8)		455 (3.2)		432 (2.8)	▲	424 (3.9)		479 (3.6)		483 (3.2)	
Palestinian Nat'l Auth.	387 (4.4)		383 (5.7)		404 (4.5)	▲	378 (5.4)		380 (3.9)		392 (4.4)	▲
Philippines	401 (5.2)	▲	384 (5.6)		408 (5.4)	▲	390 (5.7)		373 (5.1)		370 (5.7)	
Romania	477 (5.3)		472 (5.1)		487 (5.1)	▲	473 (5.1)		484 (5.1)		487 (5.0)	
Russian Federation	506 (4.0)		504 (4.5)		522 (3.0)	▲	510 (4.0)		505 (4.2)		510 (4.2)	
Saudi Arabia	293 (8.9)		318 (5.9)	▲	333 (8.0)		329 (6.1)		326 (4.4)		347 (4.9)	▲
† Scotland	486 (4.9)		482 (4.5)		493 (4.5)	▲	484 (4.3)		508 (4.4)		508 (3.8)	
1 Serbia	480 (3.5)		475 (2.8)		496 (3.1)	▲	480 (2.9)		474 (3.2)		476 (3.2)	
Singapore	623 (3.3)	▲	612 (4.2)		597 (3.4)	▲	583 (4.3)		613 (3.8)		608 (4.2)	
Slovak Republic	514 (3.3)		514 (4.1)		510 (3.3)	▲	500 (3.9)		504 (3.7)		511 (4.5)	▲
Slovenia	499 (2.5)		498 (2.5)		494 (3.1)	▲	479 (2.5)		493 (2.7)		499 (3.6)	
South Africa	273 (6.4)		274 (6.0)		273 (6.0)		275 (6.0)		296 (5.5)		301 (5.6)	
Sweden	495 (2.9)		497 (2.7)		482 (3.9)		478 (3.1)		509 (3.3)		515 (2.8)	
Tunisia	408 (2.3)		432 (2.8)	▲	398 (3.1)		412 (2.5)	▲	394 (2.7)		421 (3.4)	▲
‡ United States	504 (3.5)		512 (3.6)	▲	510 (3.2)		509 (3.3)		489 (3.4)		501 (3.3)	▲
‡ England	484 (5.8)		486 (6.1)		494 (5.3)		490 (5.6)		504 (5.1)		506 (5.2)	
International Avg.	467 (0.6)		467 (0.6)		471 (0.6)	▲	462 (0.6)		464 (0.6)		470 (0.6)	▲
Benchmarking Participants												
Basque Country, Spain	489 (2.7)		490 (3.5)		499 (3.2)	▲	482 (3.6)		490 (3.0)		487 (3.3)	
Indiana State, US	508 (5.7)		524 (6.6)	▲	510 (5.4)		509 (5.8)		493 (5.7)		512 (6.5)	▲
Ontario Province, Can.	514 (3.8)		518 (3.9)		517 (3.0)		512 (3.0)		517 (2.9)		523 (3.7)	
Quebec Province, Can.	542 (4.2)		550 (3.5)	▲	527 (3.7)		531 (3.7)		535 (4.2)		548 (3.8)	▲

▲ Significantly higher than other gender

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 3.3: Average Achievement in Mathematics Content Areas by Gender

MATHEMATICS Grade 8

Countries	Average Scale Scores for Mathematics Content Areas							
	Geometry				Data			
	Girls		Boys		Girls		Boys	
Armenia	485 (3.4)	▲	476 (3.5)		425 (3.6)	▲	412 (3.3)	
Australia	485 (5.7)		497 (6.1)		527 (4.8)		536 (4.3)	
Bahrain	453 (2.4)	▲	422 (2.8)		427 (2.2)	▲	401 (2.7)	
Belgium (Flemish)	522 (3.7)		533 (5.0)		541 (3.8)		552 (4.2)	▲
Botswana	328 (4.9)		343 (4.2)	▲	375 (3.6)		374 (3.3)	
Bulgaria	483 (5.4)		486 (4.8)		454 (4.8)		462 (5.0)	
Chile	369 (3.9)		386 (4.6)	▲	405 (3.9)		419 (4.1)	▲
Chinese Taipei	595 (5.9)	▲	581 (5.6)		570 (3.6)		566 (4.0)	
Cyprus	464 (3.2)	▲	451 (2.7)		465 (2.5)	▲	451 (2.0)	
Egypt	407 (4.9)		409 (5.3)		393 (4.2)		394 (4.7)	
Estonia	539 (3.0)		540 (3.2)		538 (3.2)	▲	532 (3.2)	
Ghana	259 (6.0)		293 (4.2)	▲	286 (4.5)		299 (4.6)	▲
† Hong Kong, SAR	587 (4.3)		589 (4.8)		568 (3.3)		564 (4.1)	
Hungary	510 (4.0)		521 (3.5)	▲	523 (3.6)		528 (3.3)	
1 Indonesia	408 (4.5)		419 (5.8)	▲	417 (4.8)		420 (4.6)	
Iran, Islamic Rep. of	446 (4.8)		432 (4.7)		407 (4.5)		403 (4.4)	
2 Israel	487 (3.8)		488 (4.8)		486 (3.7)		497 (4.4)	▲
Italy	466 (3.4)		472 (4.0)	▲	484 (3.0)		496 (3.6)	▲
Japan	588 (3.9)		585 (3.5)		570 (3.4)		575 (2.3)	
Jordan	455 (4.4)	▲	438 (5.8)		441 (3.7)	▲	420 (4.7)	
◆◆ Korea, Rep. of	593 (3.9)		601 (2.4)	▲	564 (2.8)		574 (2.7)	▲
Latvia	518 (3.9)		512 (3.6)		513 (3.7)	▲	500 (4.5)	
Lebanon	453 (3.2)		467 (4.2)	▲	391 (5.2)		398 (4.6)	
1 Lithuania	508 (3.2)		505 (4.8)		501 (3.2)		503 (3.0)	
2 Macedonia, Rep. of	445 (4.2)		438 (4.4)		421 (4.8)		416 (4.9)	
Malaysia	494 (6.0)		495 (5.2)		507 (3.8)		503 (3.6)	
Moldova, Rep. of	467 (4.6)	▲	458 (5.5)		431 (3.7)		425 (4.2)	
1 ‡ Morocco	408 (3.9)		423 (3.6)	▲	364 (3.8)		384 (3.8)	▲
† Netherlands	512 (4.3)		514 (5.1)		556 (3.6)		564 (4.0)	
New Zealand	490 (4.5)		486 (5.8)		530 (4.7)		522 (6.7)	
Norway	463 (3.9)		459 (3.7)		500 (2.8)		497 (3.4)	
Palestinian Nat'l Auth.	426 (4.2)		419 (4.8)		397 (3.9)	▲	382 (5.2)	
Philippines	344 (5.4)		346 (6.3)		395 (4.2)	▲	384 (5.7)	
Romania	474 (5.3)		479 (5.5)		445 (5.2)		445 (4.9)	
Russian Federation	517 (4.2)		513 (4.7)		483 (3.4)		485 (3.9)	
Saudi Arabia	381 (7.2)		382 (4.9)		345 (5.9)		334 (5.3)	
† Scotland	493 (4.4)		488 (3.6)		533 (4.3)		529 (3.9)	
1 Serbia	475 (3.2)	▲	467 (3.7)		454 (3.1)		458 (3.4)	
Singapore	584 (3.8)	▲	575 (4.5)		581 (3.0)		578 (4.0)	
Slovak Republic	497 (3.9)		505 (4.8)		488 (3.5)		502 (3.9)	▲
Slovenia	486 (4.0)		480 (3.6)		495 (2.9)		492 (3.0)	
South Africa	246 (6.0)		245 (6.4)		297 (6.2)		294 (5.7)	
Sweden	469 (4.0)		465 (3.3)		540 (3.6)		539 (3.6)	
Tunisia	419 (2.4)		437 (2.4)	▲	373 (2.1)		402 (3.5)	▲
‡ United States	469 (3.0)		475 (3.8)	▲	526 (3.3)		527 (3.5)	
‡ England	490 (5.6)		494 (5.9)		535 (4.7)		535 (5.4)	
International Avg.	466 (0.6)		467 (0.6)		467 (0.5)		467 (0.6)	
Benchmarking Participants								
Basque Country, Spain	457 (3.2)		454 (4.2)		500 (3.6)		498 (3.4)	
Indiana State, US	462 (5.9)		474 (5.5)	▲	526 (4.9)		530 (5.8)	
Ontario Province, Can.	511 (3.5)		514 (3.7)		536 (3.1)		540 (3.3)	
Quebec Province, Can.	538 (3.9)		545 (3.7)	▲	541 (3.0)		546 (3.2)	

▲ 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 Mathematics Content Areas by Gender

MATHEMATICS Grade 4

Countries	Average Scale Scores for Mathematics Content Areas					
	Number		Patterns and Relationships		Measurement	
	Girls	Boys	Girls	Boys	Girls	Boys
Armenia	480 (3.3) ▲	467 (3.2)	468 (4.6) ▲	453 (4.6)	468 (3.3)	463 (3.9)
† Australia	476 (5.1)	481 (5.0)	493 (4.5)	497 (4.3)	510 (4.4)	517 (4.1)
Belgium (Flemish)	547 (2.1)	550 (2.5)	542 (2.7)	543 (2.2)	547 (1.7)	552 (2.1) ▲
Chinese Taipei	568 (2.5)	567 (2.1)	555 (2.4)	555 (2.9)	556 (2.0)	558 (1.9)
Cyprus	510 (3.1)	517 (3.0) ▲	516 (3.4)	522 (2.9)	498 (2.4)	513 (3.1) ▲
† England	520 (4.4)	518 (4.8)	523 (4.1)	524 (4.5)	531 (3.5)	539 (3.8) ▲
† Hong Kong, SAR	575 (3.5)	573 (3.6)	568 (4.4)	568 (3.6)	561 (3.0)	564 (2.9)
Hungary	522 (3.5)	525 (3.4)	550 (4.1) ▲	539 (4.9)	527 (3.5)	538 (2.8) ▲
Iran, Islamic Rep. of	415 (6.1)	407 (5.0)	402 (6.5)	389 (5.3)	401 (5.5)	397 (4.3)
Italy	499 (4.0)	506 (3.7) ▲	496 (5.3)	496 (5.3)	496 (3.8)	512 (3.8) ▲
Japan	553 (2.5)	558 (2.3)	551 (1.9)	557 (2.0) ▲	567 (2.0)	569 (2.0)
Latvia	532 (3.1)	530 (3.3)	533 (3.9)	530 (3.8)	542 (3.1)	548 (3.0)
1 Lithuania	536 (3.5)	536 (3.6)	531 (3.5)	533 (4.1)	539 (2.9)	544 (3.7)
Moldova, Rep. of	513 (5.0) ▲	501 (4.8)	527 (5.6) ▲	515 (5.3)	506 (4.4)	504 (4.3)
Morocco	355 (6.0)	363 (4.8)	356 (5.9)	365 (5.2)	336 (6.5)	353 (5.7) ▲
† Netherlands	531 (2.6)	541 (2.8) ▲	527 (3.6)	528 (2.5)	540 (2.6)	549 (2.3) ▲
New Zealand	473 (3.4)	477 (2.6)	496 (4.0)	493 (3.7)	501 (3.2)	505 (2.1)
Norway	437 (3.2)	444 (2.4) ▲	439 (3.0)	438 (3.0)	469 (2.9)	480 (2.9) ▲
Philippines	388 (8.9) ▲	372 (6.3)	384 (8.2)	380 (6.7)	332 (9.4)	328 (7.4)
Russian Federation	532 (5.1)	531 (4.7)	531 (5.6)	531 (5.3)	533 (4.3)	544 (4.0) ▲
† Scotland	471 (3.6)	479 (4.5)	492 (2.7)	498 (4.2)	492 (3.2)	507 (3.9) ▲
Singapore	617 (5.9) ▲	608 (6.7)	583 (5.4)	575 (6.0)	569 (4.5)	564 (5.2)
Slovenia	458 (3.4)	465 (3.4)	487 (3.0)	493 (4.9)	493 (3.1)	501 (3.5) ▲
Tunisia	361 (4.8)	360 (4.1)	331 (5.4)	329 (5.4)	311 (6.3)	306 (5.5)
† United States	513 (2.5)	520 (3.2) ▲	521 (2.7)	526 (3.1) ▲	494 (2.0)	505 (2.7) ▲
International Avg.	495 (0.8)	496 (0.8)	496 (0.8)	495 (0.8)	493 (0.8)	498 (0.7) ▲
Benchmarking Participants						
Indiana State, US	529 (3.5)	532 (4.5)	535 (3.4)	536 (4.6)	515 (3.8)	515 (3.7)
Ontario Province, Can.	490 (4.2)	498 (6.7)	508 (4.0)	517 (4.3) ▲	506 (3.6)	517 (4.8) ▲
Quebec Province, Can.	503 (2.9)	514 (3.0) ▲	499 (3.5)	499 (3.1)	499 (2.7)	508 (2.9) ▲

▲ Significantly higher than other gender

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 3.3: Average Achievement in Mathematics Content Areas by Gender

MATHEMATICS Grade 4

Countries	Average Scale Scores for Mathematics Content Areas			
	Geometry		Data	
	Girls	Boys	Girls	Boys
Armenia	437 (3.9) ▲	425 (4.4)	424 (4.0) ▲	411 (4.0)
† Australia	529 (3.6) ▲	519 (4.9)	529 (4.3)	521 (4.7)
Belgium (Flemish)	534 (2.0)	531 (2.3)	547 (2.8)	549 (2.9)
Chinese Taipei	554 (2.6)	552 (2.7)	568 (2.1) ▲	560 (3.3)
Cyprus	506 (2.5)	504 (2.7)	506 (2.4)	513 (3.1) ▲
† England	545 (4.4)	538 (4.4)	554 (4.3)	549 (4.3)
† Hong Kong, SAR	559 (3.8)	555 (2.9)	563 (2.6)	561 (2.7)
Hungary	515 (4.1)	513 (3.7)	515 (4.6)	512 (3.8)
Iran, Islamic Rep. of	430 (5.9) ▲	407 (4.7)	360 (7.3)	354 (5.4)
Italy	523 (4.2)	521 (3.4)	495 (3.9)	499 (3.5)
Japan	562 (1.9)	557 (2.7)	595 (2.4)	591 (2.4)
Latvia	525 (2.0) ▲	520 (2.9)	529 (3.2)	522 (3.5)
1 Lithuania	525 (2.7)	526 (2.7)	519 (3.3)	518 (3.3)
Moldova, Rep. of	505 (5.5) ▲	496 (4.8)	483 (4.9) ▲	470 (4.3)
Morocco	362 (7.3)	362 (5.2)	356 (6.2)	354 (4.9)
† Netherlands	522 (4.1)	519 (3.1)	552 (2.8)	554 (3.1)
New Zealand	521 (2.4) ▲	514 (2.5)	524 (2.9)	519 (2.9)
Norway	482 (2.7) ▲	473 (2.9)	480 (2.8)	478 (3.0)
Philippines	336 (10.6)	334 (7.8)	393 (8.8) ▲	374 (7.2)
Russian Federation	528 (5.2)	528 (4.9)	502 (4.8)	508 (4.3)
† Scotland	513 (2.8)	509 (3.3)	513 (3.2)	519 (3.6)
Singapore	573 (5.4)	566 (6.1)	579 (3.8) ▲	571 (4.4)
Slovenia	502 (3.1)	495 (2.5)	486 (3.6)	487 (3.9)
Tunisia	351 (6.2)	342 (5.4)	311 (5.3)	305 (5.0)
† United States	517 (2.5)	519 (2.4)	546 (1.9)	551 (2.5) ▲
International Avg.	498 (0.8) ▲	493 (0.8)	497 (0.8) ▲	494 (0.7)
Benchmarking Participants				
Indiana State, US	524 (3.4)	526 (5.0)	557 (4.4)	558 (3.6)
Ontario Province, Can.	532 (3.6)	537 (5.2)	542 (4.4)	546 (4.5)
Quebec Province, Can.	525 (2.1)	519 (3.6)	505 (3.0)	508 (3.4)

▲ Significantly higher than other gender

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.

than boys across countries was geometry. The girls had higher achievement in 7 countries and the boys none. Internationally, there was a 5-point difference favoring girls. The results were relatively similar for the genders in number (4 countries favoring girls and 6 entities favoring boys) and in data (5 countries favoring girls and 2 favoring boys). In data, however, the small difference between in the international averages was significantly higher for girls.

In some respects, the patterns in the performance of girls and boys found in TIMSS 2003 are consistent with previous IEA mathematics assessments. Girls tended to perform better than boys in algebra in both previous TIMSS assessments and the Second International Mathematics Study (SIMS),[4] while boys were markedly stronger in measurement in previous studies.

What Changes Have Occurred in Content Area Achievement?

To examine changes in achievement in the mathematics 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, countries were consistent in either showing improvements or declines. No country showed statistically significant improvements in some areas while showing declines in other areas. Israel had statistically significant improvements in all five content areas. Lithuania improved in three areas. Participants improving in two areas included the Philippines,

4 Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., Gregory, K.D., Garden, R.A., O'Connor, K.M., Chrostowki, 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. Beaton, A.E., Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., Kelly, D.L., and Smith, T.A. (1996), *Mathematics Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study (TIMSS),* Chestnut Hill, MA: Boston College. Robitaille D.F. (1989), "Student's Achievements: Population A" in D.F. Robitaille and R.A. Garden (eds.), *The IEA Study of Mathematics II: Contexts and Outcomes of School Mathematics,* New York: Pergamon Press, p.121

the United States, and the Canadian province of Ontario. On the other hand, Bulgaria, Japan, the Slovak Republic, and Tunisia had statistically significant decreases in all five content areas. In Belgium (Flemish), Iran, and Jordan average achievement showed statistically significant decreases in four content areas. Cyprus and Malaysia showed significant decreases in three content areas, Macedonia in two areas, and the Russian Federation in one.

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

MATHEMATICS Grade 8

Countries	Average Percent Correct for Mathematics Content Areas											
	Total Mathematics Trend Items (79 items)			Number Trend Items (25 items)			Algebra Trend Items (16 items)		
	2003	1999		2003	1999		2003	1999	
Australia	52 (1.0)	– –		53 (1.0)	– –		47 (1.3)	– –	
Belgium (Flemish)	60 (0.7)	64 (0.8)	▼	61 (0.8)	64 (1.0)	▼	52 (0.8)	56 (1.0)	▼
Bulgaria	45 (1.0)	53 (1.5)	▼	47 (1.0)	54 (1.5)	▼	43 (1.1)	53 (1.6)	▼
Chile	29 (0.6)	29 (0.8)		31 (0.6)	32 (0.9)		23 (0.7)	24 (0.9)	
Chinese Taipei	69 (1.0)	70 (0.9)		70 (1.1)	73 (0.9)		66 (1.2)	68 (1.1)	
Cyprus	43 (0.4)	46 (0.4)	▼	46 (0.5)	49 (0.5)	▼	38 (0.6)	40 (0.7)	
Hong Kong, SAR	70 (0.7)	71 (1.1)		69 (0.8)	71 (1.2)		68 (0.9)	69 (1.3)	
Hungary	57 (0.9)	59 (0.8)		59 (1.0)	60 (0.9)		56 (1.0)	57 (0.9)	
Indonesia	32 (0.8)	34 (0.8)		35 (0.9)	36 (0.8)		30 (0.8)	32 (0.9)	
Iran, Islamic Rep. of	32 (0.5)	35 (0.7)	▼	36 (0.5)	39 (0.7)	▼	29 (0.6)	31 (0.8)	▼
Israel	50 (0.9)	43 (0.9)	▲	52 (0.9)	44 (0.9)	▲	48 (0.9)	42 (1.1)	▲
Italy	47 (0.9)	48 (0.9)		48 (0.9)	49 (0.9)		42 (1.1)	41 (0.9)	
Japan	66 (0.6)	70 (0.5)	▼	65 (0.7)	70 (0.6)	▼	64 (0.7)	69 (0.7)	▼
Jordan	33 (0.8)	36 (0.6)	▼	35 (0.8)	38 (0.7)	▼	31 (0.9)	33 (0.8)	▼
Korea, Rep. of	72 (0.5)	71 (0.5)		73 (0.6)	72 (0.5)		71 (0.6)	68 (0.7)	▲
Latvia (LSS)	51 (1.0)	51 (0.8)		53 (1.1)	53 (0.9)		48 (1.2)	47 (0.9)	
Lithuania	50 (0.7)	47 (1.0)	▲	51 (0.7)	50 (1.1)		46 (0.8)	44 (1.2)	
Macedonia, Rep. of	36 (0.7)	38 (0.8)		38 (0.8)	37 (0.9)		35 (0.9)	38 (1.0)	▼
Malaysia	52 (1.1)	56 (1.2)	▼	57 (1.1)	62 (1.2)	▼	42 (1.0)	46 (1.0)	▼
Moldova, Rep. of	43 (0.9)	44 (1.0)		47 (1.0)	46 (1.1)		40 (1.0)	41 (1.0)	
Netherlands	60 (1.0)	58 (2.0)		60 (1.0)	58 (2.1)		51 (1.1)	51 (2.3)	
New Zealand	48 (1.2)	47 (1.3)		47 (1.2)	47 (1.3)		43 (1.4)	43 (1.4)	
Philippines	27 (0.8)	25 (0.7)	▲	31 (0.8)	30 (0.8)		27 (1.0)	20 (0.9)	▲
Romania	45 (1.2)	46 (1.3)		46 (1.1)	46 (1.4)		44 (1.4)	44 (1.5)	
Russian Federation	53 (1.0)	55 (1.3)		54 (1.1)	57 (1.4)	▼	52 (1.0)	54 (1.3)	
Singapore	74 (1.0)	76 (1.4)		78 (0.9)	80 (1.2)		69 (1.1)	69 (1.6)	
Slovak Republic	52 (0.9)	59 (1.1)	▼	55 (1.0)	62 (1.2)	▼	49 (1.0)	55 (1.3)	▼
Slovenia	50 (0.7)	– –		53 (0.7)	– –		45 (0.9)	– –	
South Africa	18 (0.7)	19 (0.7)		20 (0.7)	22 (0.7)		14 (0.7)	15 (0.7)	
Tunisia	30 (0.4)	39 (0.5)	▼	33 (0.5)	41 (0.5)	▼	26 (0.5)	33 (0.6)	▼
United States	51 (0.9)	50 (0.9)		54 (0.9)	54 (1.0)		50 (1.0)	47 (1.0)	▲
‡ England	49 (1.1)	47 (1.1)		49 (1.1)	47 (1.1)		43 (1.2)	42 (1.2)	
International Avg.	48 (0.2)	50 (0.2)	▼	50 (0.2)	51 (0.2)	▼	45 (0.2)	46 (0.2)	▼
Benchmarking Participants									
Indiana State, US	52 (1.3)	52 (1.7)		56 (1.4)	56 (1.8)		49 (1.3)	49 (1.8)	
Ontario Province, Can.	55 (0.8)	53 (0.8)		55 (0.9)	56 (1.0)		51 (0.9)	48 (0.9)	
Quebec Province, Can.	61 (0.8)	65 (1.5)	▼	62 (0.9)	65 (1.8)		56 (1.0)	60 (1.2)	▼

▲ 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 Mathematics Content Areas*

MATHEMATICS Grade 8

Countries	Average Percent Correct for Mathematics Content Areas											
	Measurement Trend Items (16 items)			Geometry Trend Items (12 items)			Data Trend Items (10 items)		
	2003	1999		2003	1999		2003	1999	
Australia	47 (1.2)	– –		50 (1.1)	– –		71 (1.1)	– –	
Belgium (Flemish)	54 (0.8)	60 (0.8)	▼	61 (0.9)	64 (1.0)	▼	79 (0.7)	81 (0.8)	
Bulgaria	35 (1.2)	45 (1.5)	▼	50 (0.9)	58 (1.6)	▼	58 (1.1)	62 (1.6)	▼
Chile	21 (0.6)	19 (0.8)		30 (0.7)	32 (0.9)		44 (1.0)	45 (1.0)	
Chinese Taipei	61 (1.1)	64 (1.0)		71 (1.0)	72 (0.9)		79 (0.8)	80 (0.7)	
Cyprus	34 (0.6)	40 (0.6)	▼	45 (0.5)	47 (0.6)	▼	61 (0.7)	61 (1.0)	
Hong Kong, SAR	66 (0.9)	66 (1.2)		73 (0.8)	72 (1.1)		76 (0.6)	78 (0.9)	
Hungary	51 (1.0)	53 (1.0)		55 (1.0)	55 (1.1)		69 (1.0)	71 (0.9)	
Indonesia	21 (0.8)	22 (0.8)		36 (0.8)	37 (1.0)		47 (1.1)	47 (1.1)	
Iran, Islamic Rep. of	20 (0.5)	22 (0.8)		36 (0.6)	39 (0.8)	▼	46 (0.8)	49 (1.0)	▼
Israel	39 (0.9)	32 (0.9)	▲	51 (1.1)	44 (0.9)	▲	65 (1.1)	59 (1.1)	▲
Italy	43 (1.0)	44 (1.0)		46 (1.0)	47 (1.0)		64 (0.9)	64 (1.2)	
Japan	58 (0.7)	63 (0.7)	▼	74 (0.6)	75 (0.6)	▼	76 (0.5)	79 (0.5)	▼
Jordan	23 (0.8)	27 (0.8)	▼	37 (0.8)	41 (0.7)	▼	46 (1.1)	49 (0.7)	
Korea, Rep. of	63 (0.7)	64 (0.6)		75 (0.6)	74 (0.6)		80 (0.4)	82 (0.4)	▼
Latvia (LSS)	38 (1.0)	40 (1.1)		57 (1.2)	59 (1.0)		67 (1.4)	63 (1.0)	▲
Lithuania	38 (0.8)	34 (1.2)	▲	54 (0.8)	49 (1.3)	▲	68 (0.8)	64 (1.2)	▲
Macedonia, Rep. of	27 (0.9)	29 (1.0)		39 (0.7)	42 (1.0)	▼	49 (1.0)	48 (1.0)	
Malaysia	45 (1.3)	51 (1.4)	▼	51 (1.2)	53 (1.3)		67 (1.0)	68 (1.0)	
Moldova, Rep. of	36 (1.1)	37 (1.3)		46 (1.3)	47 (1.2)		49 (1.0)	50 (1.1)	
Netherlands	58 (1.2)	56 (2.0)		57 (1.2)	58 (1.7)		79 (1.0)	75 (2.4)	
New Zealand	42 (1.5)	42 (1.5)		49 (1.3)	48 (1.3)		66 (1.4)	65 (1.4)	
Philippines	18 (0.8)	15 (0.6)	▲	25 (0.7)	25 (0.8)		40 (0.9)	39 (0.9)	
Romania	39 (1.4)	40 (1.4)		45 (1.3)	48 (1.3)		55 (1.4)	54 (1.3)	
Russian Federation	44 (1.2)	47 (1.6)		56 (1.1)	58 (1.5)		64 (1.2)	65 (1.3)	
Singapore	74 (1.1)	76 (1.6)		71 (1.1)	73 (1.6)		79 (0.8)	81 (1.2)	
Slovak Republic	44 (1.1)	53 (1.5)	▼	53 (1.0)	61 (1.2)	▼	64 (1.0)	71 (1.1)	▼
Slovenia	42 (0.9)	– –		50 (0.9)	– –		67 (0.9)	– –	
South Africa	12 (0.7)	13 (0.6)		19 (0.8)	21 (0.8)		29 (1.1)	30 (0.9)	
Tunisia	20 (0.5)	32 (0.7)	▼	34 (0.6)	46 (0.6)	▼	39 (0.6)	52 (0.7)	▼
United States	42 (1.0)	40 (1.1)		45 (0.9)	44 (1.0)		72 (0.8)	68 (0.9)	▲
‡ England	45 (1.3)	43 (1.3)		50 (1.3)	47 (1.3)	▲	69 (1.3)	66 (1.4)	
International Avg.	41 (0.2)	42 (0.2)	▼	50 (0.2)	51 (0.2)	▼	62 (0.2)	62 (0.2)	
Benchmarking Participants									
Indiana State, US	42 (1.7)	43 (2.0)		44 (1.7)	44 (1.9)		72 (1.3)	72 (1.9)	
Ontario Province, Can.	47 (0.9)	45 (1.1)		56 (1.1)	52 (1.0)	▲	75 (0.8)	71 (0.9)	▲
Quebec Province, Can.	54 (1.1)	60 (2.0)	▼	64 (0.9)	68 (2.0)		74 (0.6)	77 (1.4)	▼

▲ 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 Mathematics

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 mathematics 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 mathematics, and the value they place on mathematics. Also provided is information on trends in attitudes to learning mathematics 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 mathematics and other subjects

1 For results from TIMSS 1999, see 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. For TIMSS 1995 results, see Beaton, A.E., Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., Kelly, D.L., and Smith, T.A.(1996), *Mathematics Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study*, Chestnut Hill, MA: Boston College;

than 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 mathematics 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 mathematics in almost all countries. At 503 score points, the average mathematics 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 mathematics 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 mathematics 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 at home

Exhibit 4.1: Highest Level of Education of Either Parent*

MATHEMATICS Grade 8

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)	492 (3.6)	22 (0.9)	473 (4.4)	24 (1.1)	467 (4.0)
Australia	r	29 (1.3)	543 (5.6)	27 (1.0)	517 (5.8)	25 (1.1)	493 (6.1)
Bahrain		33 (0.7)	427 (2.5)	7 (0.5)	410 (5.7)	23 (0.6)	409 (2.9)
Belgium (Flemish)	s	25 (1.4)	568 (3.9)	26 (1.0)	565 (3.0)	31 (1.1)	535 (3.5)
Botswana		10 (0.7)	411 (7.1)	14 (0.6)	378 (4.0)	16 (0.8)	361 (3.5)
Bulgaria		28 (1.3)	516 (6.2)	36 (1.4)	475 (4.7)	29 (1.4)	457 (5.3)
Chile		16 (1.0)	465 (4.7)	10 (0.5)	418 (5.5)	32 (1.1)	391 (3.7)
Chinese Taipei		17 (1.4)	643 (5.1)	11 (0.6)	618 (5.3)	46 (1.0)	583 (4.3)
Cyprus		28 (0.8)	486 (2.6)	14 (0.7)	475 (3.0)	36 (0.9)	459 (2.8)
Egypt		24 (1.1)	464 (4.5)	0 (0.0)	~ ~	11 (0.6)	433 (5.7)
Estonia		40 (1.4)	555 (3.4)	39 (1.1)	525 (3.3)	19 (0.7)	512 (3.8)
Ghana		10 (0.7)	320 (8.1)	17 (0.9)	296 (6.7)	22 (1.0)	292 (5.8)
Hong Kong, SAR		12 (1.0)	612 (7.0)	12 (0.5)	598 (5.2)	36 (0.9)	587 (3.0)
Hungary	r	37 (1.6)	573 (3.4)	0 (0.0)	~ ~	49 (1.6)	515 (3.0)
Indonesia		9 (0.9)	457 (8.4)	6 (0.5)	433 (7.7)	24 (1.1)	422 (5.9)
Iran, Islamic Rep. of		10 (0.8)	456 (6.6)	10 (0.7)	429 (5.2)	15 (0.8)	434 (4.2)
Israel	r	45 (1.3)	531 (3.7)	24 (0.9)	493 (4.0)	18 (0.9)	474 (4.9)
Italy		21 (1.3)	509 (5.6)	5 (0.4)	500 (6.4)	40 (0.9)	495 (3.1)
Japan	r	45 (1.4)	601 (2.9)	18 (0.7)	569 (3.8)	36 (1.1)	548 (2.5)
Jordan		35 (1.8)	458 (6.8)	15 (0.8)	439 (4.8)	30 (1.0)	419 (3.3)
Korea, Rep. of		35 (1.2)	619 (3.0)	15 (0.6)	589 (3.6)	41 (1.0)	580 (2.2)
Latvia	r	43 (1.8)	532 (4.0)	0 (0.0)	~ ~	34 (1.4)	512 (4.2)
Lebanon		19 (1.2)	465 (4.8)	21 (1.0)	448 (4.5)	19 (0.7)	436 (4.4)
Lithuania	r	36 (1.6)	538 (2.9)	31 (1.0)	502 (3.2)	30 (1.3)	473 (3.3)
Macedonia, Rep. of		22 (1.3)	479 (5.4)	19 (0.9)	459 (3.9)	43 (1.2)	435 (3.6)
Malaysia		11 (0.9)	544 (7.4)	20 (0.9)	522 (4.9)	27 (0.9)	519 (4.6)
Moldova, Rep. of		34 (1.4)	485 (4.0)	18 (1.0)	463 (5.5)	21 (1.1)	457 (5.1)
Morocco	r	16 (1.3)	406 (4.8)	0 (0.0)	~ ~	17 (0.8)	398 (5.3)
Netherlands	r	22 (1.6)	569 (5.7)	32 (1.3)	563 (4.2)	43 (1.9)	526 (4.3)
New Zealand	s	28 (1.9)	535 (8.0)	30 (1.5)	502 (6.3)	34 (1.9)	492 (5.3)
Norway	s	66 (1.4)	485 (2.6)	16 (1.0)	459 (5.7)	12 (0.9)	451 (4.9)
Palestinian Nat'l Auth.		27 (0.9)	426 (4.5)	12 (0.5)	401 (6.1)	36 (0.8)	396 (3.3)
Philippines		19 (1.2)	425 (8.5)	22 (0.8)	394 (5.4)	33 (0.9)	372 (5.8)
Romania		17 (1.8)	533 (5.7)	16 (1.0)	493 (5.8)	47 (1.5)	479 (4.2)
Russian Federation		44 (2.3)	530 (3.6)	26 (1.5)	513 (3.7)	24 (1.2)	484 (4.8)
Saudi Arabia		27 (1.9)	363 (6.3)	0 (0.0)	~ ~	12 (0.5)	339 (7.6)
Scotland		x x	x x	x x	x x	x x	x x
Serbia		20 (1.2)	529 (4.0)	68 (1.2)	475 (2.4)	2 (0.2)	~ ~
Singapore	r	16 (0.6)	651 (3.3)	4 (0.3)	624 (5.9)	21 (0.8)	621 (3.6)
Slovak Republic	r	34 (1.9)	549 (3.8)	0 (0.0)	~ ~	65 (1.9)	502 (3.4)
Slovenia	r	26 (1.3)	522 (3.5)	31 (0.8)	498 (2.9)	34 (1.1)	486 (3.5)
South Africa	r	11 (1.0)	352 (16.6)	13 (0.7)	294 (10.0)	30 (0.9)	266 (6.0)
Sweden	s	48 (1.8)	525 (3.5)	18 (1.1)	513 (3.9)	22 (1.3)	489 (4.6)
Tunisia		11 (0.9)	437 (5.8)	12 (0.8)	437 (4.1)	16 (0.6)	419 (3.7)
United States	r	56 (1.3)	530 (3.6)	9 (0.4)	495 (3.6)	26 (0.9)	488 (3.0)
‡ England		x x	x x	x x	x x	x x	x x
International Avg.		28 (0.2)	503 (0.9)	17 (0.1)	480 (0.9)	28 (0.2)	463 (0.7)
Benchmarking Participants							
Basque Country, Spain		34 (2.1)	508 (4.0)	14 (1.1)	492 (4.2)	21 (1.1)	482 (4.1)
Indiana State, US	r	46 (2.1)	529 (7.4)	10 (0.8)	505 (4.6)	33 (1.3)	505 (5.4)
Ontario Province, Can.	s	46 (2.3)	552 (3.8)	37 (1.6)	517 (3.2)	13 (1.1)	510 (4.8)
Quebec Province, Can.	r	33 (1.6)	562 (4.7)	34 (0.9)	547 (4.0)	21 (1.1)	529 (2.7)

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*

MATHEMATICS Grade 8

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)	482 (5.2)	3 (0.4)	429 (13.3)
Bahrain		20 (0.7)	387 (3.6)	17 (0.7)	385 (3.5)
Belgium (Flemish)	s	11 (0.7)	524 (5.8)	6 (0.7)	462 (12.7)
Botswana		20 (0.8)	366 (3.1)	41 (1.2)	356 (3.0)
Bulgaria		6 (0.7)	443 (11.5)	2 (0.4)	~ ~
Chile		31 (1.0)	354 (3.2)	11 (0.9)	334 (5.3)
Chinese Taipei		21 (1.1)	553 (5.6)	6 (0.5)	537 (7.8)
Cyprus		15 (0.7)	430 (4.0)	7 (0.4)	412 (6.1)
Egypt		29 (0.9)	398 (4.0)	36 (1.4)	387 (3.7)
Estonia		2 (0.3)	~ ~	0 (0.1)	~ ~
Ghana		37 (1.2)	261 (5.7)	14 (1.0)	246 (5.5)
Hong Kong, SAR		25 (0.8)	586 (3.5)	15 (0.7)	578 (5.0)
Hungary	r	14 (1.3)	473 (7.2)	0 (0.1)	~ ~
Indonesia		22 (0.9)	392 (7.5)	39 (1.6)	406 (5.1)
Iran, Islamic Rep. of		22 (0.8)	408 (2.8)	43 (1.6)	395 (2.6)
Israel	r	8 (0.6)	457 (7.9)	5 (0.6)	455 (11.1)
Italy		30 (1.1)	459 (4.1)	5 (0.4)	425 (6.5)
Japan	r	2 (0.3)	~ ~	0 (0.0)	~ ~
Jordan		12 (0.9)	403 (5.9)	8 (0.6)	377 (5.7)
Korea, Rep. of		6 (0.4)	551 (4.9)	3 (0.4)	516 (9.8)
Latvia	r	23 (1.1)	502 (4.5)	0 (0.1)	~ ~
Lebanon		15 (0.8)	418 (4.6)	26 (1.7)	405 (3.9)
Lithuania	r	2 (0.3)	~ ~	1 (0.2)	~ ~
Macedonia, Rep. of		11 (0.8)	384 (5.9)	5 (0.6)	367 (12.6)
Malaysia		24 (1.0)	496 (4.9)	18 (1.0)	485 (5.0)
Moldova, Rep. of		17 (0.9)	450 (7.2)	10 (0.8)	420 (8.3)
Morocco	r	17 (1.1)	372 (5.6)	50 (1.7)	385 (3.0)
Netherlands	r	0 (0.0)	~ ~	3 (0.4)	502 (11.2)
New Zealand	s	5 (0.7)	475 (10.8)	2 (0.4)	~ ~
Norway	s	4 (0.5)	419 (9.4)	2 (0.3)	~ ~
Palestinian Nat'l Auth.		18 (0.8)	368 (4.2)	6 (0.5)	339 (6.3)
Philippines		13 (0.5)	348 (6.1)	14 (0.9)	339 (5.3)
Romania		13 (1.6)	465 (9.8)	7 (0.8)	392 (9.5)
Russian Federation		6 (0.5)	471 (8.4)	0 (0.1)	~ ~
Saudi Arabia		19 (1.7)	322 (6.2)	41 (1.7)	320 (4.3)
Scotland		x x	x x	x x	x x
Serbia		9 (0.9)	425 (6.0)	1 (0.2)	~ ~
Singapore	r	48 (0.8)	600 (3.9)	11 (0.5)	571 (6.0)
Slovak Republic	r	1 (0.3)	~ ~	0 (0.1)	~ ~
Slovenia	r	8 (0.7)	458 (5.5)	1 (0.2)	~ ~
South Africa	r	18 (0.7)	244 (4.0)	28 (1.1)	223 (4.4)
Sweden	s	9 (0.8)	478 (6.0)	3 (0.5)	441 (11.8)
Tunisia		17 (0.7)	406 (2.8)	44 (1.5)	397 (2.4)
United States	r	6 (0.4)	457 (5.6)	3 (0.3)	436 (7.5)
‡ England		x x	x x	x x	x x
International Avg.		15 (0.1)	434 (1.1)	12 (0.1)	410 (1.4)
Benchmarking Participants					
Basque Country, Spain		20 (1.5)	475 (3.6)	11 (0.8)	457 (5.7)
Indiana State, US	r	7 (0.9)	470 (8.0)	4 (0.5)	487 (15.0)
Ontario Province, Can.	s	3 (0.5)	511 (9.6)	2 (0.4)	~ ~
Quebec Province, Can.	r	10 (0.7)	527 (3.8)	1 (0.3)	~ ~

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

MATHEMATICS 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)	510 (3.5)	18 (0.9)	492 (4.0)	37 (1.5)	456 (4.2)	9 (0.5)	471 (5.7)
Australia s	22 (1.3)	555 (6.2)	22 (1.0)	537 (6.3)	45 (1.4)	483 (4.4)	11 (0.7)	506 (6.4)
Bahrain r	28 (0.7)	440 (2.4)	39 (0.8)	420 (2.5)	16 (0.7)	357 (4.2)	16 (0.6)	379 (4.1)
Belgium (Flemish) s	16 (1.2)	583 (4.0)	17 (0.9)	578 (3.3)	46 (1.6)	528 (3.4)	21 (0.8)	530 (4.8)
Botswana	8 (0.6)	424 (6.4)	36 (0.9)	395 (2.8)	45 (1.0)	344 (3.1)	12 (0.6)	340 (5.7)
Bulgaria	23 (1.3)	527 (6.3)	28 (1.1)	490 (4.6)	37 (1.7)	445 (5.8)	12 (0.9)	462 (5.6)
Chile	15 (1.0)	473 (4.5)	43 (1.1)	397 (3.9)	36 (1.0)	350 (3.3)	7 (0.4)	350 (6.8)
Chinese Taipei	15 (1.3)	650 (5.0)	56 (1.0)	607 (3.4)	16 (0.9)	500 (4.8)	14 (0.6)	543 (6.6)
Cyprus	23 (0.8)	500 (2.9)	40 (0.9)	482 (2.3)	18 (0.8)	406 (3.1)	19 (0.6)	427 (3.5)
Egypt r	23 (1.1)	479 (4.4)	44 (1.2)	423 (3.5)	18 (0.8)	369 (3.9)	14 (0.8)	411 (5.0)
Estonia	25 (1.2)	571 (3.6)	19 (0.7)	549 (3.3)	37 (1.1)	513 (3.6)	19 (0.6)	512 (3.7)
Ghana	6 (0.6)	351 (8.6)	21 (1.4)	318 (6.8)	67 (1.5)	263 (3.9)	7 (0.6)	247 (6.9)
Hong Kong, SAR	11 (0.9)	619 (6.0)	63 (1.1)	599 (2.6)	19 (1.0)	547 (5.9)	8 (0.4)	583 (6.2)
Hungary s	38 (1.8)	583 (3.1)	36 (1.2)	542 (3.5)	19 (1.4)	454 (4.7)	8 (0.7)	491 (10.1)
Indonesia	8 (0.9)	467 (8.4)	46 (1.3)	425 (5.1)	25 (1.2)	390 (7.3)	21 (1.0)	395 (5.8)
Iran, Islamic Rep. of	7 (0.6)	472 (8.3)	37 (0.9)	430 (2.8)	16 (0.8)	385 (3.4)	39 (1.1)	398 (2.4)
Israel r	35 (1.1)	540 (4.0)	29 (0.9)	499 (4.1)	23 (0.8)	455 (4.8)	14 (0.6)	489 (4.7)
Italy	15 (1.1)	522 (5.7)	35 (1.1)	507 (2.8)	38 (1.2)	458 (3.8)	12 (0.6)	455 (6.1)
Japan r	29 (1.3)	622 (2.9)	17 (0.7)	594 (3.3)	37 (1.2)	540 (2.3)	18 (0.7)	550 (4.1)
Jordan	27 (1.6)	472 (7.7)	35 (1.2)	437 (3.9)	13 (0.8)	375 (4.6)	24 (1.0)	409 (3.9)
Korea, Rep. of	31 (1.2)	626 (2.8)	48 (0.9)	593 (2.1)	11 (0.5)	514 (4.3)	9 (0.4)	559 (5.2)
Latvia s	35 (1.7)	540 (3.7)	34 (1.5)	522 (3.3)	16 (1.3)	506 (7.1)	15 (0.9)	489 (6.3)
Lebanon	16 (1.1)	473 (5.4)	52 (1.2)	439 (3.6)	16 (0.9)	403 (3.8)	16 (0.9)	407 (4.8)
Lithuania r	33 (1.6)	546 (3.0)	42 (1.3)	503 (2.9)	26 (1.2)	461 (3.9)	0 (0.0)	~ ~
Macedonia, Rep. of	20 (1.3)	489 (5.2)	40 (1.1)	463 (3.0)	30 (1.1)	394 (5.2)	10 (0.8)	401 (6.7)
Malaysia	10 (0.9)	549 (7.6)	54 (1.5)	516 (3.9)	26 (1.3)	486 (5.2)	10 (0.7)	509 (6.1)
Moldova, Rep. of r	23 (1.3)	495 (4.1)	23 (1.0)	477 (5.3)	37 (1.4)	446 (5.3)	17 (0.9)	440 (5.6)
Morocco r	13 (1.2)	414 (5.2)	38 (1.2)	398 (3.8)	20 (1.1)	376 (4.1)	29 (1.3)	382 (3.5)
Netherlands r	13 (1.3)	585 (6.0)	16 (1.5)	589 (5.1)	55 (2.5)	527 (3.8)	16 (1.1)	541 (6.6)
New Zealand s	17 (1.6)	558 (7.8)	22 (1.3)	519 (7.2)	36 (1.9)	484 (5.4)	25 (1.3)	494 (6.8)
Norway s	47 (1.3)	490 (2.8)	13 (0.9)	469 (5.7)	19 (1.0)	437 (5.1)	21 (0.8)	467 (4.5)
Palestinian Nat'l Auth.	20 (0.8)	440 (4.4)	34 (0.9)	412 (3.1)	19 (0.8)	350 (4.3)	26 (0.8)	379 (3.6)
Philippines	15 (1.2)	438 (7.9)	26 (1.2)	400 (5.4)	44 (1.7)	352 (5.8)	15 (0.9)	365 (6.3)
Romania	14 (1.6)	550 (5.0)	30 (1.2)	520 (4.0)	41 (1.7)	450 (4.9)	16 (1.2)	438 (7.3)
Russian Federation	35 (2.2)	543 (3.5)	30 (1.4)	515 (4.5)	21 (1.2)	475 (5.7)	13 (0.6)	474 (3.9)
Saudi Arabia r	24 (1.9)	374 (6.3)	45 (1.6)	337 (5.5)	13 (1.0)	310 (5.2)	19 (1.7)	324 (6.3)
Scotland	x x	x x	x x	x x	x x	x x	x x	x x
Serbia	15 (1.1)	547 (3.7)	27 (0.9)	524 (2.8)	48 (1.3)	445 (2.9)	10 (0.6)	429 (5.2)
Singapore r	13 (0.5)	655 (3.3)	43 (1.1)	627 (2.9)	28 (1.0)	566 (5.0)	15 (0.5)	603 (5.1)
Slovak Republic r	25 (1.8)	570 (3.9)	27 (1.1)	542 (3.8)	36 (1.5)	479 (3.1)	13 (0.8)	471 (5.8)
Slovenia r	18 (1.1)	544 (3.5)	26 (0.9)	525 (3.0)	42 (1.1)	464 (2.7)	14 (0.8)	486 (4.9)
South Africa r	8 (1.0)	391 (16.2)	26 (0.9)	293 (7.8)	54 (1.2)	240 (3.7)	12 (0.8)	232 (6.5)
Sweden s	32 (1.4)	536 (3.8)	14 (0.8)	513 (5.4)	33 (1.5)	482 (3.5)	21 (0.9)	502 (4.2)
Tunisia	8 (0.7)	453 (5.7)	46 (1.1)	417 (2.8)	26 (0.8)	396 (2.7)	21 (0.7)	406 (2.5)
United States r	48 (1.3)	535 (3.7)	27 (0.8)	496 (3.3)	16 (0.7)	458 (3.3)	9 (0.3)	494 (4.1)
‡ England	x x	x x	x x	x x	x x	x x	x x	x x
International Avg.	21 (0.2)	516 (0.9)	33 (0.2)	485 (0.7)	30 (0.2)	434 (0.7)	15 (0.1)	447 (0.8)
Benchmarking Participants								
Basque Country, Spain	23 (1.7)	519 (4.3)	27 (1.3)	503 (4.2)	18 (1.2)	461 (4.4)	32 (1.3)	469 (3.1)
Indiana State, US r	40 (2.4)	535 (7.5)	33 (1.5)	512 (5.0)	16 (1.5)	472 (4.9)	11 (1.0)	497 (7.2)
Ontario Province, Can. s	39 (2.2)	558 (3.3)	26 (1.4)	534 (3.5)	22 (1.7)	491 (3.4)	13 (0.9)	519 (4.4)
Quebec Province, Can. r	26 (1.6)	568 (4.8)	28 (1.1)	551 (4.0)	35 (1.9)	525 (2.4)	11 (0.7)	550 (4.6)

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.

in relation to their average mathematics achievement, shows that this remains true for the TIMSS 2003 countries, and holds also for mathematics 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 21 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. Even though most of these countries had relatively low mathematics achievement, Singapore was a notable exception, with average achievement among those *sometimes or never* speaking the language of the test at home well above the international average for students *always* 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,

Exhibit 4.3: Students Speak Language of the Test at Home

MATHEMATICS Grade 8

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)	477 (3.3)	16 (0.8)	491 (4.0)	4 (0.5)	461 (8.4)	0 (0.1)	~ ~
Australia	80 (2.3)	503 (4.1)	12 (1.1)	510 (10.9)	7 (1.3)	534 (15.1)	1 (0.4)	~ ~
Bahrain	66 (1.1)	398 (2.2)	15 (0.7)	424 (3.4)	15 (0.7)	399 (3.7)	4 (0.5)	384 (5.9)
Belgium (Flemish)	77 (1.3)	547 (2.7)	11 (0.6)	527 (6.9)	9 (0.8)	483 (8.3)	4 (0.6)	513 (8.0)
Botswana	5 (0.3)	375 (10.3)	6 (0.4)	402 (8.0)	80 (0.8)	367 (2.6)	9 (0.6)	329 (6.2)
Bulgaria	81 (2.0)	477 (4.0)	10 (0.8)	493 (9.5)	8 (1.4)	454 (12.1)	1 (0.3)	~ ~
Chile	87 (0.7)	390 (3.3)	9 (0.5)	386 (4.5)	4 (0.4)	334 (8.2)	0 (0.1)	~ ~
Chinese Taipei	44 (1.5)	609 (3.9)	36 (1.0)	586 (4.7)	19 (1.2)	537 (8.6)	1 (0.2)	~ ~
Cyprus	79 (0.8)	460 (1.8)	14 (0.6)	469 (4.6)	6 (0.4)	447 (6.7)	2 (0.2)	~ ~
Egypt	61 (1.3)	403 (3.7)	14 (0.8)	428 (5.6)	22 (1.0)	415 (4.4)	3 (0.3)	389 (10.6)
Estonia	90 (0.6)	532 (3.2)	8 (0.4)	532 (4.5)	2 (0.3)	~ ~	1 (0.2)	~ ~
Ghana	23 (1.1)	272 (5.3)	10 (0.7)	295 (8.7)	63 (1.3)	285 (4.6)	5 (0.9)	189 (12.2)
Hong Kong, SAR	77 (0.8)	596 (2.8)	15 (0.6)	566 (6.1)	7 (0.5)	541 (8.5)	1 (0.2)	~ ~
Hungary	95 (0.4)	529 (3.2)	4 (0.4)	533 (9.3)	0 (0.1)	~ ~	0 (0.1)	~ ~
Indonesia	22 (2.0)	406 (7.1)	11 (0.7)	420 (7.5)	57 (2.0)	410 (5.3)	10 (0.8)	412 (7.0)
Iran, Islamic Rep. of	55 (3.2)	422 (3.0)	9 (0.6)	428 (4.8)	21 (1.8)	392 (3.4)	15 (1.9)	391 (5.4)
Israel	79 (1.0)	496 (3.6)	15 (0.7)	506 (5.8)	5 (0.5)	484 (6.1)	1 (0.2)	~ ~
Italy	94 (0.5)	486 (3.1)	3 (0.3)	475 (8.2)	3 (0.3)	424 (10.2)	1 (0.2)	~ ~
Japan	94 (0.4)	572 (2.1)	4 (0.3)	542 (6.8)	1 (0.2)	~ ~	0 (0.1)	~ ~
Jordan	72 (1.2)	420 (3.8)	13 (0.7)	459 (7.6)	11 (0.7)	424 (5.8)	4 (0.5)	423 (17.7)
Korea, Rep. of	71 (0.8)	588 (2.5)	28 (0.8)	595 (2.9)	1 (0.2)	~ ~	0 (0.0)	~ ~
Latvia	77 (1.9)	511 (3.4)	14 (0.9)	509 (4.1)	6 (1.3)	486 (8.0)	2 (0.5)	~ ~
Lebanon	5 (0.5)	425 (8.1)	12 (0.7)	442 (5.1)	68 (1.1)	433 (3.2)	15 (0.8)	428 (5.0)
Lithuania	89 (1.0)	501 (2.6)	9 (0.5)	508 (5.5)	2 (0.4)	~ ~	1 (0.2)	~ ~
Macedonia, Rep. of	89 (1.4)	438 (3.5)	4 (0.4)	429 (8.8)	5 (0.9)	394 (12.2)	2 (0.6)	~ ~
Malaysia	51 (2.1)	490 (4.1)	14 (0.8)	510 (4.5)	28 (1.9)	530 (6.3)	7 (0.8)	551 (9.7)
Moldova, Rep. of	68 (1.6)	461 (4.6)	18 (0.9)	466 (5.3)	13 (1.2)	448 (5.7)	1 (0.2)	~ ~
Morocco	35 (1.8)	375 (3.3)	18 (0.9)	403 (4.4)	39 (1.4)	391 (3.2)	8 (0.8)	394 (6.6)
Netherlands	83 (1.3)	542 (3.8)	12 (1.0)	518 (7.4)	4 (0.5)	491 (12.2)	1 (0.2)	~ ~
New Zealand	80 (1.3)	495 (5.4)	12 (0.8)	487 (7.2)	6 (0.8)	508 (13.4)	1 (0.3)	~ ~
Norway	85 (0.8)	463 (2.4)	10 (0.5)	463 (5.2)	3 (0.4)	427 (8.8)	1 (0.2)	~ ~
Palestinian Nat'l Auth.	73 (1.3)	391 (3.2)	11 (0.6)	410 (5.9)	13 (1.0)	382 (5.6)	2 (0.3)	~ ~
Philippines	2 (0.3)	~ ~	4 (0.3)	386 (10.8)	80 (1.0)	383 (5.3)	14 (0.9)	351 (5.7)
Romania	86 (1.8)	475 (4.9)	8 (0.6)	493 (7.0)	4 (1.0)	453 (17.3)	2 (1.0)	~ ~
Russian Federation	86 (2.0)	507 (3.9)	10 (1.0)	524 (6.5)	4 (1.1)	492 (15.0)	1 (0.3)	~ ~
Saudi Arabia	100 (0.0)	332 (4.6)	0 (0.0)	~ ~	0 (0.0)	~ ~	0 (0.0)	~ ~
Scotland	92 (0.6)	499 (3.7)	5 (0.5)	508 (8.0)	3 (0.3)	446 (10.4)	1 (0.2)	~ ~
Serbia	93 (0.7)	477 (2.6)	5 (0.4)	486 (7.1)	2 (0.4)	~ ~	0 (0.1)	~ ~
Singapore	23 (0.6)	625 (3.8)	19 (0.6)	620 (3.5)	49 (0.8)	595 (4.3)	8 (0.4)	581 (5.7)
Slovak Republic	79 (1.6)	509 (3.5)	12 (0.7)	518 (5.8)	7 (1.0)	480 (8.0)	2 (0.4)	~ ~
Slovenia	80 (1.3)	497 (2.4)	11 (0.7)	488 (3.8)	6 (0.7)	464 (7.1)	2 (0.5)	~ ~
South Africa	18 (1.7)	349 (14.6)	9 (0.7)	319 (13.0)	57 (1.7)	247 (3.1)	15 (1.0)	192 (3.9)
Sweden	84 (1.3)	504 (2.5)	10 (0.8)	491 (5.0)	5 (0.7)	457 (8.8)	1 (0.2)	~ ~
Tunisia	51 (1.7)	408 (2.6)	13 (0.8)	429 (5.1)	28 (1.3)	406 (2.7)	9 (0.9)	411 (5.3)
United States	83 (0.9)	509 (3.1)	10 (0.5)	496 (5.7)	5 (0.4)	464 (6.8)	1 (0.2)	~ ~
‡ England	87 (1.6)	501 (5.3)	10 (1.3)	504 (6.3)	2 (0.6)	~ ~	1 (0.2)	~ ~
International Avg.	68 (0.2)	472 (0.7)	11 (0.1)	477 (1.0)	17 (0.1)	441 (1.4)	4 (0.1)	396 (2.0)
Benchmarking Participants								
Basque Country, Spain	65 (1.6)	487 (3.3)	25 (1.1)	490 (3.5)	8 (0.7)	485 (5.1)	3 (0.5)	476 (10.2)
Indiana State, US	88 (0.9)	509 (5.1)	7 (0.8)	514 (9.0)	4 (0.4)	488 (11.6)	1 (0.2)	~ ~
Ontario Province, Can.	72 (2.0)	520 (2.8)	16 (1.1)	517 (4.8)	9 (0.9)	530 (9.2)	2 (0.3)	~ ~
Quebec Province, Can.	72 (1.8)	545 (3.2)	19 (0.9)	540 (5.0)	7 (0.9)	532 (5.8)	2 (0.4)	~ ~

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 4.3: Students Speak Language of the Test at Home

MATHEMATICS Grade 4

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)	459 (3.6)	11 (0.7)	470 (5.7)	4 (0.4)	427 (11.3)	1 (0.2)	~ ~
Australia	80 (1.7)	500 (4.3)	11 (0.9)	510 (6.1)	8 (1.0)	488 (7.2)	1 (0.2)	~ ~
Belgium (Flemish)	68 (1.4)	558 (1.7)	16 (0.9)	550 (2.9)	12 (1.2)	517 (5.2)	4 (0.5)	533 (6.7)
Chinese Taipei	31 (1.2)	581 (2.3)	41 (0.8)	563 (1.7)	26 (1.1)	548 (2.7)	1 (0.1)	~ ~
Cyprus	72 (1.1)	510 (2.4)	14 (0.7)	526 (4.4)	11 (0.6)	497 (5.8)	3 (0.3)	488 (9.6)
England	82 (1.3)	534 (3.9)	12 (0.8)	540 (5.9)	5 (0.7)	476 (7.9)	1 (0.2)	~ ~
Hong Kong, SAR	51 (1.3)	592 (3.4)	24 (0.8)	568 (3.3)	21 (1.0)	554 (3.8)	4 (0.4)	521 (5.1)
Hungary	91 (0.6)	530 (3.0)	8 (0.6)	536 (6.2)	1 (0.2)	~ ~	0 (0.1)	~ ~
Iran, Islamic Rep. of	53 (3.4)	407 (4.6)	6 (0.5)	405 (9.9)	21 (1.9)	379 (6.0)	20 (2.5)	354 (6.8)
Italy	88 (0.7)	508 (3.7)	3 (0.3)	487 (9.5)	6 (0.5)	470 (7.1)	2 (0.3)	~ ~
Japan	91 (0.5)	568 (1.6)	8 (0.5)	546 (5.2)	1 (0.2)	~ ~	0 (0.1)	~ ~
Latvia	78 (1.5)	537 (2.8)	15 (0.8)	546 (4.6)	6 (0.8)	511 (7.9)	2 (0.4)	~ ~
Lithuania	83 (1.0)	534 (3.1)	13 (0.8)	556 (5.2)	3 (0.6)	494 (10.7)	0 (0.1)	~ ~
Moldova, Rep. of	76 (1.8)	508 (5.4)	14 (1.0)	501 (7.8)	9 (1.1)	502 (8.2)	1 (0.3)	~ ~
Morocco	35 (2.3)	344 (5.9)	11 (0.8)	344 (7.1)	28 (1.6)	362 (6.2)	27 (2.5)	350 (8.9)
Netherlands	75 (1.2)	547 (1.9)	17 (0.9)	532 (3.7)	7 (0.8)	503 (7.1)	1 (0.3)	~ ~
New Zealand	76 (1.0)	500 (2.2)	13 (0.6)	509 (4.8)	11 (0.8)	443 (7.1)	1 (0.2)	~ ~
Norway	78 (1.0)	455 (2.4)	15 (0.8)	458 (3.8)	5 (0.5)	410 (8.3)	1 (0.2)	~ ~
Philippines	6 (0.6)	321 (10.9)	8 (0.9)	336 (21.1)	59 (1.8)	382 (8.5)	27 (2.1)	325 (6.8)
Russian Federation	81 (2.3)	531 (4.7)	8 (0.7)	546 (7.1)	8 (1.7)	532 (15.2)	2 (0.5)	~ ~
Scotland	78 (1.3)	495 (3.2)	10 (0.6)	501 (6.2)	9 (0.8)	466 (6.0)	3 (0.4)	439 (12.7)
Singapore	24 (1.2)	610 (6.2)	22 (1.0)	625 (4.9)	47 (1.5)	580 (5.7)	7 (0.6)	551 (8.6)
Slovenia	72 (1.3)	480 (2.8)	18 (1.1)	496 (3.9)	8 (1.0)	459 (5.5)	2 (0.3)	~ ~
Tunisia	43 (2.5)	342 (6.9)	9 (0.8)	341 (9.4)	36 (2.2)	347 (5.3)	12 (1.5)	353 (9.9)
United States	73 (1.1)	526 (2.4)	13 (0.5)	525 (4.0)	12 (0.8)	477 (4.8)	2 (0.1)	~ ~
International Avg.	67 (0.3)	499 (0.9)	14 (0.2)	501 (1.4)	15 (0.2)	471 (1.6)	5 (0.2)	435 (2.9)
Benchmarking Participants								
Indiana State, US	83 (0.9)	534 (2.8)	11 (0.7)	550 (5.8)	5 (0.7)	502 (8.3)	1 (0.2)	~ ~
Ontario Province, Can.	63 (1.7)	510 (3.5)	24 (1.1)	526 (5.1)	13 (1.1)	492 (6.8)	1 (0.2)	~ ~
Quebec Province, Can.	67 (1.3)	505 (2.6)	24 (0.9)	515 (3.7)	8 (0.8)	490 (5.0)	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.

the Philippines, Singapore, and South Africa, testing in all possible dialects and languages was prohibitive.

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 numbers of books in the home in relation to average mathematics 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 student 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 mathematics achievement. Eighth-grade students reporting more than 200 books in their homes had an average score of 498 on the mathematics scale, compared with an average of just 429 for students reporting 10 books or less, a difference of 69 points. If anything, the difference at fourth grade was even larger, ranging from 521 for students reporting more than 200 books to 457 for students reporting 10 books or less.

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

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.

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 mathematics achievement. About 60 percent of eighth-grade students, on average, reported having a computer at home, and 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 mathematics achievement difference between students with a computer at home and those without was substantial on average – 39 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 mathematics achievement at both grades – a 35 point difference at eighth grade and a 27 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. At the eighth grade, 39 percent of the students, on average, across countries reported using a computer both at home and at school. Eighteen percent reported using a computer at home

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)	497 (4.1)	13 (0.6)	497 (4.8)	28 (0.7)	483 (3.4)
Australia	31 (1.4)	526 (5.0)	23 (0.8)	514 (4.6)	30 (1.0)	501 (6.0)
Bahrain	17 (0.5)	416 (3.1)	14 (0.6)	426 (3.7)	31 (0.8)	407 (2.1)
Belgium (Flemish)	12 (0.6)	560 (4.6)	15 (0.6)	558 (3.6)	34 (0.9)	544 (2.9)
Botswana	4 (0.5)	401 (12.5)	5 (0.3)	400 (6.9)	13 (0.6)	386 (5.8)
Bulgaria	28 (1.3)	502 (6.3)	18 (0.9)	492 (5.3)	25 (1.1)	472 (4.3)
Chile	5 (0.4)	461 (5.9)	7 (0.4)	444 (5.1)	27 (0.9)	415 (3.7)
Chinese Taipei	15 (1.0)	639 (4.9)	14 (0.6)	622 (4.8)	30 (0.7)	600 (4.7)
Cyprus	11 (0.5)	492 (4.6)	16 (0.7)	478 (3.6)	35 (0.8)	472 (2.5)
Egypt	6 (0.4)	433 (8.8)	6 (0.4)	426 (9.5)	18 (0.7)	426 (4.8)
Estonia	45 (1.2)	549 (3.3)	18 (0.6)	534 (3.6)	23 (0.7)	515 (3.5)
Ghana	10 (0.6)	275 (7.2)	6 (0.4)	300 (9.6)	16 (0.7)	294 (7.8)
Hong Kong, SAR	9 (0.6)	608 (6.3)	8 (0.4)	611 (4.6)	27 (0.6)	595 (3.6)
Hungary	31 (1.2)	567 (3.3)	22 (0.7)	543 (3.7)	29 (1.0)	516 (3.5)
Indonesia	1 (0.2)	~ ~	3 (0.3)	443 (10.2)	19 (0.7)	423 (5.8)
Iran, Islamic Rep. of	7 (0.5)	456 (5.8)	5 (0.3)	452 (5.2)	17 (0.8)	432 (3.6)
Israel	22 (0.9)	520 (4.6)	22 (0.7)	514 (3.9)	33 (0.8)	492 (4.2)
Italy	19 (0.9)	516 (4.7)	14 (0.6)	501 (4.2)	25 (0.7)	489 (3.8)
Japan	17 (0.7)	604 (3.5)	17 (0.5)	587 (3.5)	32 (0.8)	571 (2.4)
Jordan	9 (0.6)	456 (9.1)	8 (0.5)	463 (7.7)	28 (0.9)	445 (4.8)
Korea, Rep. of	19 (0.8)	636 (3.3)	22 (0.7)	608 (2.9)	33 (0.8)	586 (2.4)
Latvia	28 (1.3)	528 (4.3)	25 (0.8)	515 (4.2)	31 (1.1)	505 (3.3)
Lebanon	8 (0.6)	447 (6.6)	8 (0.8)	465 (6.5)	25 (1.0)	457 (3.9)
Lithuania	12 (0.8)	540 (5.2)	15 (0.7)	532 (3.9)	34 (0.9)	509 (2.4)
Macedonia, Rep. of	8 (0.7)	452 (8.2)	8 (0.6)	475 (6.6)	28 (0.9)	465 (3.8)
Malaysia	5 (0.5)	555 (8.0)	9 (0.6)	539 (6.0)	28 (0.8)	524 (4.4)
Moldova, Rep. of	8 (0.8)	488 (6.7)	9 (0.6)	483 (7.0)	23 (1.0)	471 (4.6)
Morocco	5 (0.6)	396 (11.4)	4 (0.3)	403 (6.6)	21 (0.9)	391 (4.5)
Netherlands	21 (1.4)	565 (5.3)	19 (0.9)	558 (4.6)	31 (1.3)	539 (3.8)
New Zealand	25 (1.5)	527 (8.0)	22 (1.1)	508 (4.4)	31 (1.0)	489 (5.2)
Norway	27 (1.2)	481 (3.2)	22 (0.7)	477 (3.1)	33 (0.9)	460 (3.0)
Palestinian Nat'l Auth.	7 (0.5)	402 (7.9)	6 (0.4)	420 (7.1)	24 (0.7)	413 (4.2)
Philippines	3 (0.3)	372 (9.4)	4 (0.3)	403 (12.4)	17 (0.8)	410 (7.2)
Romania	12 (1.2)	529 (6.6)	13 (1.1)	517 (5.1)	29 (1.2)	489 (4.1)
Russian Federation	21 (1.3)	534 (4.4)	26 (0.9)	521 (3.6)	32 (1.4)	505 (4.4)
Saudi Arabia	10 (0.7)	347 (8.5)	9 (0.9)	355 (9.0)	25 (1.0)	347 (5.7)
Scotland	17 (1.0)	539 (5.6)	16 (0.7)	527 (4.0)	29 (0.8)	504 (3.8)
Serbia	6 (0.5)	519 (5.8)	9 (0.5)	534 (4.9)	27 (1.0)	500 (3.2)
Singapore	14 (0.5)	642 (3.5)	16 (0.5)	627 (3.7)	33 (0.7)	617 (3.2)
Slovak Republic	12 (0.8)	551 (5.4)	18 (0.8)	543 (3.9)	41 (0.9)	514 (3.1)
Slovenia	13 (0.7)	517 (5.3)	15 (0.7)	513 (4.4)	38 (0.9)	501 (2.1)
South Africa	6 (0.5)	324 (17.5)	5 (0.4)	325 (19.5)	14 (0.7)	304 (11.7)
Sweden	32 (1.3)	531 (2.7)	21 (0.6)	513 (3.1)	27 (0.9)	485 (3.4)
Tunisia	4 (0.4)	453 (7.8)	6 (0.5)	436 (6.6)	22 (0.9)	422 (3.4)
United States	24 (0.9)	541 (4.4)	18 (0.5)	528 (3.4)	28 (0.6)	506 (3.0)
‡ England	24 (1.1)	539 (6.9)	18 (1.0)	518 (6.7)	27 (1.0)	494 (5.5)
International Avg.	15 (0.1)	498 (1.0)	13 (0.1)	492 (1.0)	27 (0.1)	476 (0.6)
Benchmarking Participants						
Basque Country, Spain	25 (1.4)	509 (3.5)	20 (0.9)	497 (3.6)	36 (1.3)	486 (3.1)
Indiana State, US	19 (1.6)	541 (8.8)	17 (0.9)	526 (6.8)	32 (1.0)	514 (4.6)
Ontario Province, Can.	28 (1.6)	544 (3.4)	21 (0.9)	532 (3.5)	31 (1.1)	513 (3.7)
Quebec Province, Can.	13 (0.8)	561 (4.9)	16 (0.9)	563 (5.5)	33 (0.9)	547 (3.1)

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)	466 (4.2)	15 (0.9)	449 (4.5)
Australia	11 (0.8)	477 (7.1)	5 (0.5)	448 (10.8)
Bahrain	26 (0.8)	384 (3.4)	11 (0.5)	376 (3.9)
Belgium (Flemish)	25 (0.8)	527 (4.0)	14 (0.7)	497 (5.9)
Botswana	30 (0.9)	368 (4.1)	48 (1.3)	355 (2.6)
Bulgaria	15 (0.7)	453 (5.7)	14 (1.6)	441 (11.2)
Chile	37 (0.9)	374 (3.1)	23 (1.2)	342 (3.8)
Chinese Taipei	24 (0.9)	564 (4.8)	17 (0.9)	513 (5.3)
Cyprus	27 (0.7)	441 (3.4)	11 (0.5)	410 (4.2)
Egypt	38 (0.8)	408 (3.8)	33 (1.2)	398 (3.5)
Estonia	11 (0.6)	503 (4.4)	3 (0.3)	476 (6.8)
Ghana	34 (1.0)	285 (6.0)	34 (1.5)	264 (4.7)
Hong Kong, SAR	28 (0.7)	583 (3.9)	28 (0.7)	567 (4.4)
Hungary	13 (0.6)	481 (4.7)	5 (0.7)	433 (9.1)
Indonesia	45 (0.9)	404 (5.2)	32 (1.0)	408 (5.7)
Iran, Islamic Rep. of	31 (0.8)	411 (2.7)	39 (1.3)	391 (2.7)
Israel	17 (0.8)	466 (4.4)	6 (0.4)	465 (7.0)
Italy	29 (0.7)	464 (3.9)	13 (0.7)	450 (4.8)
Japan	22 (0.6)	553 (3.2)	13 (0.7)	533 (3.7)
Jordan	33 (0.9)	416 (3.8)	23 (0.8)	398 (4.2)
Korea, Rep. of	10 (0.6)	555 (3.8)	15 (0.7)	534 (3.4)
Latvia	12 (0.7)	480 (5.6)	4 (0.4)	453 (8.2)
Lebanon	36 (1.1)	422 (3.5)	23 (1.4)	410 (3.0)
Lithuania	30 (1.1)	477 (3.0)	10 (0.7)	455 (5.9)
Macedonia, Rep. of	40 (1.2)	427 (3.6)	17 (0.8)	388 (5.2)
Malaysia	40 (1.0)	498 (4.0)	17 (0.9)	477 (4.7)
Moldova, Rep. of	37 (1.2)	457 (4.8)	23 (1.1)	438 (6.2)
Morocco	38 (1.0)	385 (3.2)	33 (1.4)	387 (3.2)
Netherlands	19 (1.2)	504 (6.5)	10 (0.8)	490 (6.2)
New Zealand	14 (0.8)	464 (5.2)	8 (0.7)	439 (8.9)
Norway	11 (0.6)	425 (4.2)	7 (0.4)	408 (7.2)
Palestinian Nat'l Auth.	36 (0.8)	387 (3.6)	27 (1.0)	371 (3.5)
Philippines	34 (0.8)	382 (4.8)	43 (1.0)	361 (5.4)
Romania	27 (1.4)	454 (5.1)	20 (1.7)	430 (8.1)
Russian Federation	17 (1.1)	476 (5.3)	4 (0.5)	457 (9.1)
Saudi Arabia	33 (1.1)	321 (5.1)	23 (1.4)	318 (4.6)
Scotland	21 (1.0)	471 (4.4)	16 (0.9)	450 (4.8)
Serbia	38 (1.0)	466 (2.9)	21 (1.1)	435 (4.5)
Singapore	24 (0.7)	580 (5.1)	12 (0.7)	554 (5.2)
Slovak Republic	24 (1.1)	465 (3.8)	5 (0.5)	424 (7.3)
Slovenia	27 (0.7)	474 (3.6)	8 (0.6)	444 (5.4)
South Africa	31 (0.9)	261 (5.0)	44 (1.3)	241 (3.1)
Sweden	14 (0.7)	460 (4.0)	6 (0.6)	447 (6.3)
Tunisia	44 (1.1)	404 (2.2)	23 (1.1)	400 (2.3)
United States	18 (0.6)	473 (3.5)	13 (0.6)	449 (4.2)
‡ England	17 (0.9)	480 (5.9)	13 (1.1)	446 (5.7)
International Avg.	26 (0.1)	449 (0.7)	18 (0.1)	429 (1.0)
Benchmarking Participants				
Basque Country, Spain	15 (0.8)	458 (3.4)	5 (0.5)	430 (7.5)
Indiana State, US	19 (1.0)	484 (5.9)	14 (1.2)	467 (5.4)
Ontario Province, Can.	14 (0.9)	494 (4.2)	7 (0.6)	482 (6.7)
Quebec Province, Can.	24 (1.1)	529 (2.5)	14 (0.7)	521 (3.4)

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 4.4: 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)	476 (4.8)	14 (0.7)	474 (5.7)	29 (1.1)	474 (3.6)
Australia	23 (1.3)	517 (4.7)	23 (1.1)	519 (4.2)	34 (1.1)	496 (3.8)
Belgium (Flemish)	11 (0.7)	559 (3.7)	17 (0.7)	567 (2.7)	42 (1.0)	558 (1.8)
Chinese Taipei	15 (0.8)	588 (3.1)	14 (0.6)	584 (3.0)	30 (0.7)	571 (2.1)
Cyprus	9 (0.7)	518 (5.5)	14 (0.7)	527 (4.8)	38 (1.0)	523 (3.0)
England	19 (1.2)	565 (6.0)	20 (1.0)	552 (4.9)	35 (1.2)	536 (4.5)
Hong Kong, SAR	7 (0.6)	587 (5.8)	10 (0.8)	590 (5.0)	28 (1.0)	585 (3.9)
Hungary	18 (1.1)	561 (4.6)	17 (0.8)	552 (4.3)	35 (1.0)	537 (3.1)
Iran, Islamic Rep. of	5 (0.6)	424 (10.4)	5 (0.5)	409 (11.6)	13 (0.9)	423 (6.3)
Italy	10 (0.8)	505 (5.3)	11 (0.6)	515 (4.7)	27 (0.8)	515 (4.3)
Japan	7 (0.4)	590 (5.1)	14 (0.6)	587 (4.1)	40 (0.9)	575 (1.9)
Latvia	17 (0.9)	550 (4.0)	21 (0.9)	551 (3.7)	38 (1.1)	542 (3.5)
Lithuania	8 (0.6)	556 (6.0)	11 (0.6)	562 (4.9)	36 (1.0)	551 (3.1)
Moldova, Rep. of	6 (0.6)	536 (10.2)	8 (0.7)	539 (7.3)	24 (1.2)	527 (6.0)
Morocco r	2 (0.3)	~ ~	3 (0.3)	362 (11.6)	10 (1.0)	371 (9.7)
Netherlands	14 (1.1)	563 (4.0)	18 (1.0)	554 (3.3)	37 (1.2)	542 (2.3)
New Zealand	17 (0.7)	523 (3.5)	21 (0.8)	520 (4.0)	36 (1.0)	499 (2.7)
Norway	17 (0.9)	469 (4.0)	22 (0.8)	471 (3.6)	37 (0.9)	457 (2.8)
Philippines	5 (0.6)	333 (13.6)	6 (0.6)	366 (21.8)	14 (1.1)	399 (18.0)
Russian Federation	13 (0.7)	548 (6.7)	15 (0.8)	544 (6.6)	35 (1.2)	539 (4.9)
Scotland	21 (1.1)	507 (5.3)	18 (0.8)	512 (5.5)	31 (1.0)	500 (3.2)
Singapore	10 (0.6)	628 (6.4)	17 (0.9)	622 (5.6)	40 (0.9)	609 (5.0)
Slovenia	13 (0.9)	482 (6.9)	15 (0.9)	501 (5.1)	36 (0.9)	495 (2.8)
Tunisia r	4 (0.6)	378 (12.6)	8 (0.8)	374 (10.4)	18 (1.2)	375 (6.9)
United States	15 (0.7)	545 (3.6)	17 (0.5)	548 (2.9)	34 (0.7)	526 (2.4)
International Avg.	12 (0.2)	521 (1.4)	14 (0.2)	516 (1.5)	31 (0.2)	509 (1.2)
Benchmarking Participants						
Indiana State, US	16 (1.1)	542 (5.1)	19 (1.1)	555 (4.9)	36 (1.1)	540 (2.8)
Ontario Province, Can.	20 (1.4)	531 (5.5)	22 (1.1)	526 (5.3)	35 (1.3)	510 (3.6)
Quebec Province, Can.	7 (0.5)	522 (4.7)	11 (0.7)	528 (3.5)	44 (1.0)	514 (2.6)

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 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)	456 (5.2)	17 (1.2)	434 (6.3)
Australia		13 (0.9)	477 (5.7)	6 (0.8)	437 (9.6)
Belgium (Flemish)		23 (0.9)	537 (3.0)	8 (0.5)	512 (5.2)
Chinese Taipei		24 (0.8)	555 (2.1)	17 (0.8)	527 (2.8)
Cyprus		29 (1.0)	506 (3.3)	11 (0.7)	467 (5.1)
England		17 (1.0)	497 (4.5)	8 (0.8)	466 (5.9)
Hong Kong, SAR		30 (0.8)	572 (3.4)	25 (1.4)	561 (4.0)
Hungary		22 (0.9)	500 (3.8)	8 (0.7)	469 (6.0)
Iran, Islamic Rep. of		22 (1.2)	410 (4.4)	55 (2.1)	374 (4.0)
Italy		33 (1.0)	498 (4.4)	18 (0.9)	489 (7.0)
Japan		28 (0.8)	549 (2.7)	12 (0.8)	528 (3.8)
Latvia		18 (0.9)	517 (4.4)	6 (0.7)	488 (7.6)
Lithuania		34 (1.1)	526 (3.4)	13 (0.9)	491 (5.0)
Moldova, Rep. of		31 (1.4)	502 (6.8)	30 (1.4)	477 (6.3)
Morocco	r	26 (1.5)	352 (5.4)	60 (2.1)	352 (6.4)
Netherlands		21 (1.1)	529 (3.0)	9 (0.8)	500 (6.5)
New Zealand		17 (0.6)	464 (4.4)	9 (0.7)	430 (4.8)
Norway		17 (0.8)	428 (5.6)	7 (0.5)	400 (5.4)
Philippines		27 (1.1)	391 (8.7)	48 (2.1)	332 (5.2)
Russian Federation		27 (1.5)	522 (5.1)	10 (0.7)	499 (8.4)
Scotland		20 (1.1)	469 (4.1)	11 (0.7)	445 (5.3)
Singapore		22 (0.9)	569 (4.9)	11 (0.8)	528 (8.7)
Slovenia		28 (1.1)	466 (3.7)	7 (0.6)	422 (6.1)
Tunisia	r	29 (1.5)	359 (5.2)	41 (2.3)	321 (5.5)
United States		22 (0.6)	496 (2.7)	13 (0.6)	473 (3.0)
International Avg.		24 (0.2)	486 (1.0)	18 (0.2)	457 (1.2)
Benchmarking Participants					
Indiana State, US		19 (1.2)	515 (3.7)	10 (0.8)	490 (6.7)
Ontario Province, Can.		16 (1.3)	494 (4.2)	7 (0.9)	463 (5.7)
Quebec Province, Can.		27 (0.8)	496 (2.9)	11 (0.7)	478 (4.7)

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 4.5: Computer and Study Desk/Table in the Home

MATHEMATICS Grade 8

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)	479 (4.4)	81 (0.7)	479 (3.3)	64 (1.1)	489 (3.1)	36 (1.1)	461 (4.0)
Australia	96 (0.3)	508 (4.6)	4 (0.3)	448 (9.6)	92 (0.5)	508 (4.8)	8 (0.5)	484 (5.8)
Bahrain	81 (0.6)	407 (1.6)	19 (0.6)	379 (3.7)	80 (0.7)	407 (1.9)	20 (0.7)	382 (3.5)
Belgium (Flemish)	95 (0.5)	541 (2.7)	5 (0.5)	476 (8.7)	95 (0.4)	540 (2.7)	5 (0.4)	495 (6.2)
Botswana	16 (0.8)	370 (7.2)	84 (0.8)	369 (2.3)	68 (0.8)	376 (2.7)	32 (0.8)	354 (3.6)
Bulgaria	37 (1.5)	493 (5.7)	63 (1.5)	470 (4.7)	79 (1.2)	482 (4.4)	21 (1.2)	458 (7.6)
Chile	39 (1.4)	423 (3.6)	61 (1.4)	365 (3.2)	56 (1.0)	403 (3.3)	44 (1.0)	368 (3.8)
Chinese Taipei	91 (0.8)	592 (4.4)	9 (0.8)	512 (6.0)	93 (0.5)	589 (4.5)	7 (0.5)	537 (6.9)
Cyprus	82 (0.6)	470 (1.5)	18 (0.6)	417 (4.2)	95 (0.3)	464 (1.5)	5 (0.3)	391 (6.6)
Egypt	16 (0.8)	443 (5.5)	84 (0.8)	403 (3.6)	80 (1.0)	423 (3.4)	20 (1.0)	360 (4.0)
Estonia	67 (1.1)	540 (3.1)	33 (1.1)	515 (3.3)	93 (0.6)	531 (3.1)	7 (0.6)	532 (5.6)
Ghana	24 (1.1)	272 (6.4)	76 (1.1)	284 (4.8)	60 (1.5)	298 (4.8)	40 (1.5)	258 (5.1)
Hong Kong, SAR	97 (0.3)	588 (3.3)	3 (0.3)	560 (8.5)	75 (0.8)	590 (3.4)	25 (0.8)	577 (4.0)
Hungary	75 (1.0)	542 (3.0)	25 (1.0)	497 (4.9)	98 (0.3)	531 (3.1)	2 (0.3)	~ ~
Indonesia	17 (1.3)	431 (5.4)	83 (1.3)	412 (4.9)	75 (1.2)	418 (4.7)	25 (1.2)	393 (5.6)
Iran, Islamic Rep. of	27 (1.4)	433 (4.0)	73 (1.4)	407 (2.3)	50 (1.6)	426 (2.5)	50 (1.6)	399 (2.7)
Israel	92 (0.7)	501 (3.4)	8 (0.7)	442 (9.3)	97 (0.3)	498 (3.5)	3 (0.3)	464 (9.4)
Italy	84 (0.7)	490 (3.2)	16 (0.7)	453 (4.4)	88 (0.6)	486 (3.2)	12 (0.6)	467 (4.8)
Japan	82 (0.8)	576 (2.1)	18 (0.8)	542 (3.1)	96 (0.3)	572 (2.0)	4 (0.3)	537 (8.0)
Jordan	41 (1.7)	454 (5.8)	59 (1.7)	407 (3.6)	73 (1.3)	435 (4.3)	27 (1.3)	400 (5.2)
Korea, Rep. of	98 (0.3)	591 (2.1)	2 (0.3)	~ ~	97 (0.3)	592 (2.1)	3 (0.3)	516 (9.0)
Latvia	43 (1.6)	523 (3.4)	57 (1.6)	499 (3.5)	94 (0.6)	510 (3.3)	6 (0.6)	498 (6.3)
Lebanon	59 (1.5)	444 (3.5)	41 (1.5)	419 (3.6)	71 (1.2)	440 (3.3)	29 (1.2)	418 (3.5)
Lithuania	48 (1.6)	522 (2.9)	52 (1.6)	482 (2.6)	97 (0.3)	502 (2.6)	3 (0.3)	471 (12.0)
Macedonia, Rep. of	42 (1.6)	452 (4.9)	58 (1.6)	427 (3.4)	87 (0.8)	442 (3.6)	13 (0.8)	401 (6.5)
Malaysia	57 (1.4)	525 (4.8)	43 (1.4)	487 (3.9)	87 (0.6)	511 (4.2)	13 (0.6)	489 (5.8)
Moldova, Rep. of	18 (1.0)	465 (5.7)	82 (1.0)	460 (4.1)	80 (1.2)	463 (4.2)	20 (1.2)	449 (5.2)
Morocco	18 (1.2)	391 (4.6)	82 (1.2)	388 (2.7)	73 (1.4)	392 (2.6)	27 (1.4)	379 (4.4)
Netherlands	98 (0.3)	538 (3.9)	2 (0.3)	~ ~	99 (0.2)	537 (3.9)	1 (0.2)	~ ~
New Zealand	91 (0.7)	497 (5.5)	9 (0.7)	471 (7.6)	87 (0.8)	499 (5.3)	13 (0.8)	465 (7.2)
Norway	96 (0.4)	464 (2.4)	4 (0.4)	415 (9.5)	98 (0.3)	463 (2.4)	2 (0.3)	~ ~
Palestinian Nat'l Auth.	41 (1.2)	409 (4.1)	59 (1.2)	380 (3.0)	77 (1.3)	396 (3.2)	23 (1.3)	377 (4.4)
Philippines	21 (1.1)	391 (8.1)	79 (1.1)	376 (5.1)	75 (1.1)	386 (5.4)	25 (1.1)	358 (5.6)
Romania	32 (1.9)	507 (5.8)	68 (1.9)	465 (4.6)	77 (1.8)	492 (4.3)	23 (1.8)	432 (6.9)
Russian Federation	30 (2.0)	533 (4.8)	70 (2.0)	498 (3.6)	92 (0.5)	511 (3.8)	8 (0.5)	484 (5.9)
Saudi Arabia	57 (1.9)	342 (5.5)	43 (1.9)	320 (3.7)	61 (1.5)	341 (5.2)	39 (1.5)	321 (4.2)
Scotland	91 (0.7)	502 (3.7)	9 (0.7)	464 (6.3)	82 (0.8)	503 (3.8)	18 (0.8)	475 (5.3)
Serbia	44 (1.4)	499 (3.5)	56 (1.4)	463 (2.5)	91 (0.6)	481 (2.6)	9 (0.6)	442 (6.6)
Singapore	94 (0.4)	610 (3.4)	6 (0.4)	538 (7.4)	91 (0.5)	609 (3.4)	9 (0.5)	570 (6.2)
Slovak Republic	67 (1.2)	519 (3.5)	33 (1.2)	485 (3.7)	88 (0.8)	512 (3.3)	12 (0.8)	477 (4.9)
Slovenia	86 (0.9)	498 (2.1)	14 (0.9)	469 (4.5)	97 (0.4)	494 (2.1)	3 (0.4)	455 (11.5)
South Africa	37 (1.3)	289 (10.6)	63 (1.3)	251 (4.3)	58 (1.5)	281 (8.5)	42 (1.5)	245 (3.6)
Sweden	98 (0.3)	500 (2.6)	2 (0.3)	~ ~	98 (0.3)	500 (2.6)	2 (0.3)	~ ~
Tunisia	22 (1.4)	432 (4.5)	78 (1.4)	404 (2.0)	73 (1.2)	415 (2.4)	27 (1.2)	398 (2.5)
United States	93 (0.4)	509 (3.3)	7 (0.4)	453 (4.9)	86 (0.5)	510 (3.3)	14 (0.5)	475 (4.0)
‡ England	94 (0.5)	503 (5.1)	6 (0.5)	460 (8.1)	87 (1.0)	505 (4.9)	13 (1.0)	472 (6.4)
International Avg.	60 (0.2)	479 (0.7)	40 (0.2)	440 (0.9)	83 (0.1)	473 (0.6)	17 (0.1)	438 (1.0)
Benchmarking Participants								
Basque Country, Spain	89 (0.7)	490 (2.9)	11 (0.7)	464 (4.8)	93 (0.6)	489 (2.8)	7 (0.6)	462 (6.9)
Indiana State, US	92 (0.9)	511 (5.3)	8 (0.9)	479 (8.0)	84 (0.9)	512 (5.3)	16 (0.9)	490 (7.1)
Ontario Province, Can.	97 (0.4)	522 (3.0)	3 (0.4)	479 (9.1)	91 (0.7)	523 (3.0)	9 (0.7)	497 (5.4)
Quebec Province, Can.	93 (0.5)	545 (3.2)	7 (0.5)	520 (3.2)	91 (0.6)	545 (3.2)	9 (0.6)	528 (3.9)

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

MATHEMATICS Grade 4

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)	462 (4.5)	72 (1.2)	460 (3.8)	60 (1.5)	467 (3.9)	40 (1.5)	449 (4.2)
Australia	92 (0.9)	503 (3.8)	8 (0.9)	461 (7.1)	85 (1.1)	504 (3.6)	15 (1.1)	479 (6.8)
Belgium (Flemish)	90 (0.5)	553 (1.8)	10 (0.5)	534 (3.5)	91 (0.5)	551 (1.8)	9 (0.5)	547 (3.5)
Chinese Taipei	89 (0.7)	568 (1.8)	11 (0.7)	535 (3.0)	87 (0.6)	567 (1.8)	13 (0.6)	549 (3.0)
Cyprus	75 (0.7)	517 (2.6)	25 (0.7)	496 (3.5)	90 (0.5)	516 (2.4)	10 (0.5)	470 (4.3)
England	91 (0.6)	537 (3.8)	9 (0.6)	494 (5.4)	80 (1.1)	537 (3.9)	20 (1.1)	514 (5.0)
Hong Kong, SAR	85 (1.0)	577 (3.2)	15 (1.0)	565 (3.7)	71 (1.1)	574 (3.2)	29 (1.1)	578 (3.8)
Hungary	71 (1.2)	542 (3.0)	29 (1.2)	509 (4.1)	96 (0.5)	532 (2.9)	4 (0.5)	477 (10.5)
Iran, Islamic Rep. of	25 (1.7)	411 (5.4)	75 (1.7)	385 (4.3)	40 (1.8)	420 (4.3)	60 (1.8)	373 (4.7)
Italy	79 (0.7)	506 (3.4)	21 (0.7)	497 (5.6)	72 (0.9)	508 (3.8)	28 (0.9)	492 (4.5)
Japan	77 (0.8)	570 (1.8)	23 (0.8)	549 (2.5)	94 (0.4)	566 (1.6)	6 (0.4)	547 (5.5)
Latvia	42 (1.4)	545 (3.7)	58 (1.4)	533 (3.0)	91 (0.7)	537 (2.9)	9 (0.7)	526 (5.5)
Lithuania	45 (1.4)	548 (4.1)	55 (1.4)	526 (3.0)	97 (0.3)	537 (3.0)	3 (0.3)	503 (13.3)
Moldova, Rep. of	20 (1.1)	507 (6.9)	80 (1.1)	507 (4.8)	81 (1.2)	509 (5.1)	19 (1.2)	488 (5.8)
Morocco	r 20 (1.2)	354 (7.4)	r 80 (1.2)	352 (5.2)	r 52 (1.8)	361 (5.8)	r 48 (1.8)	344 (6.1)
Netherlands	93 (0.6)	543 (2.0)	7 (0.6)	511 (6.3)	94 (0.5)	542 (2.1)	6 (0.5)	524 (6.1)
New Zealand	87 (0.7)	502 (2.1)	13 (0.7)	464 (5.5)	80 (0.7)	501 (2.2)	20 (0.7)	475 (4.2)
Norway	91 (0.5)	458 (2.3)	9 (0.5)	412 (5.0)	92 (0.5)	458 (2.4)	8 (0.5)	405 (7.0)
Philippines	26 (1.7)	400 (16.5)	74 (1.7)	348 (5.8)	69 (1.3)	372 (7.8)	31 (1.3)	338 (9.5)
Russian Federation	23 (1.1)	540 (6.3)	77 (1.1)	530 (4.7)	83 (0.9)	535 (4.9)	17 (0.9)	521 (5.5)
Scotland	89 (0.8)	496 (3.2)	11 (0.8)	468 (5.1)	77 (1.1)	498 (3.1)	23 (1.1)	471 (4.7)
Singapore	89 (0.8)	601 (5.4)	11 (0.8)	546 (6.5)	90 (0.7)	600 (5.4)	10 (0.7)	547 (8.5)
Slovenia	77 (1.0)	492 (2.9)	23 (1.0)	454 (3.8)	91 (0.6)	480 (2.7)	9 (0.6)	474 (7.0)
Tunisia	26 (1.3)	365 (6.6)	74 (1.3)	336 (4.7)	64 (1.8)	357 (5.3)	36 (1.8)	325 (6.1)
United States	92 (0.4)	523 (2.3)	8 (0.4)	478 (4.2)	77 (0.8)	528 (2.3)	23 (0.8)	492 (3.3)
International Avg.	65 (0.2)	505 (1.1)	35 (0.2)	478 (0.9)	80 (0.2)	502 (0.8)	20 (0.2)	476 (1.2)
Benchmarking Participants								
Indiana State, US	90 (0.8)	537 (2.8)	10 (0.8)	505 (4.8)	80 (0.9)	538 (2.8)	20 (0.9)	517 (4.6)
Ontario Province, Can.	92 (0.6)	515 (3.9)	8 (0.6)	473 (6.0)	83 (1.1)	516 (3.9)	17 (1.1)	490 (4.2)
Quebec Province, Can.	89 (0.8)	509 (2.4)	11 (0.8)	484 (4.2)	86 (0.9)	511 (2.3)	14 (0.9)	480 (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 4.6: 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)	591 (2.9)	9 (0.6)	554 (8.1)	2 (0.2)	~ ~
Chinese Taipei	88 (0.9)	595 (4.4)	2 (0.2)	~ ~	9 (0.8)	509 (6.4)
Australia	83 (0.9)	512 (4.6)	10 (0.9)	498 (7.3)	5 (0.4)	447 (9.1)
Singapore	79 (0.7)	615 (3.4)	14 (0.5)	589 (4.5)	5 (0.4)	537 (7.9)
United States	79 (1.0)	515 (3.1)	11 (0.9)	481 (6.7)	8 (0.4)	452 (4.6)
Netherlands	78 (1.5)	542 (3.7)	19 (1.4)	526 (6.9)	1 (0.2)	~ ~
Sweden	78 (1.3)	505 (2.7)	17 (1.3)	488 (4.6)	3 (0.3)	463 (6.4)
Scotland	77 (1.1)	506 (3.8)	12 (0.9)	482 (5.8)	9 (0.6)	463 (5.5)
Israel	72 (1.8)	506 (3.6)	19 (1.6)	492 (5.1)	6 (0.5)	446 (8.9)
New Zealand	71 (1.4)	505 (5.9)	16 (1.3)	490 (5.4)	10 (0.7)	463 (7.9)
Norway	71 (1.5)	468 (2.6)	22 (1.4)	457 (4.4)	5 (0.5)	438 (6.4)
Cyprus	70 (0.7)	476 (1.5)	7 (0.5)	453 (5.3)	16 (0.6)	417 (4.3)
Belgium (Flemish)	64 (1.9)	544 (2.9)	26 (1.8)	536 (5.6)	4 (0.5)	478 (10.9)
Hungary	61 (1.4)	548 (3.0)	8 (1.0)	539 (8.6)	26 (1.1)	493 (5.2)
Japan	55 (1.3)	582 (3.1)	16 (1.1)	580 (6.7)	26 (0.8)	545 (2.8)
Slovenia	51 (1.5)	504 (3.0)	34 (1.7)	491 (2.9)	8 (0.8)	476 (4.6)
Estonia	41 (1.5)	539 (3.4)	24 (1.3)	544 (4.5)	24 (1.1)	516 (3.5)
Lebanon	39 (1.4)	459 (3.9)	16 (1.4)	416 (5.0)	21 (2.0)	426 (5.7)
Italy	39 (1.9)	498 (3.7)	39 (1.9)	491 (3.9)	9 (0.7)	445 (5.8)
Jordan	35 (1.5)	449 (6.3)	10 (0.8)	429 (7.7)	43 (1.5)	413 (3.7)
Korea, Rep. of	35 (1.6)	603 (2.7)	61 (1.7)	587 (2.7)	1 (0.2)	~ ~
Bahrain	31 (1.4)	418 (3.1)	45 (1.4)	403 (2.3)	8 (0.4)	383 (6.0)
Slovak Republic	26 (1.8)	537 (5.3)	33 (2.0)	519 (4.0)	16 (1.5)	486 (5.8)
Lithuania	26 (1.5)	523 (3.4)	22 (1.4)	524 (3.9)	35 (1.6)	482 (3.2)
Malaysia	26 (1.7)	538 (5.3)	26 (1.8)	527 (6.5)	24 (1.7)	491 (5.5)
Palestinian Nat'l Auth.	26 (1.5)	398 (5.3)	18 (1.3)	410 (5.4)	33 (1.6)	378 (3.9)
Latvia	25 (1.3)	536 (4.0)	16 (1.0)	516 (4.5)	42 (1.8)	503 (3.8)
Chile	22 (1.2)	445 (4.0)	11 (0.8)	416 (5.9)	49 (1.8)	364 (3.7)
Egypt	18 (0.7)	419 (5.5)	5 (0.5)	393 (8.9)	62 (1.4)	403 (3.5)
South Africa	16 (1.2)	286 (18.6)	11 (1.1)	309 (15.2)	18 (1.3)	250 (4.8)
Serbia	15 (1.3)	518 (5.1)	22 (1.6)	504 (4.3)	23 (2.0)	471 (4.0)
Moldova, Rep. of	15 (1.2)	459 (8.6)	4 (0.4)	454 (9.2)	63 (2.1)	461 (4.7)
Morocco	15 (1.1)	375 (5.2)	17 (1.1)	386 (4.9)	21 (1.7)	388 (5.1)
Romania	15 (1.7)	515 (6.9)	16 (1.2)	504 (6.4)	25 (2.1)	474 (7.3)
Macedonia, Rep. of	14 (1.2)	461 (6.7)	22 (1.5)	462 (6.3)	21 (2.0)	433 (4.7)
Russian Federation	12 (1.1)	542 (6.3)	19 (2.3)	528 (4.9)	28 (1.8)	505 (3.9)
Saudi Arabia	12 (1.5)	360 (11.9)	46 (2.0)	339 (4.6)	5 (0.8)	332 (6.4)
Philippines	11 (0.9)	411 (12.4)	7 (0.5)	377 (8.9)	24 (1.7)	396 (7.2)
Ghana	9 (0.7)	256 (7.6)	9 (0.7)	258 (10.3)	21 (1.6)	264 (8.0)
Armenia	7 (0.7)	482 (8.3)	14 (0.8)	478 (4.3)	15 (2.0)	488 (6.2)
Indonesia	7 (1.4)	476 (13.6)	2 (0.4)	~ ~	31 (3.2)	432 (6.6)
Tunisia	5 (0.5)	422 (5.6)	20 (1.4)	430 (5.1)	16 (1.5)	408 (3.3)
Bulgaria	5 (0.8)	505 (15.4)	22 (1.4)	502 (5.9)	8 (1.1)	459 (8.8)
Botswana r	5 (0.7)	394 (15.8)	6 (0.5)	381 (9.3)	23 (2.5)	365 (3.8)
Iran, Islamic Rep. of	2 (0.6)	~ ~	17 (1.2)	443 (4.5)	1 (0.3)	~ ~
‡ England	81 (0.8)	508 (5.3)	10 (0.7)	480 (7.0)	7 (0.7)	459 (8.9)
International Avg.	39 (0.2)	485 (1.1)	18 (0.2)	470 (0.9)	19 (0.2)	441 (1.0)
Benchmarking Participants						
Basque Country, Spain	70 (2.1)	494 (2.9)	16 (1.9)	484 (5.5)	11 (0.8)	467 (4.5)
Indiana State, US	81 (1.3)	516 (5.5)	8 (0.9)	482 (7.0)	8 (0.9)	477 (5.8)
Ontario Province, Can.	85 (1.0)	525 (3.0)	11 (1.0)	510 (6.4)	3 (0.5)	473 (9.1)
Quebec Province, Can.	70 (1.9)	552 (3.7)	21 (1.8)	528 (3.8)	6 (0.6)	520 (4.3)

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)	420 (5.3)
Belgium (Flemish)	5 (0.3)	527 (7.8)	1 (0.2)	~ ~
Hungary	2 (0.4)	~ ~	3 (0.4)	503 (9.2)
Japan	1 (0.2)	~ ~	2 (0.2)	~ ~
Slovenia	3 (0.4)	450 (6.8)	4 (0.4)	454 (7.7)
Estonia	6 (0.5)	515 (5.9)	4 (0.5)	501 (10.0)
Lebanon	14 (1.2)	408 (4.9)	10 (1.2)	417 (4.9)
Italy	5 (0.4)	448 (7.3)	9 (0.5)	456 (5.4)
Jordan	7 (0.8)	393 (6.9)	4 (0.5)	412 (7.7)
Korea, Rep. of	2 (0.2)	~ ~	0 (0.1)	~ ~
Bahrain	10 (0.6)	377 (4.7)	6 (0.4)	379 (6.5)
Slovak Republic	13 (0.8)	480 (3.6)	12 (1.1)	476 (4.8)
Lithuania	13 (1.0)	482 (4.2)	4 (0.6)	472 (10.3)
Malaysia	14 (1.0)	478 (5.1)	11 (1.1)	479 (5.1)
Palestinian Nat'l Auth.	13 (1.1)	379 (4.8)	10 (0.9)	397 (5.4)
Latvia	12 (0.9)	492 (5.7)	5 (0.7)	461 (8.0)
Chile	10 (0.7)	370 (4.5)	8 (0.6)	350 (4.9)
Egypt	8 (0.6)	393 (6.5)	7 (0.7)	437 (6.8)
South Africa	27 (1.3)	247 (5.5)	28 (2.0)	258 (5.4)
Serbia	19 (1.2)	451 (4.3)	20 (1.1)	453 (3.5)
Moldova, Rep. of	8 (0.8)	459 (7.7)	9 (1.4)	469 (7.3)
Morocco	28 (1.2)	393 (3.5)	20 (1.5)	393 (4.2)
Romania	24 (1.4)	460 (4.8)	20 (1.8)	453 (5.9)
Macedonia, Rep. of	32 (1.8)	429 (4.4)	10 (1.0)	405 (6.6)
Russian Federation	21 (1.1)	505 (5.7)	21 (1.7)	482 (5.7)
Saudi Arabia	12 (0.7)	311 (4.8)	25 (1.9)	321 (6.5)
Philippines	14 (0.9)	391 (7.5)	44 (1.6)	357 (5.1)
Ghana	26 (1.5)	285 (7.2)	34 (2.5)	291 (6.2)
Armenia	18 (1.1)	484 (5.0)	45 (2.1)	475 (3.0)
Indonesia	19 (1.3)	372 (7.4)	40 (2.8)	407 (6.9)
Tunisia	23 (1.1)	413 (2.6)	36 (1.7)	399 (2.3)
Bulgaria	40 (1.8)	465 (4.7)	24 (1.6)	473 (6.4)
Botswana r	5 (0.4)	376 (7.3)	61 (2.5)	374 (2.9)
Iran, Islamic Rep. of	12 (0.8)	415 (4.5)	68 (1.7)	403 (2.5)
‡ England	1 (0.2)	~ ~	1 (0.2)	~ ~
International Avg.	10 (0.1)	422 (1.2)	14 (0.2)	420 (1.3)
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)	570 (1.7)	5 (1.3)	564 (5.3)	12 (0.7)	531 (2.8)
Australia	80 (1.6)	508 (3.7)	7 (0.8)	481 (6.7)	11 (1.1)	458 (8.5)
England	79 (1.0)	540 (3.9)	8 (0.6)	516 (7.5)	11 (0.8)	489 (5.2)
Netherlands	79 (2.0)	544 (1.9)	12 (1.7)	535 (4.7)	4 (0.4)	517 (10.6)
Scotland	78 (1.0)	497 (3.2)	8 (0.7)	463 (7.3)	12 (0.7)	470 (5.3)
Hong Kong, SAR	76 (1.3)	581 (3.2)	9 (0.9)	548 (5.6)	11 (0.9)	571 (4.6)
United States	73 (1.2)	530 (2.2)	12 (0.9)	503 (5.6)	11 (0.6)	477 (4.2)
Singapore	71 (1.4)	607 (5.4)	17 (1.0)	577 (5.7)	8 (0.6)	549 (8.4)
New Zealand	71 (1.1)	507 (2.2)	12 (0.8)	479 (5.6)	13 (0.7)	459 (5.2)
Belgium (Flemish)	66 (1.4)	556 (1.8)	21 (1.5)	547 (3.4)	6 (0.6)	538 (4.9)
Norway	60 (1.7)	461 (2.4)	28 (1.6)	456 (3.4)	5 (0.5)	416 (8.5)
Japan	54 (1.1)	578 (1.9)	9 (0.7)	566 (4.8)	31 (1.0)	547 (2.7)
Cyprus	36 (1.6)	522 (3.7)	27 (1.6)	519 (4.0)	16 (0.9)	493 (3.7)
Slovenia	33 (1.9)	483 (4.5)	46 (2.0)	487 (3.1)	6 (0.7)	463 (7.4)
Italy	30 (1.8)	511 (4.2)	38 (1.9)	506 (4.7)	12 (1.0)	487 (6.0)
Hungary	24 (2.1)	550 (5.3)	43 (2.1)	535 (3.5)	9 (1.0)	500 (7.8)
Morocco r	16 (1.2)	339 (9.1)	25 (1.8)	355 (5.9)	7 (0.7)	336 (10.0)
Philippines	16 (2.0)	400 (25.4)	11 (0.8)	393 (9.5)	8 (0.7)	379 (19.2)
Lithuania	11 (1.2)	551 (7.2)	35 (1.5)	548 (4.0)	18 (1.6)	519 (5.1)
Latvia	10 (1.1)	545 (6.8)	27 (1.4)	546 (4.0)	17 (1.8)	536 (6.0)
Moldova, Rep. of	8 (0.8)	455 (12.1)	14 (1.1)	507 (8.4)	10 (1.4)	508 (7.2)
Tunisia	7 (0.8)	331 (10.5)	24 (1.4)	364 (6.4)	7 (1.1)	326 (10.0)
Armenia	6 (0.5)	441 (7.3)	30 (1.2)	454 (4.3)	9 (1.2)	455 (6.3)
Russian Federation	4 (0.6)	524 (13.9)	20 (1.0)	537 (6.7)	11 (1.6)	528 (7.7)
Iran, Islamic Rep. of	2 (0.4)	~ ~	11 (1.4)	437 (5.7)	2 (0.4)	~ ~
International Avg.	43 (0.3)	505 (1.6)	20 (0.3)	497 (1.2)	11 (0.2)	481 (1.6)
Benchmarking Participants						
Indiana State, US	79 (1.3)	540 (2.8)	8 (0.7)	508 (5.2)	10 (0.9)	512 (5.1)
Ontario Province, Can.	78 (2.0)	517 (3.9)	12 (1.6)	500 (8.1)	7 (0.6)	482 (5.4)
Quebec Province, Can.	75 (1.5)	511 (2.6)	12 (1.1)	495 (3.8)	10 (0.7)	493 (4.6)

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 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)	530 (7.0)
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)	443 (8.1)	2 (0.3)	~ ~
Belgium (Flemish)	1 (0.2)	~ ~	5 (0.4)	541 (4.5)
Norway	2 (0.3)	~ ~	5 (0.6)	422 (7.9)
Japan	2 (0.3)	~ ~	3 (0.4)	542 (5.5)
Cyprus	8 (0.6)	481 (5.4)	14 (0.7)	504 (4.2)
Slovenia	5 (0.6)	448 (9.0)	12 (0.9)	464 (5.5)
Italy	8 (0.6)	490 (9.3)	12 (0.7)	497 (7.1)
Hungary	12 (0.8)	495 (5.7)	12 (0.8)	526 (4.8)
Morocco r	15 (1.2)	353 (6.5)	37 (3.2)	353 (7.3)
Philippines	9 (0.8)	374 (10.6)	56 (2.5)	341 (5.7)
Lithuania	24 (1.1)	532 (3.7)	13 (1.0)	527 (5.1)
Latvia	25 (1.5)	532 (4.0)	22 (1.6)	530 (4.0)
Moldova, Rep. of	25 (1.6)	517 (6.7)	43 (2.5)	512 (6.5)
Tunisia	15 (1.1)	376 (6.3)	46 (2.1)	323 (6.3)
Armenia	24 (1.0)	456 (4.8)	32 (1.5)	468 (5.0)
Russian Federation	30 (1.4)	531 (5.9)	35 (1.6)	534 (4.8)
Iran, Islamic Rep. of	8 (0.9)	407 (6.6)	76 (1.9)	382 (4.3)
International Avg.	9 (0.2)	460 (1.8)	18 (0.3)	470 (1.4)
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.

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. At fourth grade, the results were similar to the eighth grade. Forty-three percent of the fourth-grade students reported using a computer both at home and at school, 20 percent at home but not at school, 11 percent at school but not at home, and 9 percent some other place. Eighteen percent reported that they did not use a computer at all.

Interestingly, at both grades, the data indicate that students were somewhat more likely to use a computer at home than at school. Also, it should be highlighted that at both grades percentages of students reporting that they did not use a computer at all varied dramatically across countries. For example at the eighth grade, it varied from 0 percent in several countries (Hong Kong SAR and Chinese Taipei) to about one-third (34 to 45%) in the Philippines, Ghana, Armenia, Indonesia, and Tunisia to about two-thirds (61-68%) in Botswana and Iran.

Mathematics 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 (485 points). Next highest was achievement among students using computers at home but not school (470 points), followed by students using computers at school but not home (441 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). At the fourth grade, countries with the greatest percentages (80% or more) of students using computers at home and at school included Chinese Taipei and Australia, as well as England, the Netherlands, Scotland, Hong Kong SAR, the United States, Singapore, and New Zealand.

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 provides students who are having trouble keeping up with their classmates an opportunity to review material taught in class.

To summarize the amount of time typically devoted to mathematics homework in each country, TIMSS constructed an index of the time students spend doing mathematics homework that assigns students to a high, medium, or low level on the basis of the frequency and amount of mathematics homework they are assigned each week. Students at the high level reported that they were assigned more than 30 minutes of mathematics homework at least 3-4 times per week. Students at the low level were reportedly assigned not more than 30 minutes of mathematics 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 mathematics achievement. Countries are ordered by the percentage of students at the high level of the index. At the eighth grade across countries, on average, 26 percent of students were at the high level of the *time spent on mathematics homework* index, 54 percent at the medium level, and 19 percent at the low level. Students at the low level, on average, had lower achievement than the students in the high and medium categories. Countries with the greatest emphasis on homework the eighth grade included Romania, Italy, and the Russian Federation, where 50 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 Scotland, Japan, Sweden,

Exhibit 4.7: Index of Time Students Spend Doing Mathematics Homework (TMH) in a Normal School Week

MATHEMATICS Grade 8

Index of Time Students Spend Doing Mathematics Homework

Index based on students reports on the frequency and amount of mathematics homework they are given. High level indicates more than 30 minutes of mathematics homework assigned 3-4 times a week. Low level indicates no more than 30 minutes of mathematics homework no more than twice a week. Medium level includes all other possible combinations of responses.

Countries	High TMH		Medium TMH		Low TMH	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Romania	68 (1.6)	492 (4.5)	28 (1.4)	451 (6.4)	3 (0.4)	437 (13.0)
Italy	54 (1.4)	484 (3.8)	40 (1.1)	487 (3.6)	7 (0.7)	471 (8.0)
Russian Federation	53 (1.2)	509 (4.4)	45 (1.2)	511 (3.4)	2 (0.2)	~ ~
Lebanon	42 (1.7)	436 (3.5)	52 (1.7)	437 (3.5)	5 (0.6)	412 (7.6)
Tunisia	39 (1.1)	410 (2.7)	50 (1.1)	414 (2.2)	11 (0.9)	414 (4.3)
Moldova, Rep. of	38 (1.4)	472 (4.3)	57 (1.3)	458 (4.6)	5 (0.5)	437 (8.3)
Singapore	38 (1.1)	621 (3.1)	51 (0.9)	604 (3.8)	11 (0.8)	566 (7.8)
Indonesia	37 (1.1)	435 (4.3)	48 (0.8)	406 (5.3)	15 (0.8)	391 (7.3)
Armenia	35 (1.3)	490 (3.9)	60 (1.2)	478 (3.7)	4 (0.4)	475 (7.5)
Morocco r	34 (1.5)	390 (4.5)	52 (1.1)	392 (3.2)	14 (1.0)	380 (4.8)
Israel	33 (1.4)	498 (3.9)	55 (1.3)	505 (4.1)	12 (0.9)	479 (6.3)
Malaysia	33 (1.3)	515 (4.4)	56 (1.1)	510 (4.5)	11 (0.8)	485 (5.9)
Latvia	33 (1.3)	502 (4.7)	61 (1.3)	516 (3.0)	6 (0.7)	508 (9.3)
Bulgaria	33 (1.8)	482 (6.4)	54 (1.5)	478 (4.6)	14 (1.5)	469 (5.4)
Hong Kong, SAR	32 (1.9)	600 (3.5)	49 (1.5)	587 (3.6)	19 (1.5)	566 (7.6)
Lithuania	32 (1.4)	493 (3.1)	63 (1.3)	509 (3.0)	5 (0.8)	490 (8.7)
United States	31 (1.0)	518 (4.1)	60 (0.9)	506 (3.2)	9 (0.9)	461 (6.3)
Estonia	28 (1.3)	519 (4.0)	66 (1.3)	538 (3.2)	7 (1.2)	523 (10.3)
Palestinian Nat'l Auth.	27 (1.1)	393 (3.5)	65 (1.1)	398 (3.5)	8 (0.6)	371 (6.6)
Egypt	26 (0.8)	402 (4.3)	60 (1.0)	418 (3.6)	14 (0.7)	419 (4.7)
Macedonia, Rep. of	26 (1.1)	440 (4.5)	61 (1.3)	444 (3.9)	13 (1.3)	439 (6.0)
Norway	26 (1.3)	454 (4.0)	52 (1.3)	466 (2.5)	22 (1.3)	472 (3.5)
Slovenia	25 (1.1)	482 (2.9)	71 (1.2)	500 (2.5)	4 (0.8)	463 (8.8)
Botswana	25 (0.8)	385 (3.9)	53 (0.8)	368 (2.6)	22 (0.9)	355 (3.0)
Serbia	25 (1.3)	466 (4.1)	54 (1.2)	481 (3.5)	20 (1.7)	497 (3.5)
Jordan	25 (0.8)	425 (4.7)	64 (1.1)	437 (4.1)	11 (0.9)	411 (4.9)
Ghana	24 (0.9)	288 (5.8)	56 (0.9)	280 (4.5)	20 (1.0)	275 (7.5)
Philippines	24 (0.9)	390 (5.4)	54 (1.0)	382 (5.5)	22 (1.2)	361 (6.6)
Iran, Islamic Rep. of	24 (1.2)	420 (3.8)	52 (0.9)	414 (2.8)	25 (1.1)	403 (3.4)
South Africa	21 (0.8)	275 (8.1)	58 (0.8)	270 (6.3)	20 (1.0)	260 (5.4)
Cyprus	21 (0.8)	459 (2.8)	70 (0.7)	469 (1.8)	9 (0.6)	438 (5.3)
Hungary	20 (1.2)	516 (5.8)	77 (1.2)	537 (3.1)	3 (0.5)	501 (14.1)
Australia	19 (1.6)	520 (6.0)	50 (1.5)	509 (5.4)	31 (2.0)	497 (5.5)
Netherlands	19 (1.3)	540 (5.2)	62 (1.4)	542 (4.4)	19 (1.7)	518 (6.5)
Chinese Taipei	18 (1.5)	611 (6.0)	45 (1.2)	594 (4.4)	37 (2.0)	563 (5.6)
Bahrain	18 (0.8)	387 (3.3)	69 (1.2)	409 (2.0)	13 (1.1)	398 (4.9)
Saudi Arabia	15 (1.0)	315 (8.1)	62 (1.6)	335 (4.6)	23 (1.6)	345 (5.7)
New Zealand	14 (1.1)	488 (5.1)	49 (1.8)	505 (6.0)	37 (2.1)	492 (7.2)
Belgium (Flemish)	13 (1.1)	542 (4.5)	42 (1.4)	546 (3.2)	44 (2.0)	532 (3.7)
Korea, Rep. of	11 (1.0)	582 (4.3)	46 (1.6)	592 (2.6)	43 (2.0)	590 (2.8)
Slovak Republic	11 (0.9)	495 (6.4)	81 (1.4)	511 (3.4)	8 (1.3)	500 (7.7)
Chile	10 (0.7)	387 (6.9)	43 (1.0)	389 (3.8)	47 (1.4)	388 (3.7)
Scotland	8 (0.8)	493 (5.8)	46 (2.1)	507 (4.5)	46 (2.5)	496 (4.1)
Japan	6 (0.7)	565 (10.1)	36 (1.5)	566 (2.8)	58 (1.9)	576 (2.1)
Sweden	4 (0.5)	453 (7.0)	38 (1.4)	494 (3.5)	58 (1.5)	509 (2.7)
‡ England	7 (1.2)	509 (7.0)	37 (1.5)	507 (5.3)	56 (1.9)	498 (5.8)
International Avg.	26 (0.2)	468 (0.8)	54 (0.2)	471 (0.6)	19 (0.2)	456 (1.0)
Benchmarking Participants						
Basque Country, Spain	31 (1.9)	481 (3.2)	60 (1.8)	493 (3.1)	9 (1.2)	483 (6.9)
Indiana State, US	31 (2.7)	514 (7.5)	65 (2.5)	510 (4.7)	5 (0.7)	458 (9.3)
Ontario Province, Can.	24 (1.2)	515 (5.1)	71 (1.4)	526 (3.0)	6 (0.9)	496 (8.1)
Quebec Province, Can.	29 (1.7)	548 (4.3)	53 (1.6)	545 (3.5)	19 (2.0)	536 (4.5)

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 4.7: Index of Time Students Spend Doing Mathematics Homework (TMH) in a Normal School Week

MATHEMATICS Grade 4

Countries	High TMH		Medium TMH		Low TMH	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Singapore	40 (1.5)	604 (6.0)	49 (1.3)	595 (5.8)	11 (0.6)	575 (7.2)
Russian Federation	38 (1.3)	531 (5.3)	59 (1.2)	537 (4.7)	2 (0.4)	~ ~
Armenia r	33 (1.3)	467 (5.1)	65 (1.3)	465 (3.5)	2 (0.3)	~ ~
Moldova, Rep. of	31 (2.0)	518 (6.3)	66 (1.9)	504 (5.4)	3 (0.6)	494 (10.9)
Iran, Islamic Rep. of	31 (2.3)	404 (5.1)	52 (1.8)	391 (5.0)	17 (2.3)	376 (8.1)
Lithuania	29 (1.2)	527 (3.8)	66 (1.3)	545 (3.1)	5 (0.6)	510 (10.7)
Latvia	25 (1.1)	525 (4.1)	71 (1.1)	546 (2.7)	4 (0.6)	517 (9.1)
Hong Kong, SAR	24 (1.0)	575 (3.8)	71 (0.9)	580 (3.2)	5 (0.5)	530 (5.6)
Italy	24 (1.1)	496 (5.2)	52 (1.1)	504 (4.5)	24 (1.6)	512 (3.6)
Morocco s	22 (1.3)	362 (5.9)	58 (1.9)	365 (4.8)	20 (2.1)	353 (12.3)
Tunisia s	22 (2.2)	373 (8.6)	50 (2.8)	365 (6.3)	28 (3.0)	365 (8.0)
Hungary	17 (0.9)	515 (4.9)	78 (1.1)	538 (3.1)	5 (0.9)	535 (10.6)
Philippines	17 (0.8)	349 (7.0)	52 (1.7)	362 (6.7)	31 (1.9)	372 (15.7)
Cyprus	14 (0.6)	494 (4.6)	76 (0.9)	521 (2.4)	10 (0.6)	497 (5.3)
Slovenia	14 (0.9)	466 (6.7)	76 (1.2)	490 (2.6)	10 (0.9)	455 (8.6)
United States	12 (0.6)	504 (4.0)	63 (1.3)	524 (2.7)	25 (1.5)	520 (3.5)
Norway	12 (1.0)	447 (4.7)	56 (1.8)	462 (3.2)	32 (2.1)	467 (4.0)
Chinese Taipei	11 (0.6)	546 (3.5)	62 (1.1)	569 (2.0)	27 (1.2)	561 (2.7)
Belgium (Flemish)	9 (0.7)	538 (3.9)	48 (1.7)	549 (2.7)	43 (2.0)	557 (2.0)
Japan	8 (0.6)	543 (4.6)	57 (1.8)	568 (2.3)	35 (2.1)	565 (2.7)
New Zealand	7 (0.4)	489 (6.7)	41 (1.1)	491 (3.3)	52 (1.3)	504 (3.1)
Australia	7 (0.8)	486 (13.0)	43 (2.1)	500 (4.6)	50 (2.1)	505 (4.4)
Scotland	6 (0.8)	477 (6.8)	40 (2.0)	488 (4.2)	54 (2.2)	498 (3.4)
England	4 (0.6)	489 (14.3)	37 (1.8)	531 (4.8)	59 (1.9)	540 (4.2)
Netherlands	1 (0.2)	~ ~	10 (0.8)	508 (6.6)	89 (0.9)	546 (1.8)
International Avg.	18 (0.2)	489 (1.3)	56 (0.3)	500 (0.9)	26 (0.3)	494 (1.6)
Benchmarking Participants						
Indiana State, US	15 (1.6)	531 (5.6)	65 (2.6)	537 (2.7)	21 (3.0)	525 (5.9)
Ontario Province, Can.	16 (0.9)	514 (6.3)	53 (1.7)	511 (3.4)	31 (2.0)	513 (6.4)
Quebec Province, Can.	10 (0.9)	487 (3.8)	44 (1.5)	505 (2.9)	46 (1.7)	514 (3.0)

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. 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

MATHEMATICS Grade 8

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)

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.

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

Exhibit 4.8: How Students Spend Their Leisure Time on a Normal School Day

MATHEMATICS Grade 4

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.

and England, where less than ten percent of students were at the high level of the index.

In general, fourth-grade students reported being given less mathematics homework than did students at the eighth grade. Eighteen percent of fourth-grade students, on average, were at the high level of the index, 56 percent at the middle level, and 26 percent at the low level. Singapore was the country with the highest percentage of students in the high category—40 percent. Despite this, across countries, fourth-grade students in the medium category had the highest average mathematics achievement. This pattern 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 Mathematics?

To investigate how students think of their abilities in mathematics, TIMSS created an index of students' self-confidence in learning mathematics. This index is based on students' responses to four statements about their mathematics ability:

- I usually do well in mathematics;
- Mathematics is more difficult for me than for many of my classmates;*

* The response categories for this statement were reversed in constructing the index.

- Mathematics is not one of my strengths;*
- I learn things quickly in mathematics.

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 mathematics achievement, are presented in Exhibit 4.9 for both eighth and fourth grades.

On average, internationally, 40 percent of the eighth-grade students had high self-confidence in learning mathematics. The percentages ranged from a high of 59 percent in Israel to a low of 17 percent in Japan. Although there was a clear positive association between self-confidence in learning mathematics and mathematics 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 mathematics achievement. Since all of these are Asian Pacific countries, they may share cultural traditions that encourage modest self-confidence.

At fourth grade, on average, internationally, 55 percent of students were at the high level of the self-confidence in learning mathematics index, compared with 33 percent at the medium and just 11 percent at the low. The countries with the greatest percentages included Slovenia, and Cyprus, each with 70 percent or more. Countries with relatively lower percentages included Japan and the Philippines, each with less than 40 percent at the high level. Again, there was a positive relationship, on average, between self-confidence in learning mathematics and mathematics achievement.

* The response categories for this statement were reversed in constructing the index.

Exhibit 4.9: Index of Students' Self-Confidence in Learning Mathematics (SCM)

MATHEMATICS Grade 8

Index of Students' Self-Confidence in Learning Mathematics

Index based on students' responses to four statements about mathematics:1) I usually do well in mathematics; 2) Mathematics is more difficult for me than for many of my classmates (Reversed); 3) Mathematics is not one of my strengths (Reversed); 4) I learn things quickly in mathematics.

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 SCM		Medium SCM		Low SCM	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Israel	59 (1.2)	526 (3.5)	30 (0.9)	461 (3.8)	11 (0.7)	451 (5.7)
Egypt	58 (1.0)	437 (3.3)	35 (0.9)	383 (3.7)	7 (0.4)	374 (5.3)
Scotland	52 (1.5)	524 (3.9)	32 (1.0)	477 (3.8)	15 (0.9)	456 (5.0)
United States	51 (0.8)	534 (3.3)	29 (0.6)	483 (3.5)	20 (0.6)	461 (3.6)
Australia	50 (1.7)	542 (4.5)	31 (1.1)	483 (3.7)	19 (1.2)	451 (6.4)
Jordan	49 (1.2)	463 (4.7)	38 (1.0)	400 (3.7)	13 (0.7)	390 (4.4)
Sweden	49 (1.3)	534 (2.6)	36 (0.9)	477 (3.1)	16 (0.9)	446 (3.4)
Norway	46 (1.1)	502 (2.0)	32 (0.8)	445 (2.9)	21 (0.8)	405 (3.4)
Cyprus	46 (0.8)	503 (2.0)	32 (0.8)	437 (2.2)	22 (0.7)	407 (3.6)
Italy	46 (0.9)	521 (3.3)	29 (0.9)	466 (3.6)	25 (1.0)	439 (3.4)
Belgium (Flemish)	45 (0.9)	556 (3.2)	30 (0.7)	526 (3.0)	25 (0.8)	518 (3.5)
Netherlands	45 (1.4)	557 (4.4)	33 (1.0)	527 (4.7)	23 (1.0)	511 (4.8)
Serbia	44 (1.1)	530 (2.8)	26 (0.7)	458 (3.2)	30 (1.1)	422 (3.4)
Bahrain	44 (0.9)	437 (2.0)	38 (0.9)	379 (2.4)	18 (0.6)	366 (3.2)
Tunisia	44 (1.0)	436 (2.7)	36 (0.8)	399 (2.5)	20 (0.9)	384 (2.2)
Hungary	44 (1.0)	574 (3.3)	32 (1.0)	507 (3.9)	24 (0.8)	479 (3.9)
Ghana	43 (1.4)	306 (5.6)	44 (1.2)	265 (4.8)	12 (0.7)	265 (7.5)
Palestinian Nat'l Auth.	43 (1.0)	428 (3.9)	41 (0.9)	370 (2.9)	16 (0.6)	355 (3.6)
Russian Federation	43 (1.1)	548 (3.0)	30 (0.8)	492 (4.1)	27 (0.8)	466 (4.6)
New Zealand	43 (1.4)	534 (6.4)	36 (1.1)	475 (5.4)	21 (0.9)	452 (4.1)
Lebanon	43 (1.4)	462 (3.6)	44 (1.1)	416 (3.1)	13 (0.7)	403 (4.4)
Saudi Arabia	41 (1.4)	361 (4.8)	43 (1.1)	321 (5.4)	16 (0.9)	303 (5.8)
Armenia	41 (1.1)	505 (4.0)	40 (1.0)	468 (3.7)	19 (0.9)	462 (4.1)
Estonia	41 (0.9)	569 (3.2)	32 (0.7)	520 (3.1)	28 (0.8)	489 (3.5)
Slovak Republic	40 (1.1)	556 (3.7)	35 (1.0)	487 (3.9)	25 (1.0)	462 (4.1)
Slovenia	40 (0.9)	533 (3.2)	39 (1.0)	474 (2.5)	20 (0.9)	453 (2.8)
Morocco r	40 (1.3)	413 (4.1)	41 (1.4)	377 (2.6)	19 (1.2)	368 (4.5)
Singapore	39 (0.8)	639 (3.0)	34 (0.7)	594 (3.9)	27 (0.7)	571 (4.6)
Malaysia	39 (1.2)	546 (4.2)	45 (1.0)	490 (3.7)	16 (0.7)	471 (4.4)
Botswana	38 (0.9)	390 (2.8)	45 (0.8)	361 (2.5)	17 (0.8)	352 (3.4)
South Africa	37 (0.9)	300 (8.3)	48 (0.9)	242 (3.9)	15 (0.8)	255 (9.9)
Lithuania	36 (1.0)	552 (3.1)	37 (0.9)	486 (2.8)	26 (0.9)	456 (2.7)
Iran, Islamic Rep. of	35 (0.9)	447 (3.5)	49 (0.8)	399 (2.6)	16 (0.7)	377 (3.4)
Chile	35 (0.9)	427 (3.9)	42 (0.7)	369 (3.4)	23 (0.7)	361 (3.9)
Latvia	34 (1.0)	555 (3.4)	33 (0.9)	499 (3.2)	33 (1.0)	473 (3.4)
Bulgaria	33 (1.3)	519 (5.5)	39 (1.4)	467 (4.2)	28 (1.2)	445 (4.8)
Macedonia, Rep. of	33 (1.0)	482 (4.0)	37 (1.0)	418 (4.7)	31 (1.0)	424 (3.9)
Korea, Rep. of	30 (0.7)	650 (2.8)	36 (0.6)	592 (2.5)	34 (0.8)	534 (2.3)
Moldova, Rep. of	30 (1.2)	494 (5.0)	50 (0.9)	451 (4.5)	20 (1.1)	441 (5.3)
Romania	30 (1.2)	533 (4.6)	45 (1.1)	465 (4.5)	25 (0.9)	442 (5.4)
Hong Kong, SAR	30 (0.9)	627 (2.9)	38 (0.7)	581 (4.1)	33 (0.9)	556 (4.0)
Philippines	29 (0.7)	405 (6.1)	59 (0.7)	369 (4.8)	12 (0.5)	366 (6.5)
Indonesia	27 (1.1)	420 (6.6)	59 (0.8)	408 (4.5)	15 (0.9)	416 (4.7)
Chinese Taipei	26 (1.0)	661 (4.1)	30 (0.7)	593 (5.1)	44 (1.1)	534 (4.0)
Japan	17 (0.6)	634 (3.1)	38 (0.7)	580 (2.7)	45 (0.8)	538 (2.3)
‡ England	47 (1.5)	526 (5.8)	34 (1.2)	485 (4.7)	19 (1.1)	468 (5.5)
International Avg.	40 (0.2)	504 (0.6)	38 (0.1)	453 (0.6)	22 (0.1)	433 (0.7)
Benchmarking Participants						
Basque Country, Spain	46 (1.6)	518 (3.1)	29 (1.1)	471 (3.1)	24 (1.4)	449 (2.9)
Indiana State, US	50 (1.7)	536 (6.0)	28 (1.0)	493 (4.8)	22 (1.2)	470 (4.4)
Ontario Province, Can.	63 (1.2)	549 (3.0)	22 (0.9)	484 (3.2)	15 (0.8)	460 (3.6)
Quebec Province, Can.	59 (1.3)	566 (3.3)	24 (0.9)	521 (2.9)	16 (0.8)	498 (3.2)

Background data provided by students.

An "r" indicates data are available for at least 70 but less than 85% of the 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 4.9: Index of Students' Self-Confidence in Learning Mathematics (SCM)

MATHEMATICS Grade 4

Countries	High SCM		Medium SCM		Low SCM	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Slovenia	77 (1.0)	499 (2.6)	18 (0.8)	424 (4.2)	5 (0.5)	409 (5.8)
Cyprus	71 (1.0)	531 (2.6)	24 (0.9)	466 (3.5)	5 (0.4)	443 (6.5)
Netherlands	67 (1.0)	556 (2.3)	22 (0.9)	516 (2.8)	11 (0.6)	498 (4.4)
Norway	65 (0.9)	472 (2.4)	28 (0.8)	426 (3.0)	8 (0.6)	399 (5.7)
United States	64 (0.7)	541 (2.3)	25 (0.5)	486 (2.8)	11 (0.4)	475 (2.7)
Hungary	64 (0.8)	556 (3.1)	26 (0.8)	487 (3.8)	9 (0.5)	473 (5.2)
Australia	64 (0.9)	522 (3.7)	25 (0.9)	471 (5.2)	11 (0.8)	436 (8.1)
Scotland	64 (0.8)	508 (3.5)	26 (0.9)	468 (3.7)	11 (0.6)	451 (5.8)
Belgium (Flemish)	62 (0.8)	569 (1.8)	26 (0.7)	526 (2.7)	13 (0.6)	510 (3.1)
Italy	62 (1.0)	523 (3.9)	29 (0.8)	479 (5.0)	9 (0.5)	458 (6.1)
Lithuania	61 (1.2)	559 (3.0)	31 (1.0)	505 (3.9)	8 (0.6)	489 (8.0)
England	59 (1.1)	556 (4.1)	30 (0.9)	505 (4.3)	11 (0.6)	480 (5.3)
Tunisia r	56 (1.8)	367 (4.9)	37 (1.6)	321 (5.5)	7 (0.7)	305 (9.4)
New Zealand	54 (1.1)	526 (2.5)	36 (1.0)	464 (2.9)	9 (0.5)	446 (4.3)
Morocco r	54 (1.8)	372 (5.0)	40 (1.5)	342 (6.4)	6 (0.6)	324 (10.6)
Russian Federation	53 (1.4)	558 (4.8)	32 (1.1)	513 (5.1)	15 (0.7)	500 (5.5)
Moldova, Rep. of	52 (1.5)	535 (5.9)	40 (1.4)	478 (4.5)	8 (0.7)	461 (8.6)
Latvia	50 (1.1)	566 (3.2)	34 (0.9)	513 (3.6)	16 (0.8)	492 (4.1)
Singapore	49 (1.6)	629 (5.0)	35 (1.1)	573 (5.3)	16 (0.9)	540 (6.2)
Armenia s	43 (1.1)	495 (4.5)	44 (1.1)	453 (4.6)	13 (0.8)	446 (5.7)
Iran, Islamic Rep. of	42 (1.6)	418 (4.8)	51 (1.6)	374 (4.3)	7 (0.5)	349 (8.9)
Chinese Taipei	41 (0.9)	591 (2.2)	39 (0.9)	549 (2.2)	20 (0.6)	539 (2.1)
Hong Kong, SAR	40 (1.1)	601 (3.1)	42 (0.9)	562 (3.6)	19 (0.8)	548 (3.7)
Japan	39 (0.9)	600 (2.2)	40 (0.9)	550 (2.3)	21 (0.8)	532 (2.2)
Philippines	34 (1.2)	395 (11.7)	53 (1.2)	351 (6.8)	12 (0.7)	326 (7.4)
International Avg.	55 (0.2)	522 (0.9)	33 (0.2)	472 (0.9)	11 (0.1)	453 (1.2)
Benchmarking Participants						
Indiana State, US	64 (1.5)	551 (3.1)	22 (0.9)	511 (3.5)	14 (1.0)	493 (6.2)
Ontario Province, Can.	67 (1.4)	531 (4.2)	23 (1.2)	480 (3.4)	10 (0.7)	463 (5.3)
Quebec Province, Can.	70 (1.1)	525 (2.2)	22 (0.9)	471 (3.2)	8 (0.5)	448 (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.

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 Value Do Students Place on Mathematics?

Students' motivation to learn mathematics 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 mathematics among students is an important goal of mathematics education in many countries. To gain some understanding about the value eighth- and fourth-grade students place on mathematics, TIMSS created an index of students valuing mathematics. Students were asked to state their agreement with the following seven statements about mathematics:

- I would like to take more mathematics in school;
- I enjoy learning mathematics;
- I think learning mathematics will help me in my daily life;
- I need mathematics to learn other school subjects;
- I need to do well in mathematics to get into the university of my choice;
- I would like a job that involved using mathematics;
- I need to do well in mathematics to get the job I want.

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 mathematics achievement, are presented in Exhibit 4.10 for both eighth and fourth grades.

Across the participating countries, on average, students generally placed a high value on mathematics, with 55 percent in the high category, and a further 35 percent in the medium category. Only 10 percent of students were in the low category. Countries with large percentages of

students at the high level included Morocco, Botswana, Ghana, Egypt, and Jordan, with 80 percent or more in this category. Among countries where students reported placing less value on mathematics were Korea, Japan, and the Netherlands with less than 20 percent. Since these are countries with high average mathematics achievement, it may be that the students follow a demanding mathematics curriculum, one that leads to high achievement but little enthusiasm for the subject matter. Despite some high percentages for low performing countries and low percentages for high performing countries, students in the high category had higher average mathematics achievement than those in the medium and low categories.

To provide more information on changes from 1995 and 1999 in an important component of the *students valuing mathematics* 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 mathematics. Comparable data at fourth grade are shown for 2003 and 1995 only.

At the eighth grade, on average, internationally, there was a significant increase from 1995 and 1999 in the average percentage of students agreeing a lot that they enjoy learning mathematics, from 17 percent in 1995 to 25 percent in 1999 to 29 percent in 2003. Nevertheless, the upward trend from 1995 to 1999 in the percentage of students agreeing a lot that they enjoy learning mathematics appears to have leveled somewhat off in 2003. Participants showing a significant increase in 2003 over either 1995 or 1999 included Australia, Belgium (Flemish), Chile, Hungary, Iran, Japan, Jordan, Korea, Lithuania, Macedonia, Moldova, New Zealand, the Russian Federation, Singapore, the Slovak Republic, Tunisia, the United States, Ontario, and Quebec. At fourth grade, the average percentage of students agreeing a lot that they enjoy learning mathematics increased from 46 percent in 1995 to 50 percent in 2003. Countries showing a significant increase included Australia, Hungary, Iran, Japan, New Zealand, Norway, Singapore, and the United States.

Exhibit 4.10: **Index of Students' Valuing Mathematics (SVM)**

MATHEMATICS Grade 8

Index of Students' Valuing Mathematics

Index based on students' responses to seven statements about mathematics: 1) I would like to take more mathematics in school; 2) I enjoy learning mathematics; 3) I think learning mathematics will help me in my daily life; 4) I need mathematics to learn other school subjects; 5) I need to do well in mathematics to get into the university of my choice; 6) I would like a job that involved using mathematics; 7) I need to do well in mathematics 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 SVM		Medium SVM		Low SVM	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Morocco	85 (1.0)	391 (2.6)	12 (0.8)	377 (5.2)	3 (0.4)	380 (9.8)
Botswana	84 (0.7)	378 (2.7)	14 (0.7)	331 (2.8)	2 (0.2)	~ ~
Ghana	82 (1.2)	293 (4.8)	16 (1.1)	227 (4.8)	1 (0.2)	~ ~
Egypt	82 (0.7)	418 (3.3)	16 (0.7)	386 (4.7)	2 (0.3)	~ ~
Jordan	81 (0.9)	436 (3.8)	16 (0.8)	398 (8.0)	3 (0.3)	395 (8.1)
Tunisia	79 (0.9)	417 (2.2)	17 (0.7)	395 (3.2)	4 (0.4)	385 (3.8)
South Africa	79 (0.9)	271 (5.6)	17 (0.8)	243 (9.1)	4 (0.3)	241 (11.4)
Malaysia	78 (1.0)	515 (4.1)	21 (0.9)	486 (5.0)	1 (0.1)	~ ~
Palestinian Nat'l Auth.	77 (1.0)	403 (3.1)	19 (0.9)	355 (4.2)	4 (0.4)	344 (8.5)
Philippines	73 (1.1)	390 (5.1)	25 (1.0)	347 (6.1)	2 (0.2)	~ ~
Indonesia	71 (1.1)	411 (5.1)	28 (1.1)	415 (4.4)	1 (0.1)	~ ~
Lebanon	71 (1.2)	442 (3.2)	24 (1.1)	413 (5.0)	4 (0.4)	409 (7.4)
Iran, Islamic Rep. of	70 (0.9)	415 (2.6)	24 (0.8)	407 (3.1)	6 (0.4)	393 (6.1)
Bahrain	70 (0.9)	407 (2.2)	25 (0.7)	393 (2.5)	6 (0.5)	381 (6.0)
Chile	66 (1.0)	388 (3.6)	29 (0.9)	385 (3.7)	5 (0.3)	389 (6.0)
Singapore	63 (0.8)	616 (3.4)	32 (0.6)	592 (4.0)	5 (0.3)	558 (7.9)
Saudi Arabia	63 (1.5)	339 (5.2)	26 (1.0)	330 (4.4)	11 (0.8)	323 (5.7)
Moldova, Rep. of	61 (1.4)	468 (4.4)	35 (1.2)	452 (4.7)	4 (0.5)	441 (11.5)
Armenia	59 (1.1)	488 (3.7)	30 (0.9)	473 (3.4)	11 (0.7)	469 (5.4)
United States	58 (0.8)	512 (3.6)	34 (0.7)	498 (3.4)	8 (0.4)	485 (4.6)
Israel	56 (1.3)	499 (4.1)	35 (1.1)	500 (4.2)	9 (0.6)	487 (5.5)
New Zealand	56 (1.3)	499 (5.3)	36 (1.2)	493 (6.0)	8 (0.7)	480 (6.9)
Russian Federation	55 (1.1)	522 (4.3)	39 (1.0)	496 (3.3)	7 (0.5)	482 (4.6)
Macedonia, Rep. of	55 (1.0)	437 (4.1)	31 (0.8)	443 (4.4)	14 (0.8)	443 (4.9)
Scotland	54 (1.3)	503 (4.1)	37 (1.0)	497 (3.9)	9 (0.7)	479 (6.6)
Cyprus	53 (0.8)	476 (2.2)	36 (0.9)	443 (2.6)	11 (0.5)	439 (4.4)
Lithuania	53 (1.0)	515 (2.7)	40 (1.0)	489 (3.2)	7 (0.4)	473 (4.4)
Romania	53 (1.3)	493 (5.0)	35 (1.1)	469 (4.5)	12 (0.8)	451 (8.4)
Australia	51 (1.3)	517 (4.9)	37 (1.0)	499 (4.9)	12 (0.6)	481 (7.4)
Latvia	50 (1.2)	519 (3.9)	43 (1.0)	502 (3.3)	8 (0.6)	484 (6.6)
Bulgaria	48 (1.5)	488 (4.7)	39 (1.1)	472 (5.0)	14 (1.1)	461 (5.9)
Slovak Republic	47 (1.3)	519 (3.9)	44 (1.2)	500 (3.8)	9 (0.5)	498 (4.7)
Hungary	47 (1.0)	540 (3.8)	44 (0.9)	519 (3.7)	9 (0.6)	527 (5.3)
Norway	45 (1.2)	475 (3.0)	42 (1.0)	458 (2.2)	13 (0.8)	432 (4.4)
Serbia	43 (1.2)	488 (3.5)	39 (1.0)	473 (3.1)	18 (0.9)	471 (4.3)
Estonia	38 (1.2)	540 (3.6)	49 (1.1)	531 (3.5)	13 (0.7)	508 (4.0)
Hong Kong, SAR	35 (1.0)	607 (3.4)	55 (0.8)	581 (3.4)	10 (0.5)	544 (6.1)
Italy	32 (1.0)	505 (3.9)	52 (0.9)	480 (3.4)	16 (0.8)	454 (3.7)
Belgium (Flemish)	29 (1.0)	557 (3.7)	47 (0.8)	535 (2.7)	24 (0.9)	521 (3.7)
Sweden	29 (1.1)	514 (3.8)	60 (1.1)	496 (2.8)	11 (0.7)	479 (3.5)
Chinese Taipei	25 (1.0)	630 (5.3)	50 (0.8)	587 (4.7)	24 (1.0)	536 (5.0)
Slovenia	25 (1.1)	510 (3.7)	58 (1.0)	491 (2.6)	17 (1.0)	478 (3.5)
Korea, Rep. of	18 (0.7)	633 (3.4)	59 (0.7)	593 (2.5)	23 (0.8)	546 (2.9)
Japan	17 (0.6)	597 (3.1)	61 (0.8)	574 (2.2)	22 (0.8)	539 (3.3)
Netherlands	16 (1.0)	526 (7.9)	59 (1.3)	540 (4.1)	25 (1.2)	534 (4.3)
‡ England	39 (1.5)	508 (6.2)	46 (1.3)	500 (4.8)	15 (0.8)	486 (6.7)
International Avg.	55 (0.2)	479 (0.6)	35 (0.1)	458 (0.6)	10 (0.1)	458 (1.0)
Benchmarking Participants						
Basque Country, Spain	42 (1.7)	500 (3.3)	39 (1.2)	484 (3.3)	19 (1.0)	467 (3.5)
Indiana State, US	57 (1.6)	518 (6.3)	34 (1.3)	500 (4.3)	9 (0.9)	487 (5.7)
Ontario Province, Can.	69 (1.4)	532 (3.3)	25 (1.0)	501 (3.7)	6 (0.7)	481 (5.1)
Quebec Province, Can.	55 (1.1)	551 (3.6)	39 (0.9)	536 (2.9)	6 (0.4)	519 (5.1)

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

Background data provided by students.

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

‡ 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 4.11: **Trends in "I Enjoy Learning Mathematics"**

MATHEMATICS Grade 8

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
Armenia	45 (1.2)	✧ ✧	✧ ✧	28 (0.8)	✧ ✧	✧ ✧	28 (1.1)	✧ ✧	✧ ✧
Australia	18 (1.2)	– –	13 (0.7) ▲	39 (1.0)	– –	52 (0.6) ▼	42 (1.4)	– –	35 (0.9) ▲
Bahrain	40 (0.9)	✧ ✧	✧ ✧	33 (0.9)	✧ ✧	✧ ✧	26 (1.0)	✧ ✧	✧ ✧
Belgium (Flemish)	20 (0.9)	14 (0.6) ▲	14 (1.0) ▲	37 (0.9)	37 (0.8)	41 (1.2) ▼	43 (1.3)	49 (1.0) ▼	45 (1.3)
Botswana	65 (1.0)	✧ ✧	✧ ✧	22 (0.8)	✧ ✧	✧ ✧	14 (0.7)	✧ ✧	✧ ✧
Bulgaria	22 (1.1)	21 (1.4)	– –	39 (1.1)	35 (1.2) ▲	– –	38 (1.5)	44 (2.1) ▼	– –
Chile	34 (1.1)	30 (1.1) ▲	✧ ✧	37 (0.7)	45 (0.7) ▼	✧ ✧	30 (1.2)	26 (1.0) ▲	✧ ✧
Chinese Taipei	13 (0.6)	16 (0.7) ▼	✧ ✧	29 (1.0)	42 (0.7) ▼	✧ ✧	58 (1.4)	42 (1.0) ▲	✧ ✧
Cyprus	36 (0.8)	38 (1.2)	38 (1.1)	34 (0.9)	46 (1.0) ▼	45 (0.8) ▼	30 (0.7)	17 (1.0) ▲	17 (0.9) ▲
Egypt	61 (1.0)	✧ ✧	✧ ✧	27 (0.8)	✧ ✧	✧ ✧	12 (0.6)	✧ ✧	✧ ✧
Estonia	14 (0.7)	✧ ✧	✧ ✧	39 (0.8)	✧ ✧	✧ ✧	48 (1.0)	✧ ✧	✧ ✧
Ghana	53 (1.2)	✧ ✧	✧ ✧	30 (0.8)	✧ ✧	✧ ✧	16 (0.9)	✧ ✧	✧ ✧
Hong Kong, SAR	15 (0.7)	19 (0.7) ▼	15 (0.8)	45 (1.0)	50 (0.8) ▼	50 (1.1) ▼	41 (1.1)	31 (1.1) ▲	35 (1.3) ▲
Hungary	17 (0.9)	8 (0.5) ▲	8 (0.7) ▲	36 (0.9)	30 (1.1) ▲	31 (1.2) ▲	47 (1.2)	62 (1.2) ▼	61 (1.3) ▼
Indonesia	21 (0.9)	25 (1.4) ▼	✧ ✧	62 (0.9)	67 (1.2) ▼	✧ ✧	17 (0.9)	7 (0.6) ▲	✧ ✧
Iran, Islamic Rep. of	58 (1.0)	50 (0.9) ▲	39 (1.2) ▲	26 (0.8)	40 (0.9) ▼	43 (1.2) ▼	16 (0.7)	11 (0.6) ▲	18 (1.1)
Israel	27 (1.1)	31 (1.4) ▼	– –	34 (0.8)	42 (0.9) ▼	– –	39 (1.1)	28 (1.4) ▲	– –
Italy	16 (0.8)	21 (0.9) ▼	– –	43 (1.2)	45 (1.1)	– –	41 (1.2)	34 (1.3) ▲	– –
Japan	9 (0.6)	6 (0.4) ▲	5 (0.3) ▲	30 (0.8)	33 (1.0) ▼	41 (1.3) ▼	61 (1.1)	61 (1.1)	54 (1.5) ▲
Jordan	50 (1.3)	46 (1.2) ▲	✧ ✧	31 (1.0)	37 (0.8) ▼	✧ ✧	19 (1.0)	18 (0.9)	✧ ✧
Korea, Rep. of	9 (0.5)	5 (0.3) ▲	8 (0.6)	34 (0.8)	27 (0.7) ▲	33 (1.0)	57 (1.0)	68 (0.7) ▼	59 (1.1)
Latvia	14 (0.9)	– –	– –	33 (0.9)	– –	– –	53 (1.3)	– –	– –
Lebanon	50 (1.4)	✧ ✧	✧ ✧	28 (1.0)	✧ ✧	✧ ✧	23 (1.0)	✧ ✧	✧ ✧
Lithuania	18 (0.9)	13 (0.9) ▲	12 (0.9) ▲	36 (0.9)	46 (1.3) ▼	33 (1.3)	46 (1.2)	40 (1.5) ▲	55 (1.3) ▼
Macedonia, Rep. of	36 (1.1)	29 (0.9) ▲	✧ ✧	31 (0.9)	39 (0.9) ▼	✧ ✧	33 (1.0)	33 (1.1)	✧ ✧
Malaysia	41 (1.1)	43 (1.0)	✧ ✧	45 (0.9)	50 (0.9) ▼	✧ ✧	14 (0.7)	6 (0.4) ▲	✧ ✧
Moldova, Rep. of	23 (1.0)	18 (1.0) ▲	✧ ✧	51 (1.1)	49 (1.2)	✧ ✧	26 (1.2)	33 (1.4) ▼	✧ ✧
Morocco	60 (1.5)	– –	✧ ✧	23 (1.0)	– –	✧ ✧	17 (0.9)	– –	✧ ✧
Netherlands	6 (0.5)	14 (1.1) ▼	10 (1.1) ▼	26 (1.2)	44 (1.4) ▼	46 (1.9) ▼	69 (1.4)	43 (1.8) ▲	44 (2.4) ▲
New Zealand	23 (1.2)	20 (1.0) ▲	20 (1.0) ▲	38 (1.1)	53 (0.9) ▼	54 (0.9) ▼	39 (1.3)	27 (1.1) ▲	26 (1.0) ▲
Norway	22 (1.0)	✧ ✧	20 (0.9)	40 (0.9)	✧ ✧	55 (1.0) ▼	38 (1.3)	✧ ✧	24 (1.1) ▲
Palestinian Nat'l Auth.	45 (1.2)	✧ ✧	✧ ✧	33 (0.9)	✧ ✧	✧ ✧	22 (1.0)	✧ ✧	✧ ✧
Philippines	38 (0.9)	45 (1.0) ▼	✧ ✧	44 (0.7)	46 (1.0)	✧ ✧	18 (0.8)	9 (0.6) ▲	✧ ✧
Romania	21 (1.0)	19 (0.9)	25 (1.1) ▼	39 (1.0)	49 (1.1) ▼	48 (1.1) ▼	39 (1.2)	32 (1.4) ▲	27 (1.2) ▲
Russian Federation	17 (0.7)	16 (0.8)	14 (0.8) ▲	38 (1.0)	41 (1.2) ▼	40 (1.3)	45 (1.2)	43 (1.5)	46 (1.4)
Saudi Arabia	34 (1.5)	✧ ✧	✧ ✧	34 (1.0)	✧ ✧	✧ ✧	32 (1.4)	✧ ✧	✧ ✧
Scotland	18 (0.8)	✧ ✧	– –	40 (1.2)	✧ ✧	– –	42 (1.5)	✧ ✧	– –
Serbia	23 (1.1)	✧ ✧	✧ ✧	29 (0.8)	✧ ✧	✧ ✧	49 (1.2)	✧ ✧	✧ ✧
Singapore	33 (0.7)	28 (0.9) ▲	25 (1.0) ▲	42 (0.7)	52 (0.9) ▼	53 (0.8) ▼	25 (0.8)	20 (1.0) ▲	22 (1.0) ▲
Slovak Republic	13 (0.9)	11 (0.8)	10 (0.6) ▲	40 (1.2)	48 (1.2) ▼	48 (1.2) ▼	47 (1.4)	41 (1.5) ▲	42 (1.3) ▲
Slovenia	7 (0.6)	– –	10 (0.7) ▼	28 (1.1)	– –	39 (1.4) ▼	65 (1.2)	– –	51 (1.6) ▲
South Africa	56 (1.2)	54 (1.1)	– –	24 (0.8)	34 (1.0) ▼	– –	20 (1.0)	12 (0.6) ▲	– –
Sweden	15 (0.9)	✧ ✧	17 (1.1)	51 (1.1)	✧ ✧	57 (1.2) ▼	34 (1.3)	✧ ✧	26 (1.2) ▲
Tunisia	45 (1.1)	38 (1.0) ▲	✧ ✧	31 (0.8)	44 (0.8) ▼	✧ ✧	24 (1.0)	18 (0.8) ▲	✧ ✧
United States	22 (0.6)	22 (0.9)	20 (0.7) ▲	38 (0.7)	47 (0.6) ▼	50 (0.9) ▼	40 (0.8)	31 (1.1) ▲	30 (0.9) ▲
‡ England	14 (1.1)	25 (1.1) ▼	22 (1.1) ▼	39 (1.2)	54 (1.2) ▼	59 (1.5) ▼	47 (1.5)	21 (1.0) ▲	20 (1.3) ▲
International Avg.	29 (0.1)	25 (0.2) ▲	17 (0.2) ▲	36 (0.1)	44 (0.2) ▼	46 (0.3) ▼	35 (0.2)	31 (0.2) ▲	37 (0.3) ▼
Benchmarking Participants									
Basque Country, Spain	18 (1.3)	✧ ✧	✧ ✧	31 (1.4)	✧ ✧	✧ ✧	51 (1.8)	✧ ✧	✧ ✧
Indiana State, US	22 (1.0)	19 (1.4)	✧ ✧	37 (1.2)	50 (1.1) ▼	✧ ✧	41 (1.5)	30 (1.8) ▲	✧ ✧
Ontario Province, Can.	30 (1.1)	27 (1.4) ▲	24 (1.2) ▲	40 (1.1)	47 (1.1) ▼	54 (1.5) ▼	30 (1.3)	26 (1.2) ▲	22 (1.6) ▲
Quebec Province, Can.	19 (0.8)	10 (2.3) ▲	20 (2.3)	52 (0.9)	37 (4.2) ▲	51 (1.8)	28 (1.1)	53 (2.3) ▼	28 (2.1)

▲ 2003 significantly higher

▼ 2003 significantly lower

Background data provided by students.

‡ 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.

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 Mathematics"**

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	71 (1.1)	✧ ✧	8 (0.7)	✧ ✧	20 (0.9)	✧ ✧
Australia	52 (1.4)	41 (1.1) ▲	27 (1.2)	42 (0.9) ▼	20 (0.9)	17 (0.7) ▲
Belgium (Flemish)	27 (0.8)	✧ ✧	38 (0.7)	✧ ✧	35 (1.2)	✧ ✧
Chinese Taipei	31 (0.9)	✧ ✧	35 (0.8)	✧ ✧	34 (1.0)	✧ ✧
Cyprus	57 (1.2)	73 (1.2) ▼	24 (0.7)	22 (1.1)	19 (0.9)	5 (0.5) ▲
England	43 (1.2)	53 (1.4) ▼	27 (0.8)	31 (1.0) ▼	30 (1.3)	16 (1.0) ▲
Hong Kong, SAR	30 (1.2)	34 (1.6) ▼	42 (0.8)	49 (1.2) ▼	28 (1.0)	17 (1.0) ▲
Hungary	49 (1.3)	32 (1.3) ▲	27 (0.9)	45 (1.2) ▼	24 (1.2)	23 (1.5)
Iran, Islamic Rep. of r	81 (1.4)	72 (1.7) ▲	11 (1.1)	22 (1.3) ▼	7 (0.8)	5 (0.7)
Italy	40 (1.2)	– –	41 (0.9)	– –	19 (1.0)	– –
Japan	29 (1.0)	16 (0.8) ▲	36 (0.8)	56 (1.0) ▼	35 (1.2)	28 (1.1) ▲
Latvia	49 (1.1)	– –	30 (0.8)	– –	21 (0.9)	– –
Lithuania	58 (1.0)	✧ ✧	25 (0.8)	✧ ✧	17 (0.8)	✧ ✧
Moldova, Rep. of	49 (1.3)	✧ ✧	38 (1.1)	✧ ✧	12 (0.8)	✧ ✧
Morocco	71 (1.5)	✧ ✧	18 (1.2)	✧ ✧	11 (0.7)	✧ ✧
Netherlands	30 (1.3)	28 (1.2)	39 (1.0)	40 (1.3)	31 (1.4)	32 (1.5)
New Zealand	52 (1.1)	45 (1.4) ▲	29 (1.0)	37 (1.2) ▼	19 (0.7)	18 (1.0)
Norway	52 (1.5)	52 (1.9)	28 (0.9)	34 (1.4) ▼	20 (1.1)	14 (1.2) ▲
Philippines	50 (1.6)	✧ ✧	30 (1.2)	✧ ✧	20 (1.2)	✧ ✧
Russian Federation	50 (1.3)	✧ ✧	29 (1.1)	✧ ✧	21 (1.0)	✧ ✧
Scotland	50 (1.3)	– –	26 (1.0)	– –	24 (1.1)	– –
Singapore	57 (0.8)	48 (1.0) ▲	27 (0.5)	44 (0.8) ▼	15 (0.6)	8 (0.6) ▲
Slovenia	49 (1.5)	59 (1.7) ▼	26 (1.1)	31 (1.4) ▼	24 (1.4)	10 (0.9) ▲
Tunisia	70 (1.5)	✧ ✧	18 (1.0)	✧ ✧	12 (0.9)	✧ ✧
United States	54 (0.9)	47 (1.6) ▲	25 (0.5)	38 (1.0) ▼	20 (0.6)	15 (0.9) ▲
International Avg.	50 (0.2)	46 (0.4) ▲	28 (0.2)	38 (0.3) ▼	22 (0.2)	16 (0.3) ▲
Benchmarking Participants						
Indiana State, US	53 (1.7)	✧ ✧	26 (1.0)	✧ ✧	21 (1.4)	✧ ✧
Ontario Province, Can.	48 (1.5)	48 (1.1)	31 (1.1)	41 (1.0) ▼	21 (1.2)	11 (0.8) ▲
Quebec Province, Can.	56 (1.2)	57 (2.7)	32 (1.0)	35 (2.8)	12 (0.8)	8 (1.4) ▲

▲ 2003 significantly higher

▼ 2003 significantly lower

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.

An "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.


5

Chapter 5

The Mathematics Curriculum

The first part of Chapter 5 presents information about the curricular goals in the TIMSS 2003 countries, referred to as the intended curriculum. Data are provided about whether the participating countries have national curricula and public examinations in mathematics, how the curriculum is supported and monitored within each country, whether countries differentiate the curriculum 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 mathematics topics in the intended curriculum for each country, as well as teachers' reports about the mathematics 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 mathematics they have studied. Students' opportunity to learn the content, skills, and processes tested in the TIMSS 2003 mathematics assessment depends to a large degree on the curricular goals and intentions inherent in each country's policies for mathematics 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 mathematics students are taught.

This chapter presents information about the curricular goals in mathematics in the TIMSS 2003 countries and teachers' reports about the mathematics studied. Teachers' instructional programs for their classes are usually guided by an "official curriculum" that describes the mathematics 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 mathematics 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 mathematics teachers of the students tested in TIMSS 2003 completed questionnaires about whether the students had been taught the various mathematics topics included in the assessment.

Which Countries Have a National Curriculum and Public Examinations in Mathematics?

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 5.1 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 mathematics 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 mathematics 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 mathematics 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 varies by state and is a generally ongoing process.

At the fourth grade, Exhibit 5.1 shows that of the 26 countries that participated in TIMSS 2003 at this level, all but 3 reported having national curricula in fourth-grade mathematics. Similar to the eighth grade, fourth-grade mathematics 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,

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.

Exhibit 5.1: Intended Mathematics Curriculum

MATHEMATICS 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	●	●	3,8,10
Australia	○	Varies by state; generally ongoing process	●	●	12
Bahrain	●	2000-2001	●	●	9,10,11,12
[1] Belgium (Flemish)	○	1997	○	○	–
Botswana	●	1996	●	●	7,10,12
Bulgaria	●	1998	○	●	7,12
Chile	●	2002	●	●	12
Chinese Taipei	●	1997	●	●	9,12
Cyprus	●	1997	○	●	7-12
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	●	2002	○	●	11,13
Hungary	●	2000	○	●	12
Indonesia	●	1994	●	●	6,9,12
Iran, Islamic Rep. of	●	1985	○	●	5,8,11,12
Israel	●	1980	●	●	11,12
[2] Italy	●	1979, revised 2002	○	●	5,8,13
Japan	●	2002	○	○	–
Jordan	●	1994	●	●	12
Korea, Rep. of	●	2002	○	●	9,12
Latvia	●	1992	●	●	6,9,12
Lebanon	●	1999	●	○	–
Lithuania	●	1997, revised 2003	○	●	10,12
Macedonia, Rep. of	●	1994	○	●	12
Malaysia	●	1990	●	●	6,9,11,13
Moldova, Rep. of	●	2003-2004	○	●	4,9,11,12
Morocco	●	1992-1993	●	●	12
Netherlands	●	1998	●	●	10,11,12
New Zealand	●	Introduced 1993, implemented 1994	●	●	10,11,12
Norway	●	1997	○	○	–
Palestinian Nat'l Auth.	●	2002	●	●	12
Philippines	●	2002	○	○	–
Romania	●	1999	●	●	8,12
Russian Federation	●	2000	●	●	9,11
Saudi Arabia	●	1980	●	●	12
Scotland	●	1991	○	●	10,11,12
Serbia	●	1984-1985	●	●	8
Singapore	●	2002	●	●	6,10,12
Slovak Republic	●	1997	●	●	9,12
Slovenia	●	1999 for sample of schools; 2003 for all schools	●	●	3,6,9,12
South Africa	●	2001 (introduced in 1998 for prior grades)	●	●	12
Sweden	●	1994, revised 2000	○	○	–
Syrian Arab Republic	●	1984	●	●	9,12
Tunisia	●	2000	●	●	9,12
United States	○	Varies by state; generally ongoing process	●	○	–
Benchmarking Participants					
Basque Country, Spain	●	1992	●	○	–
Indiana State, US	●	2000	○	●	10
Ontario Province, Can.	●	1997	●	●	3,6,9
Quebec Province, Can.	●	1995	●	●	10,11

● 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 5.1: Intended Mathematics Curriculum

MATHEMATICS Grade 4

Countries	National Curriculum	Year Curriculum Introduced	Curriculum Under Revision	Public Exams with Consequences for Individual Students	Grades Tested in Public Exams
Armenia	●	2000	○	●	3,8,10
Australia	○	Varies by state; generally ongoing process	●	●	12
[1] Belgium (Flemish)	○	1998-1999	○	○	-
Chinese Taipei	●	2002	●	●	9,12
Cyprus	●	1995	○	●	7-12
England	●	2000	○	●	10,11,12
Hong Kong, SAR	●	1983	●	●	11,13
Hungary	●	2000	○	●	12
Iran, Islamic Rep. of	●	1983	○	●	5,8,11,12
[2] Italy	●	1985, revised 2002	●	●	5,8,13
Japan	●	2002	○	○	-
Latvia	●	2001	○	●	6,9,12
Lithuania	●	1997, revised 2003	○	●	10,12
Moldova, Rep. of	●	1999-2000	○	●	4,9,11,12
Morocco	●	2002-2003	●	●	12
Netherlands	●	1998	●	●	10,11,12
New Zealand	●	Introduced 1993, implemented 1994	●	●	10,11,12
Norway	●	1997	○	○	-
Philippines	●	2002 (pilot)	●	○	-
Russian Federation	●	2001	○	●	9,11
Scotland	●	1991	○	●	10,11,12
Singapore	●	1999	●	●	6,10,12
Slovenia	●	1999 for sample of schools; 2003 for all schools	●	●	3,6,9,12
Tunisia	●	2000	●	●	9,12
United States	○	Varies by state; generally ongoing process	●	○	-
Yemen	●	2000-2001	●	●	9,12
Benchmarking Participants					
Indiana State, US	●	2000	○	●	10
Ontario Province, Can.	●	1997	●	●	3,6,9
Quebec Province, Can.	●	2001	○	●	10,11

● 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.

Ontario, and Quebec had system-wide curricula determined at the state and provincial level, respectively.

At the time of the TIMSS 2003 assessment, the official fourth-grade mathematics 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 mathematics 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 policy makers, 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 mathematics at one or more grades. Grade 12 was the most prevalent, with 33 countries giving students public examinations in mathematics at this level.

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 5.2, 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 5.2, at the eighth grade, 12 participants reported using all 7, and an additional 22 used 5 or 6. The most widely used methods were ministry notes and directives (42 participants), instructional or pedagogical guides (41 participants), and a system of school or audit (40 participants)

The use of mandated or recommended textbooks as a means of supporting eighth-grade mathematics curriculum implementation was reported by 38 participants. Curriculum evaluation during or after implementation was used by 35 participating entities, and the use of specifically developed or recommended instructional activities by 33 participants. The least widely used method was national assessments based on student samples (25 participants).

At the fourth grade, four participants reported using all seven methods shown in Exhibit 5.2 to support and monitor curriculum implementation, and 16 participants used five or six. The most widely used methods were instructional or pedagogical guides (24 participants), ministry notes and directives (24 participants), and curriculum evaluation during or after implementation (23 participants).

A system of school inspection or audit as a means of monitoring fourth-grade mathematics curriculum implementation was used by 21 participants. The use of specifically developed or recommended instructional activities was reported by 21 participants and mandated or recommended textbooks by 20 participants. Similar to the eighth grade, the least widely used method at the fourth grade was national assessments based on student samples (12 participants).

An additional method countries often use to support curriculum implementation is to provide mathematics teachers with specific

Exhibit 5.2: Methods Used to Support or Monitor Implementation of the Intended Mathematics Curriculum

MATHEMATICS Grade 8

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 5.2: Methods Used to Support or Monitor Implementation of the Intended Mathematics 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.

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.

How Much Instructional Time is Intended for Mathematics?

Many countries designate in their intended curriculum the percentage of total instructional time that should be devoted to mathematics and other subjects at different grade levels. The percentage of instructional time designated for mathematics in the intended curriculum for grades 2, 4, 6, and 8 is shown in Exhibit 5.3 for all TIMSS 2003 participants. These data provide a good estimate of students' intended instructional time for mathematics across the primary and middle school years. The general pattern across countries shows that the percentage of time remains the same or decreases from grade 2 to grade 4, from grade 4 to grade 6, and from grade 6 to grade 8, with the largest decline usually between grades 6 and 8. Interestingly, the reverse pattern holds for science.[2] Where increases occurred in the percentage of instructional time designated for mathematics, 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 mathematics ranged from 10 to 25 percent at second grade, from 12 to 29 percent at fourth grade, from 11 to 25 percent at sixth grade, and from 8 to 25 percent at eighth grade. Schools' and teachers' reports of the percentage of instructional time actually devoted to mathematics at grades 4 and 8, shown in Exhibit 7.3, generally correspond with the intended percentages reported in Exhibit 5.3, although slightly more so at eighth grade than at fourth grade.

2 Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., and Chrostowski, S.J., (2004), *TIMSS 2003 International Science Report: Findings from IEA's Trends in International Mathematics and Science Study at the Eighth and Fourth Grades*, Chestnut Hill, MA: Boston College.

Exhibit 5.3: Percentage of Total Instructional Time Intended for Mathematics

Countries	Grade 2	Grade 4	Grade 6	Grade 8
Armenia	5 hours per week	5 hours per week	5 hours per week	5 hours per week
Australia	○	○	○	○
Bahrain	-	16	16	16
Belgium (Flemish)	25	25	25	12.5-15
Botswana	16	13	13	13
Bulgaria	17.5	13	12	12
Chile	20	20	17	15
Chinese Taipei	10	12	19	12
Cyprus	16	17	17	8
Egypt	-	20	18	18
England	○	○	○	○
Estonia	-	17.3	14.4	13.5
Ghana	-	25	25	25
Hong Kong, SAR	13	12-15	12-15	12-15
Hungary	20	13	12	11
Indonesia	-	17	17	15
Iran, Islamic Rep. of	15.8	15.8	14.3	14.3
Israel	-	20	20	16
Italy	15	15	20	20
Japan	18.5	15.9	15.9	10.7
Jordan	20	18	15	12
Korea, Rep. of	-	13.8	12.5	12.5
Latvia	17	15	16	14
Lebanon	-	17	17	15
Lithuania	20	20	17	13
Macedonia, Rep. of	-	19	15.4	9
Malaysia	-	15	15	9
Moldova, Rep. of	17.5	17	14	13
Morocco	17	15	15	15
Netherlands	○	○	○	10
New Zealand	○	○	○	○
Norway	17.5	18	14	12
Palestinian Nat'l Auth.	17	17	15	15
Philippines	20	15	○	15
Romania	-	15	12	12
Russian Federation	18	18	17	15
Saudi Arabia	14	16	16	12
Scotland	15	15	15	10
Serbia	-	29	16	16
Singapore	18	22	20	15
Slovak Republic	-	20	18	14
Slovenia	19	21	15	13
South Africa	-	15	15	13
[1] Sweden	-	13.5	13.5	13.5
Syrian Arab Republic	-	15	15	12
Tunisia	10	15	15	17
United States	○	○	○	○
Yemen	17.3	-	-	-
Benchmarking Participants				
Basque Country, Spain	-	12	12	10
Indiana State, US	15	15	11	13
Ontario Province, Can.	○	○	○	○
Quebec Province, Can.	21	17	17	17

○ Country reported that the national curriculum does not specify the percentage of total instructional time intended for mathematics

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 Mathematics 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 5.4 indicates how countries addressed this issue in organizing the intended mathematics 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 38 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 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 provided different levels of difficulty for students of differing ability levels.

Exhibit 5.4: The Way the Intended Mathematics Curriculum Addresses the Issue of Students with Different Levels of Ability

MATHEMATICS Grade 8

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 5.4: The Way the Intended Mathematics Curriculum Addresses the Issue of Students with Different Levels of Ability

MATHEMATICS Grade 4

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 Mathematics Curriculum?

Exhibit 5.5 indicates the relative emphasis given to various aspects of mathematics instruction in the intended curriculum of participating countries, for both eighth and fourth grade. At the eighth grade, as might be anticipated for students at this point in their education, "a lot of emphasis" was most commonly placed on understanding mathematical concepts and principles (32 participants) and mastering basic skills (30 participants). Not a single participant reported giving "very little" or "no" emphasis in the intended curriculum to understanding mathematical concepts and principles, and mastering basic skills received very little or no emphasis in only five countries.

Applying mathematics in real-life contexts was given a lot of emphasis in the intended eighth-grade curriculum of 17 participants. Botswana, the Netherlands, and South Africa reported placing more emphasis on this approach than on mastering basic skills or understanding mathematics concepts. Communicating mathematically received a lot of emphasis in 13 participating entities, and reasoning mathematically in 14 entities.

Relative to the other approaches and processes, participants reported placing less emphasis on integrating mathematics with other subjects, deriving formal proofs, and incorporating the experiences of different ethnic/cultural groups. Only two countries – Ghana and South Africa – reported placing a lot of emphasis on this multicultural approach in the intended curriculum.

In the intended mathematics curriculum at the fourth grade, most emphasis was placed on mastering basic skills and understanding mathematical concepts and principles, with applying mathematics in real-life contexts next in terms of emphasis. Communicating mathematically and reasoning mathematically were given a lot of emphasis in about half the participants. Integrating mathematics with other subjects and incorporating the experiences of different ethnic/cultural groups were given least emphasis in the fourth-grade mathematics curriculum.

Exhibit 5.5: Emphasis on Approaches and Processes in the Intended Mathematics Curriculum

MATHEMATICS Grade 8

Countries	Mastering Basic Skills	Understanding Mathematical Concepts and Principles	Applying Mathematics in Real-life Contexts	Communicating Mathematically	Reasoning Mathematically	Integrating Mathematics with Other Subjects	Deriving Formal Proofs	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

Background data provided by National Research Coordinators.

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

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

Exhibit 5.5: Emphasis on Approaches and Processes in the Intended Mathematics Curriculum

MATHEMATICS Grade 4

Countries	Mastering Basic Skills	Understanding Mathematical Concepts and Principles	Applying Mathematics in Real-life Contexts	Communicating Mathematically	Reasoning Mathematically	Integrating Mathematics with Other Subjects	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.

Are the TIMSS Mathematics Topics Included in the Intended Curriculum?

The ability of policy makers to make sound judgments about relative strengths and weaknesses of mathematics and 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 mathematics assessment.[3] It delineates the mathematics 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 mathematics 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 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 mathematics 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.[4]

National Research Coordinators were asked to indicate whether each of the TIMSS 2003 mathematics topics was included in their countries' intended curriculum through the target grade (eighth or fourth grade), and if so, whether the topics were intended to be taught to "all or almost all students" or "only the more able students." They were also asked to indicate the grade(s) at which each topic was primarily intended to be taught to students.

Exhibit 5.6 shows that, for most countries, a great deal of the mathematics content addressed by the TIMSS 2003 assessment was included in their intended curricula. On average, across participants at

the eighth grade, 70 percent of the assessment topics were intended for all or almost all students, and a further six percent for only the more able students. In only six countries were less than half of the topics included in the eighth-grade curriculum: Botswana, Indonesia, Lebanon, Morocco, the Philippines, and Tunisia.

Not surprisingly, at this level, the content area with the greatest coverage was number, with 96 percent of the topics, on average, included in participants' intended curriculum for all or almost all students. For all but three participants, at least nine of the ten topics in number (90%) were included in the curriculum. The mathematics content area with the next greatest coverage was measurement, with 78 percent of the topics, on average, included in the intended curriculum for all or almost all students. Sixteen participants included all eight measurement topics in their curricula, and a further 30 participants included seven of the eight topics. Countries with low emphasis on measurement in the curriculum included Botswana, Indonesia, Lebanon, Morocco, South Africa, and Tunisia, where at least half of the measurement topics were not included in the curriculum.

Geometry and algebra had similar levels of coverage across participating countries, with about two-thirds of the topics (67 percent of the geometry topics and 63 percent of the algebra topics) included in the intended curriculum for all or almost all students. In geometry, relatively high levels of coverage (11 of 13 percent of the topics) were reported for the intended curricula of 21 participants, although there also were several (Botswana, Indonesia, Latvia, Morocco, the Philippines, South Africa, Sweden, and Tunisia) where fewer than half of the geometry topics were included in the eighth-grade curriculum. For algebra, most of the topics (5 out of 6) were included in the intended curricula of 22 participants. However, in 14 of the TIMSS participants, no more than half of the algebra topics were included. One country, Chile, included none of the algebra topics in its intended curriculum.

The content area with the least coverage was data, with only 39 percent of the topics on average included in the intended curriculum for all or almost all students. All eight topics were included in the curriculum of just two countries (New Zealand and the United States) and two benchmarking participants (Indiana and Ontario). In contrast, 30 participants had no more than half of the data topics in their curricula, and in four countries – Chinese Taipei, the Philippines, Syria, and Tunisia – none of the data topics was included.

Consistent with few countries indicating that they had different curricula for students of different ability levels, the percentages of topics that were included in the intended curriculum for only the more able students were generally low, with only 6 percent of eighth-grade mathematics topics, on average, intended for the top track of students. The percentage ranged from 2 percent for number to 10 percent for data.

Although the relationship between inclusion in the intended curriculum and student achievement was not perfect, it was notable that several of the higher-performing countries reported high levels of emphasis on the mathematics topics in their intended curricula and that those with the lowest levels of curricular coverage came from the lower half of the achievement distribution. For example, five of the six top-performing countries (Chinese Taipei being the exception) included 80 percent or more of the topics for all or almost all of their students, while the six countries with fewer than half of the topics in their curricula all had average mathematics achievement below the international mean. However, high-performing Chinese Taipei and the Netherlands had relatively low coverage of the mathematics topics (69 and 53 percent, respectively) in their intended curricula, whereas lower-performing Ghana and Bahrain had 96 and 89 percent of topics, respectively, included in their intended curricula. Clearly the intended curriculum is only one of the factors that impact achievement.

At fourth grade, Exhibit 5.6 shows that on average, internationally, 59 percent of the TIMSS 2003 mathematics topics were included in the intended curricula for all or almost all students, and a further

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 ed.)*, Chestnut Hill, MA: Boston College.

4 For a full description of the TIMSS 2003 test development effort, please see Neidorf, T.S. 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.

9 percent for only the more able students. More than eighty percent of the mathematics topics were included in the intended curriculum for all or almost all students in Armenia, England, Italy, Moldova, the United States, Indiana, and Ontario.

Although measurement had fewer topics than number at the fourth grade (6 vs 12), it had a greater percentage of topics included in the intended curricula of participating countries – 81 percent for all or almost all students compared with 68 percent. Nineteen of the twenty-nine fourth-grade participants included at least five of the six measurement topics in their curricula. Comparable coverage of number topics (10 out of 12 topics) was reported in just 10 of the 29 participants.

The data content area was next at fourth grade in terms of inclusion in the intended curriculum, with 62 percent of its topics, on average, intended for all or almost all students. Five or more of the seven data topics were included in the intended curricula of 19 participants for all or almost all students. For patterns and relationships, on average, 54 percent of the topics were included in the intended curriculum for all or almost all students. At least four of the six topics in patterns and relationships were included in the intended curricula of 14 participants for all or almost all students. The content area with the least coverage was geometry, with only 38 percent of the topics on average included in the intended curriculum for all or almost all students. In 17 of the 29 participants, fewer than half of the 11 geometry topics were included in the curriculum.

As at the eighth grade, the percentages of topics included in the intended curriculum for only the more able students at fourth grade were generally low, consistent with few countries indicating that they had different curricula for different groups of students depending on ability level. Only 9 percent of fourth-grade mathematics topics on average were intended for the top track of students, with a range of 8 percent for measurement and geometry to 11 percent for patterns and relationships.

Exhibit 5.6: Summary of TIMSS Mathematics Topics in the Intended Curriculum

MATHEMATICS Grade 8

Countries	Percentage of TIMSS Mathematics Topics Intended to be Taught Up to and Including Eighth Grade*								
	Overall (45 topics)			Number (10 topics)			Algebra (6 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	69	31	0	90	10	0	67	33	0
Australia	69	29	2	90	0	10	50	50	0
Bahrain	89	0	11	100	0	0	67	0	33
Belgium (Flemish)	80	13	7	100	0	0	83	0	17
Botswana	44	0	56	90	0	10	17	0	83
Bulgaria	78	0	22	100	0	0	83	0	17
Chile	64	0	36	100	0	0	0	0	100
Chinese Taipei	69	0	31	100	0	0	67	0	33
Cyprus	64	27	9	100	0	0	50	33	17
Egypt	87	0	13	100	0	0	100	0	0
England	89	11	0	100	0	0	100	0	0
Estonia	73	0	27	100	0	0	100	0	0
Ghana	96	0	4	100	0	0	100	0	0
Hong Kong, SAR	82	0	18	100	0	0	50	0	50
Hungary	82	0	18	100	0	0	83	0	17
Indonesia	49	0	51	100	0	0	67	0	33
Iran, Islamic Rep. of	73	0	27	100	0	0	50	0	50
Israel	69	7	24	100	0	0	83	0	17
Italy	87	0	13	100	0	0	67	0	33
Japan	80	0	20	100	0	0	100	0	0
Jordan	76	0	24	100	0	0	83	0	17
Korea, Rep. of	84	0	16	90	0	10	83	0	17
Latvia	67	0	33	100	0	0	83	0	17
Lebanon	36	0	64	90	0	10	17	0	83
Lithuania	76	2	22	100	0	0	67	0	33
Macedonia, Rep. of	78	2	20	100	0	0	100	0	0
Malaysia	73	0	27	100	0	0	33	0	67
Moldova, Rep. of	82	0	18	100	0	0	100	0	0
Morocco	33	0	67	70	0	30	17	0	83
Netherlands	53	22	24	90	10	0	50	33	17
New Zealand	76	22	2	60	40	0	33	67	0
Norway	71	0	29	90	0	10	33	0	67
Palestinian Nat'l Auth.	76	0	24	100	0	0	50	0	50
Philippines	47	0	53	100	0	0	50	0	50
Romania	84	0	16	100	0	0	100	0	0
Russian Federation	76	0	24	100	0	0	83	0	17
Saudi Arabia	64	0	36	100	0	0	67	0	33
Scotland	58	29	13	70	30	0	17	50	33
Serbia	76	7	18	100	0	0	83	17	0
Singapore	80	9	11	100	0	0	83	17	0
Slovak Republic	62	33	4	100	0	0	50	33	17
Slovenia	80	0	20	100	0	0	100	0	0
South Africa	33	20	47	90	10	0	33	17	50
Sweden	53	13	33	90	0	10	0	33	67
Syrian Arab Republic	49	2	49	90	10	0	33	0	67
Tunisia	42	0	58	100	0	0	33	0	67
United States	98	2	0	100	0	0	83	17	0
International Avg.	70	6	24	96	2	2	63	9	29
Benchmarking Participants									
Basque Country, Spain	49	29	22	90	10	0	17	67	17
Indiana State, US	96	0	4	100	0	0	100	0	0
Ontario Province, Can.	98	0	2	100	0	0	83	0	17
Quebec Province, Can.	78	2	20	100	0	0	50	17	33

Background data provided by National Research Coordinators.

* Percentages may not add to 100 due to rounding.

See Exhibits 5.8 through 5.12 for data on individual topics.

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

Exhibit 5.6: Summary of TIMSS Mathematics Topics in the Intended Curriculum

Countries	Percentage of TIMSS Mathematics Topics Intended to be Taught Up to and Including Eighth Grade								
	Measurement (8 topics)			Geometry (13 topics)			Data (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	38	63	0	77	23	0	63	38	0
Australia	88	13	0	54	46	0	63	38	0
Bahrain	100	0	0	92	0	8	75	0	25
Belgium (Flemish)	88	13	0	85	0	15	38	63	0
Botswana	50	0	50	38	0	62	13	0	88
Bulgaria	100	0	0	85	0	15	13	0	88
Chile	100	0	0	54	0	46	50	0	50
Chinese Taipei	100	0	0	69	0	31	0	0	100
Cyprus	88	13	0	69	23	8	0	75	25
Egypt	75	0	25	100	0	0	50	0	50
England	88	13	0	85	15	0	75	25	0
Estonia	88	0	13	62	0	38	25	0	75
Ghana	100	0	0	100	0	0	75	0	25
Hong Kong, SAR	100	0	0	92	0	8	50	0	50
Hungary	63	0	38	92	0	8	63	0	38
Indonesia	50	0	50	15	0	85	25	0	75
Iran, Islamic Rep. of	88	0	13	85	0	15	25	0	75
Israel	63	0	38	46	8	46	63	25	13
Italy	100	0	0	85	0	15	75	0	25
Japan	88	0	13	77	0	23	38	0	63
Jordan	75	0	25	77	0	23	38	0	63
Korea, Rep. of	100	0	0	92	0	8	50	0	50
Latvia	88	0	13	38	0	62	38	0	63
Lebanon	13	0	88	23	0	77	25	0	75
Lithuania	88	0	13	69	8	23	50	0	50
Macedonia, Rep. of	75	0	25	100	0	0	0	13	88
Malaysia	100	0	0	77	0	23	38	0	63
Moldova, Rep. of	100	0	0	92	0	8	13	0	88
Morocco	13	0	88	38	0	62	13	0	88
Netherlands	63	13	25	23	38	38	50	13	38
New Zealand	100	0	0	77	15	8	100	0	0
Norway	88	0	13	54	0	46	88	0	13
Palestinian Nat'l Auth.	100	0	0	69	0	31	50	0	50
Philippines	100	0	0	0	0	100	0	0	100
Romania	75	0	25	92	0	8	50	0	50
Russian Federation	88	0	13	85	0	15	13	0	88
Saudi Arabia	75	0	25	62	0	38	13	0	88
Scotland	75	13	13	62	15	23	50	50	0
Serbia	75	13	13	92	8	0	13	0	88
Singapore	88	0	13	85	15	0	38	13	50
Slovak Republic	50	38	13	62	38	0	38	63	0
Slovenia	88	0	13	77	0	23	38	0	63
South Africa	13	38	50	23	15	62	0	25	75
Sweden	100	0	0	23	15	62	50	25	25
Syrian Arab Republic	63	0	38	46	0	54	0	0	100
Tunisia	38	0	63	31	0	69	0	0	100
United States	100	0	0	100	0	0	100	0	0
International Avg.	78	5	17	67	6	27	39	10	51
Benchmarking Participants									
Basque Country, Spain	75	13	13	38	31	31	13	38	50
Indiana State, US	88	0	13	92	0	8	100	0	0
Ontario Province, Can.	100	0	0	100	0	0	100	0	0
Quebec Province, Can.	75	0	25	85	0	15	63	0	38

Background data provided by National Research Coordinators.

* Percentages may not add to 100 due to rounding.

See Exhibits 5.8 through 5.12 for data on individual topics.

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

Exhibit 5.6: Summary of TIMSS Mathematics Topics in the Intended Curriculum

MATHEMATICS Grade 4

Countries	Percentage of TIMSS Mathematics Topics Intended to be Taught Up to and Including Fourth Grade								
	Overall (42 topics)			Number (12 topics)			Patterns and Relationships (6 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	81	14	5	83	17	0	83	17	0
Australia	74	0	26	67	0	33	83	0	17
Belgium (Flemish)	38	31	31	58	42	0	33	33	33
Chinese Taipei	57	0	43	83	0	17	50	0	50
Cyprus	45	48	7	75	25	0	83	17	0
England	81	12	7	92	0	8	50	50	0
Hong Kong, SAR	52	0	48	100	0	0	17	0	83
Hungary	69	0	31	58	0	42	83	0	17
Iran, Islamic Rep. of	60	0	40	67	0	33	50	0	50
Italy	86	0	14	92	0	8	67	0	33
Japan	69	0	31	67	0	33	100	0	0
Latvia	52	0	48	50	0	50	50	0	50
Lithuania	48	12	40	33	25	42	50	33	17
Moldova, Rep. of	81	0	19	92	0	8	100	0	0
Morocco	21	67	12	8	92	0	0	83	17
Netherlands	43	0	57	42	0	58	0	0	100
New Zealand	69	24	7	50	33	17	83	17	0
Norway	55	0	45	75	0	25	50	0	50
Philippines	48	0	52	92	0	8	0	0	100
Russian Federation	50	0	50	50	0	50	83	0	17
Scotland	52	12	36	58	17	25	33	17	50
Singapore	71	0	29	100	0	0	33	0	67
Slovenia	71	0	29	58	0	42	67	0	33
Tunisia	19	0	81	25	0	75	17	0	83
United States	83	17	0	100	0	0	83	17	0
Yemen	57	0	43	92	0	8	50	0	50
International Avg.	59	9	32	68	10	22	54	11	35
Benchmarking Participants									
Indiana State, US	83	2	14	100	0	0	83	17	0
Ontario Province, Can.	88	0	12	75	0	25	100	0	0
Quebec Province, Can.	79	0	21	75	0	25	67	0	33

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 5.13 through 5.17 for data on individual topics.

Exhibit 5.6: Summary of TIMSS Mathematics Topics in the Intended Curriculum

MATHEMATICS Grade 4

Countries	Percentage of TIMSS Mathematics Topics Intended to be Taught Up to and Including Fourth Grade								
	Measurement (6 topics)			Geometry (11 topics)			Data (7 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	100	0	0	55	27	18	100	0	0
Australia	100	0	0	45	0	55	100	0	0
Belgium (Flemish)	67	33	0	27	18	55	0	29	71
Chinese Taipei	50	0	50	27	0	73	71	0	29
Cyprus	50	50	0	0	73	27	29	71	0
England	100	0	0	73	9	18	86	14	0
Hong Kong, SAR	83	0	17	9	0	91	43	0	57
Hungary	100	0	0	36	0	64	100	0	0
Iran, Islamic Rep. of	83	0	17	45	0	55	57	0	43
Italy	100	0	0	73	0	27	100	0	0
Japan	83	0	17	27	0	73	100	0	0
Latvia	100	0	0	9	0	91	86	0	14
Lithuania	83	0	17	18	0	82	86	0	14
Moldova, Rep. of	83	0	17	64	0	36	71	0	29
Morocco	17	83	0	64	27	9	0	57	43
Netherlands	83	0	17	27	0	73	71	0	29
New Zealand	67	33	0	82	9	9	71	29	0
Norway	67	0	33	55	0	45	14	0	86
Philippines	67	0	33	9	0	91	57	0	43
Russian Federation	100	0	0	18	0	82	29	0	71
Scotland	67	17	17	36	9	55	71	0	29
Singapore	100	0	0	45	0	55	71	0	29
Slovenia	100	0	0	64	0	36	86	0	14
Tunisia	67	0	33	0	0	100	0	0	100
United States	100	0	0	64	36	0	71	29	0
Yemen	100	0	0	18	0	82	29	0	71
International Avg.	81	8	10	38	8	54	62	9	30
Benchmarking Participants									
Indiana State, US	100	0	0	45	0	55	100	0	0
Ontario Province, Can.	100	0	0	100	0	0	71	0	29
Quebec Province, Can.	67	0	33	91	0	9	86	0	14

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 5.13 through 5.17 for data on individual topics.

At the fourth grade, as at the eighth grade, the relationship between the coverage of the TIMSS mathematics topics in participants' intended curricula and student achievement in mathematics is a moderately positive one. Higher-performing countries had generally greater levels of coverage, and lower-performing countries lesser levels. For example, high-performing Singapore and Japan had 71 and 69 percent, respectively, of mathematics topics included in their intended curricula for all or almost all students, whereas low-performing Morocco and Tunisia had just 21 and 19 percent, respectively. However, as at the eighth grade, this relationship did not hold true for all countries at the fourth grade. For example, higher-performing Hong Kong, SAR and Belgium (Flemish) had 52 and 38 percent, respectively, of mathematics topics overall included in their intended curricula for all or almost all students, and lower-performing Iran had 60 percent included in its intended curriculum.

Are the TIMSS Mathematics Topics Taught in School?

The previous section described the coverage of the TIMSS mathematics 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 mathematics coverage in the implemented curricula of participating countries, the mathematics teachers[5] of the students assessed were asked to indicate whether each of the TIMSS 2003 mathematics topics was "mostly taught before this year," "mostly taught this year," or "not yet taught or just introduced." Exhibit 5.7 presents for eighth and fourth grade the percentage of students whose teachers reported that the students had been taught the TIMSS mathematics topics either prior to or during the year of the assessment. The

exhibit shows for each TIMSS participant, averaged across mathematics 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 mathematics teachers of the students who took the TIMSS 2003 test.[6] 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 students, an "s" is included. Where teacher responses are available for less than 50 percent, an "x" replaces the data.

Exhibit 5.7 shows that, according to their teachers, on average 72 percent of the eighth-grade students tested in TIMSS 2003 had been taught the TIMSS mathematics topics. In Armenia and Macedonia almost all students (90 % or more) had been taught the topics, as had the majority of students in every country except Botswana.

Consistent with the information on the intended curriculum presented in the previous section, number was the content area with the greatest coverage, with 95 percent of students across countries having been taught the TIMSS number topics by the eighth grade. This was followed by measurement (78%), geometry (69%), algebra (66%), and data (46%). All but 5 countries had 90 percent or more of their students taught the number topics, while 25 participating entities had less than half their students taught the data topics.

The agreement between the average percentages of TIMSS topics in countries' eighth-grade intended mathematics curricula and the percentages of students actually taught the TIMSS mathematics topics by the eighth grade is rather striking. The differences in these percentages were a mere two percentage points for the mathematics topics overall, one percentage point for number, three percentage points for algebra,

Exhibit 5.7: Summary of Students Taught the TIMSS Mathematics Topics

MATHEMATICS Grade 8

Countries	Average Percentage of Students Taught the TIMSS Mathematics Topics											
	Overall (45 topics)		Number (10 topics)		Algebra (6 topics)		Measurement (8 topics)		Geometry (13 topics)		Data (8 topics)	
Armenia	r	90 (0.7)	r	100 (0.2)	r	93 (1.0)	r	95 (0.8)	r	92 (0.8)	s	65 (3.0)
Australia		71 (1.1)		95 (0.7)		61 (2.1)		79 (1.4)		61 (1.7)		57 (2.7)
Bahrain		66 (0.6)		100 (0.1)		42 (1.6)		69 (1.8)		72 (0.8)		28 (1.3)
Belgium (Flemish)		62 (1.0)		93 (0.8)		42 (1.9)		69 (1.9)		61 (1.0)		35 (2.0)
Botswana		40 (1.1)		88 (0.6)		26 (2.0)		49 (2.4)		26 (1.8)		6 (1.3)
Bulgaria		75 (0.7)		99 (0.3)		86 (1.3)		93 (1.1)		70 (0.9)		24 (2.0)
Chile		66 (1.2)		93 (0.8)		55 (1.9)		59 (2.4)		64 (1.3)		47 (2.6)
Chinese Taipei		72 (0.7)		99 (0.6)		89 (1.1)		88 (1.5)		73 (1.3)		6 (1.6)
Cyprus		53 (0.5)		89 (0.8)		34 (1.1)		62 (1.2)		59 (0.5)		4 (0.7)
Egypt		88 (0.6)		99 (0.4)		91 (1.0)		92 (1.4)		94 (0.6)		60 (1.8)
Estonia		80 (0.8)		98 (0.9)		82 (1.2)		92 (1.0)		69 (1.1)		62 (2.5)
Ghana		60 (1.6)		83 (1.6)		59 (2.2)		53 (2.9)		51 (2.4)		55 (2.7)
Hong Kong, SAR		77 (1.0)		98 (0.5)		66 (2.1)		86 (1.8)		81 (1.3)		45 (2.5)
Hungary		85 (0.8)		100 (0.1)		93 (1.2)		98 (0.5)		83 (1.0)		54 (2.7)
Indonesia		79 (1.0)		98 (0.7)		72 (1.8)		88 (1.4)		69 (1.3)		68 (2.5)
Iran, Islamic Rep. of		75 (1.0)		95 (0.8)		65 (2.2)		64 (2.2)		91 (0.8)		43 (2.2)
Israel		61 (1.2)		96 (0.6)		69 (1.5)		60 (2.5)		45 (1.4)		41 (2.4)
Italy		79 (0.8)		99 (0.2)		62 (1.9)		88 (1.2)		85 (0.9)		50 (2.3)
Japan		74 (0.8)		98 (0.8)		92 (1.0)		79 (1.9)		75 (0.8)		21 (2.3)
Jordan		77 (0.9)		99 (0.4)		63 (1.7)		89 (1.8)		80 (1.0)		44 (2.4)
Korea, Rep. of	s	81 (1.2)	s	92 (1.1)	s	87 (1.4)	s	81 (1.9)	s	85 (1.5)	s	59 (2.5)
Latvia	s	67 (1.1)	s	98 (0.5)	s	52 (2.4)	s	63 (2.4)	s	61 (1.7)	s	48 (3.0)
Lebanon		68 (1.4)		92 (1.1)		58 (2.7)		72 (2.1)		71 (1.6)		38 (3.0)
Lithuania		82 (0.8)		99 (0.2)		69 (2.0)		92 (0.9)		76 (1.1)		69 (2.0)
Macedonia, Rep. of		95 (0.7)		99 (0.7)		98 (0.6)		90 (1.6)		99 (0.5)		– –
Malaysia		72 (1.1)		99 (0.3)		54 (2.1)		72 (1.9)		80 (1.4)		40 (2.5)
Moldova, Rep. of	r	82 (1.3)	r	94 (1.9)	r	89 (1.8)	r	81 (1.8)	r	82 (1.5)	r	57 (3.7)
Morocco	s	63 (1.4)	s	96 (0.9)	s	46 (3.2)	s	76 (3.0)	s	56 (2.0)		x x
Netherlands		71 (1.1)		93 (1.0)		71 (2.7)		81 (1.6)		64 (1.8)		43 (2.1)
New Zealand		75 (1.5)		94 (1.0)		67 (2.5)		80 (2.2)		62 (1.8)		69 (2.5)
Norway		55 (1.1)		87 (1.4)		23 (1.5)		66 (2.3)		41 (1.4)		53 (2.6)
Palestinian Nat'l Auth.		71 (0.9)		98 (0.7)		42 (2.1)		77 (2.0)		71 (1.0)		54 (1.6)
Philippines		60 (1.7)		98 (1.0)		85 (1.9)		67 (2.9)		33 (3.2)		30 (3.1)
Romania		89 (0.7)		100 (0.0)		94 (1.2)		94 (1.0)		95 (0.5)		59 (2.6)
Russian Federation		– –		– –		– –		– –		– –		– –
Saudi Arabia		62 (1.3)		92 (1.6)		55 (2.3)		66 (3.1)		65 (1.3)		18 (2.1)
Scotland		68 (1.3)		93 (1.0)		47 (2.9)		79 (1.6)		56 (1.7)		62 (2.1)
Serbia		89 (1.3)		94 (2.2)		95 (1.0)		93 (1.5)		92 (1.9)		65 (2.7)
Singapore		83 (0.5)		100 (0.1)		89 (0.8)		86 (0.7)		82 (1.0)		54 (1.1)
Slovak Republic		69 (0.6)		100 (0.1)		54 (1.4)		90 (1.1)		71 (0.8)		18 (1.9)
Slovenia		66 (0.7)		92 (0.5)		40 (1.9)		81 (1.6)		69 (0.9)		31 (1.8)
South Africa	r	55 (1.6)	r	77 (1.9)	r	57 (2.4)	r	49 (2.5)	r	48 (2.0)	r	40 (2.6)
Sweden		60 (0.9)		93 (0.5)		43 (2.1)		78 (1.1)		40 (1.3)		47 (1.9)
Syrian Arab Republic		– –		– –		– –		– –		– –		– –
Tunisia		64 (1.1)		93 (0.9)		44 (2.2)		75 (2.0)		60 (1.2)		37 (2.3)
United States		83 (0.8)		100 (0.2)		80 (1.3)		84 (1.2)		72 (1.6)		83 (1.3)
‡ England	s	83 (1.5)	s	99 (0.5)	s	73 (3.1)	s	84 (2.3)	s	77 (2.1)	s	79 (2.2)
International Avg.		72 (0.2)		95 (0.1)		66 (0.3)		78 (0.3)		69 (0.2)		46 (0.4)
Benchmarking Participants												
Basque Country, Spain		67 (1.4)		98 (0.4)		57 (3.0)		76 (2.0)		65 (2.1)		30 (3.5)
Indiana State, US		81 (1.8)		99 (0.3)		74 (2.9)		86 (2.0)		66 (3.5)		82 (2.7)
Ontario Province, Can.		80 (1.0)		93 (1.1)		60 (2.2)		86 (1.2)		75 (2.1)		82 (2.3)
Quebec Province, Can.		68 (1.2)		99 (0.5)		58 (2.6)		66 (2.0)		66 (2.0)		42 (2.4)

Background data provided by teachers at the time of testing.

‡ Did not satisfy guidelines for sample participation rates.

( ) 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 5.8 through 5.12 for data on individual topics.

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

Exhibit 5.7: Summary of Students Taught the TIMSS Mathematics Topics

MATHEMATICS Grade 4

Countries	Average Percentage of Students Taught the TIMSS Mathematics Topics											
	Overall (42 topics)		Number (12 topics)		Patterns and Relationships (6 topics)		Measurement (6 topics)		Geometry (11 topics)		Data (7 topics)	
Armenia	r	73 (1.1)	r	91 (0.9)	r	86 (1.4)	r	93 (1.3)	r	38 (2.5)	r	67 (2.4)
Australia		77 (1.5)		74 (1.7)		79 (3.1)		89 (1.5)		69 (1.5)		81 (2.4)
Belgium (Flemish)		81 (1.0)		93 (1.1)		83 (1.6)		93 (1.0)		62 (1.8)		79 (1.6)
Chinese Taipei		78 (1.1)		86 (1.0)		80 (1.8)		96 (1.0)		53 (2.3)		89 (1.9)
Cyprus		86 (0.9)		95 (0.7)		87 (1.4)		95 (1.0)		72 (1.9)		86 (1.7)
England	r	88 (0.9)	r	87 (1.2)	r	80 (1.9)	r	95 (0.9)	r	87 (1.5)	r	89 (1.5)
Hong Kong, SAR		73 (1.2)		90 (1.1)		55 (2.7)		84 (2.1)		53 (2.5)		83 (1.9)
Hungary		73 (1.2)		68 (1.1)		92 (1.0)		89 (1.3)		61 (2.1)		74 (2.9)
Iran, Islamic Rep. of		68 (1.4)		70 (1.4)		65 (2.3)		85 (1.8)		58 (1.9)		68 (2.4)
Italy		78 (0.9)		88 (1.0)		73 (1.7)		71 (2.0)		72 (1.6)		83 (1.7)
Japan		54 (1.0)		59 (1.4)		63 (1.9)		80 (1.7)		21 (1.1)		69 (2.0)
Latvia	s	72 (1.4)	s	67 (2.1)	s	89 (1.7)	s	93 (1.1)	s	45 (2.7)	s	87 (1.9)
Lithuania		78 (1.2)		77 (1.4)		83 (1.6)		93 (0.9)		63 (1.9)		87 (1.8)
Moldova, Rep. of	r	88 (0.9)	r	94 (0.9)	r	93 (1.3)	r	98 (0.5)	r	71 (2.1)	r	89 (1.8)
Morocco		x x		x x		x x		x x		x x		x x
Netherlands		54 (1.1)		63 (1.5)		67 (2.2)		78 (1.9)		13 (1.6)		67 (2.6)
New Zealand		77 (1.0)		76 (1.2)		84 (1.7)		85 (1.4)		65 (1.7)		87 (1.4)
Norway		52 (1.3)		54 (1.6)		53 (2.2)		78 (2.1)		32 (2.5)		54 (2.8)
Philippines		79 (1.9)		95 (0.9)		73 (3.2)		78 (3.2)		71 (2.8)		72 (3.1)
Russian Federation		– –		– –		– –		– –		– –		– –
Scotland	r	75 (1.2)	r	67 (1.8)	r	84 (1.9)	r	86 (2.6)	r	65 (1.8)	r	86 (1.9)
Singapore		82 (0.8)		97 (0.5)		87 (1.5)		95 (0.9)		51 (1.8)		90 (1.5)
Slovenia		59 (1.1)		54 (0.9)		86 (1.5)		59 (1.9)		34 (1.5)		84 (2.1)
Tunisia	r	58 (1.0)	r	40 (0.9)	r	85 (1.9)	r	82 (1.9)	r	43 (1.6)	r	71 (2.7)
United States		82 (0.8)		83 (1.1)		89 (1.0)		81 (1.3)		74 (1.5)		90 (1.2)
Yemen		– –		– –		– –		– –		– –		– –
International Avg.		73 (0.2)		77 (0.3)		79 (0.4)		86 (0.3)		55 (0.4)		80 (0.4)
Benchmarking Participants												
Indiana State, US		75 (1.5)		79 (2.1)		84 (2.2)		78 (3.2)		57 (3.5)		87 (1.7)
Ontario Province, Can.		80 (1.1)		75 (2.1)		83 (1.7)		86 (1.8)		75 (2.3)		91 (1.9)
Quebec Province, Can.		68 (1.3)		67 (1.6)		83 (1.5)		70 (2.6)		59 (1.8)		69 (2.9)

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

Background data provided 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.

See Exhibits 5.13 through 5.17 for data on individual topics.

no difference for measurement, two percentage points for geometry, and seven percentage points for data.

Although there was great agreement between coverage in the intended curriculum and the implemented curriculum internationally at the eighth grade, there was wide variation among individual countries. Agreement between the percentage of TIMSS mathematics topics included in a country's intended curriculum and the percentage of students taught the TIMSS mathematics topics in that country by the eighth grade was within 5 percentage points in 19 countries spanning the entire spectrum of achievement: Australia, Botswana, Bulgaria, Chile, Chinese Taipei, Egypt, Hong Kong SAR, Hungary, Iran, Jordan, Korea, Latvia, Malaysia, Moldova, New Zealand, the Palestinian National Authority, Romania, Saudi Arabia, and Singapore. However, there were also several participants where the level of agreement between coverage of the intended and implemented curricula was much less.

At the fourth grade, Exhibit 5.7 shows that internationally, on average, 73 percent of the students tested in TIMSS 2003 had been taught the TIMSS mathematics topics, with the percentage ranging from 88 percent in England and Moldova to 52 percent in Norway. The majority of students in every country had been taught the topics.

Consistent with the data reported on the intended mathematics curriculum at the fourth grade (Exhibit 5.6), measurement was the content area with the greatest percentage of students taught the topics (86%). The percentages of fourth-grade students internationally, on average, taught the TIMSS mathematics topics in the content areas of data, patterns and relationships, and number were rather similar. A full 80 percent of the students across countries had been taught the data topics by the fourth grade, 79 percent of students had been taught the patterns and relationships topics, and 77 percent of students had been taught the number topics. Across countries, the range for data was from 90 percent in the United States to 54 percent in Norway, for patterns and relationships from 93 percent in Moldova to 53 percent in Norway, and for number from 97 percent in Singapore to 40 percent in Tunisia.

5 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.

There was much less agreement at fourth grade than at eighth grade between the average percentages of TIMSS topics in countries' intended mathematics curricula and the percentages of students actually taught the TIMSS mathematics topics.

Which TIMSS Mathematics Topics Are in the Intended and Implemented Curriculum?

For first the eighth grade and then the fourth grade, this section presents information about the coverage of each individual mathematics topic in each country's intended and implemented curriculum. 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 5.8 through 5.12 present these data for the mathematics content areas at eighth grade, and Exhibits 5.13 through 5.17 for those at fourth grade.

Exhibit 5.8 presents information on the ten number topics at eighth grade. As shown in this exhibit, the TIMSS number topics were included in the intended curriculum of almost all participants. In particular, three topics – "common fractions," "decimal fractions," and "computations with decimals" – were included by all participants for all or almost all students. Exhibit 5.8 shows, however, that there was great variation among participants in the grade(s) at which the number 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 are taught. According to the exhibit, teachers reported that the TIMSS number topics had been taught to almost all students, with more than 90 percent of students taught each of the topics except "ratios," where the figure was 86 percent.

6 Further results from the teacher questionnaire are presented in Chapters 6 and 7.

Exhibit 5.8: Intended and Taught TIMSS Number Topics

MATHEMATICS Grade 8

Number	Whole numbers including place value, factorization, and the four operations			Computations, estimations, or approximations involving whole numbers			Common fractions			Decimal fractions		
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 100 (0.0)	●	--	r 98 (1.2)	●	--	r 100 (0.0)	●	--	r 100 (0.0)
Australia	●	3-6	100 (0.1)	●	5-8	96 (2.1)	●	5-8	100 (0.2)	●	5-8	98 (0.9)
Bahrain	●	1-6	100 (0.0)	●	1-6	99 (0.6)	●	3-4	100 (0.0)	●	5	100 (0.0)
Belgium (Flemish)	●	--	99 (0.5)	●	--	100 (0.0)	●	--	98 (1.1)	●	--	90 (2.3)
Botswana	●	8	100 (0.0)	●	8	94 (2.1)	●	6	99 (0.6)	●	8	99 (0.7)
Bulgaria	●	4	99 (0.9)	●	4	88 (3.0)	●	5	100 (0.0)	●	5	100 (0.0)
Chile	●	4	99 (0.9)	●	4	98 (0.9)	●	5	97 (1.1)	●	8	98 (1.0)
Chinese Taipei	●	7	99 (0.6)	●	7	99 (0.6)	●	7	99 (0.6)	●	7	99 (0.6)
Cyprus	●	4-7	87 (1.8)	●	4-7	62 (2.3)	●	4-7	96 (1.2)	●	4-7	84 (1.7)
Egypt	●	1-4	100 (0.0)	●	1-5	100 (0.0)	●	4-5	100 (0.0)	●	5	96 (1.6)
Estonia	●	5	98 (1.1)	●	5	98 (1.1)	●	6	98 (1.0)	●	6	98 (1.0)
Ghana	●	--	96 (1.8)	●	--	77 (3.9)	●	--	91 (2.8)	●	--	89 (3.2)
Hong Kong, SAR	●	1-4	99 (0.9)	●	4	97 (1.5)	●	4	97 (1.7)	●	5	99 (1.1)
Hungary	●	4	100 (0.0)	●	4	99 (0.7)	●	5	100 (0.0)	●	6	100 (0.0)
Indonesia	●	4-6	98 (1.3)	●	5-8	96 (2.1)	●	6-8	98 (1.5)	●	6-8	99 (1.3)
Iran, Islamic Rep. of	●	1-9	93 (2.2)	●	1-9	90 (2.8)	●	5-6	98 (1.1)	●	6	95 (1.7)
Israel	●	1-3	98 (1.0)	●	1-3	95 (1.2)	●	4-5	98 (1.0)	●	5-7	98 (1.0)
Italy	●	2-6	100 (0.0)	●	1-6	99 (0.7)	●	4-7	100 (0.0)	●	4-7	100 (0.0)
Japan	●	1-4	100 (0.0)	●	4-6	97 (1.6)	●	5	98 (1.4)	●	5	98 (1.4)
Jordan	●	1-6	100 (0.0)	●	1-6	99 (0.8)	●	2-5	99 (0.8)	●	4-8	99 (0.8)
Korea, Rep. of	○	9	s 71 (3.3)	●	--	99 (0.8)	●	--	s 95 (1.4)	●	--	s 99 (0.9)
Latvia	●	6-7	s 100 (0.0)	●	6-7	85 (4.5)	●	6	s 100 (0.0)	●	6-7	s 100 (0.0)
Lebanon	●	8	99 (1.0)	○	9-10	88 (3.0)	●	--	98 (1.2)	●	--	95 (1.8)
Lithuania	●	1-6	100 (0.0)	●	1-5	97 (1.3)	●	6	100 (0.0)	●	6	100 (0.0)
Macedonia, Rep. of	●	1-5	99 (1.0)	●	1-5	99 (0.7)	●	5	99 (0.7)	●	5	99 (1.0)
Malaysia	●	1-7	97 (1.6)	●	3-7	99 (0.7)	●	4	100 (0.0)	●	4-7	99 (1.0)
Moldova, Rep. of	●	5-6	r 94 (2.3)	●	5-6	r 94 (2.2)	●	5	r 92 (2.5)	●	5-6	r 92 (2.7)
Morocco	●	--	s 99 (0.7)	●	--	99 (1.0)	●	--	s 100 (0.0)	●	--	s 97 (2.1)
Netherlands	●	K-6	65 (4.2)	●	K-6	94 (2.0)	●	K-6	98 (1.3)	●	K-6	97 (1.6)
New Zealand	●	2-7	100 (0.1)	●	4-7	95 (2.7)	●	4-9	99 (0.8)	●	5-9	98 (1.2)
Norway	●	2-10	99 (0.7)	●	3-10	98 (1.3)	●	4-10	90 (2.6)	●	4-10	94 (2.0)
Palestinian Nat'l Auth.	●	1-5	99 (0.6)	●	1-6	95 (2.1)	●	1-5	98 (1.4)	●	1-6	100 (0.0)
Philippines	●	7	98 (1.2)	●	7	98 (1.4)	●	--	98 (1.3)	●	--	99 (1.0)
Romania	●	1-5	100 (0.0)	●	1-5	100 (0.0)	●	4-6	100 (0.0)	●	5-7	100 (0.0)
Russian Federation	●	--	– –	●	--	– –	●	--	– –	●	--	– –
Saudi Arabia	●	1-7	90 (3.5)	●	4	88 (3.7)	●	4-5	98 (1.2)	●	4-6	94 (4.3)
Scotland	●	--	96 (1.7)	●	--	99 (0.6)	●	--	95 (1.4)	●	--	97 (1.6)
Serbia	●	6	94 (2.2)	●	6	94 (2.2)	●	5	94 (2.2)	●	5	95 (2.1)
Singapore	●	1-5	100 (0.0)	●	1-5	99 (0.4)	●	3-5	100 (0.0)	●	4-5	100 (0.3)
Slovak Republic	●	6	100 (0.0)	●	5	100 (0.0)	●	6	100 (0.0)	●	5	100 (0.0)
Slovenia	●	8	99 (0.7)	●	5	97 (1.4)	●	6	100 (0.0)	●	7	100 (0.0)
South Africa	●	--	r 87 (2.5)	●	--	r 73 (3.3)	●	--	89 (2.5)	●	--	r 77 (3.2)
Sweden	●	7	100 (0.4)	●	7	99 (0.7)	●	7	98 (0.7)	●	7	98 (0.8)
Syrian Arab Republic	⦿	--	– –	●	--	– –	●	--	– –	●	--	– –
Tunisia	●	--	99 (0.6)	●	--	96 (1.7)	●	--	98 (1.1)	●	--	97 (1.4)
United States	●	--	100 (0.0)	●	--	99 (0.5)	●	--	100 (0.3)	●	--	100 (0.1)
‡ England	●	K-7	s 100 (0.0)	●	K-8	100 (0.0)	●	2-5	s 100 (0.0)	●	3-6	s 99 (1.4)
International Avg.			97 (0.2)			95 (0.3)			98 (0.2)			97 (0.2)
Benchmarking Participants												
Basque Country, Spain	⦿	10	100 (0.0)	●	--	100 (0.5)	●	--	100 (0.0)	●	--	98 (1.3)
Indiana State, US	●	--	100 (0.0)	●	--	100 (0.0)	●	--	100 (0.0)	●	--	100 (0.0)
Ontario Province, Can.	●	6-8	100 (0.1)	●	1-6	100 (0.0)	●	5-6	96 (2.0)	●	4-7	97 (1.7)
Quebec Province, Can.	●	1-6	97 (1.6)	●	1-6	98 (1.6)	●	4-7	98 (1.4)	●	2-7	97 (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.

‡ 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 5.8: Intended and Taught TIMSS Number Topics *(Continued...)*

MATHEMATICS Grade 8

Number	Representing decimals and fractions			Computations with fractions			Computations with decimals			Integers including words, numbers, or models		
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 99 (0.7)	●	--	r 100 (0.0)	●	--	r 100 (0.0)	●	--	r 99 (0.7)
Australia	●	5-8	98 (1.1)	●	5-8	97 (1.1)	●	5-8	98 (0.9)	●	8	97 (1.2)
Bahrain	●	4-6	100 (0.5)	●	4-7	100 (0.0)	●	5-7	100 (0.0)	●	7	100 (0.0)
Belgium (Flemish)	●	--	92 (1.9)	●	--	98 (1.1)	●	--	99 (0.9)	●	--	90 (1.5)
Botswana	●	6	89 (2.9)	●	8	95 (1.7)	●	8	97 (1.4)	●	8	95 (2.1)
Bulgaria	●	6	100 (0.2)	●	5	100 (0.0)	●	5	100 (0.0)	●	6	100 (0.0)
Chile	●	8	96 (1.4)	●	5-6	97 (1.0)	●	6-7	98 (0.9)	●	8	96 (1.6)
Chinese Taipei	●	7	99 (0.9)	●	7	99 (0.6)	●	7	99 (0.6)	●	7	99 (0.7)
Cyprus	●	4-7	82 (1.9)	●	4-7	99 (0.6)	●	4-7	91 (1.3)	●	4-8	94 (1.3)
Egypt	●	5	99 (0.9)	●	5	99 (0.9)	●	5	98 (1.3)	●	7	99 (0.5)
Estonia	●	6	98 (1.0)	●	6	98 (1.0)	●	5	98 (1.0)	●	6-7	97 (1.3)
Ghana	●	--	90 (3.1)	●	--	82 (4.2)	●	--	72 (3.9)	●	--	92 (2.7)
Hong Kong, SAR	●	7	95 (1.9)	●	6	99 (0.7)	●	5	99 (0.7)	●	7-9	98 (1.3)
Hungary	●	6	100 (0.0)	●	7	100 (0.0)	●	7	100 (0.0)	●	7	100 (0.0)
Indonesia	●	6-8	98 (1.1)	●	5-8	100 (0.0)	●	6-8	100 (0.0)	●	4-8	98 (1.2)
Iran, Islamic Rep. of	●	6	98 (1.3)	●	6	99 (0.7)	●	6	98 (1.0)	●	6	99 (0.8)
Israel	●	4-7	96 (1.3)	●	5-7	98 (0.5)	●	5-7	98 (1.0)	●	2-7	99 (0.8)
Italy	●	4-6	100 (0.3)	●	4-8	100 (0.0)	●	4-8	100 (0.0)	●	6-8	100 (0.3)
Japan	●	4	98 (1.2)	●	5-6	100 (0.0)	●	4-5	100 (0.0)	●	7	99 (0.6)
Jordan	●	4-7	100 (0.0)	●	4-7	99 (0.8)	●	4-7	99 (0.8)	●	7-10	99 (0.5)
Korea, Rep. of	●	--	s 96 (1.3)	●	--	94 (2.0)	●	--	s 96 (1.8)	●	--	s 95 (1.5)
Latvia	●	6-7	s 100 (0.0)	●	6	100 (0.0)	●	6	s 100 (0.0)	●	6-7	s 100 (0.0)
Lebanon	●	8	92 (2.4)	●	--	97 (1.4)	●	--	97 (1.5)	●	--	96 (1.8)
Lithuania	●	4-6	100 (0.0)	●	6	100 (0.0)	●	5-6	100 (0.0)	●	6-8	100 (0.0)
Macedonia, Rep. of	●	5-6	99 (0.7)	●	5	99 (0.7)	●	6	99 (0.7)	●	6-7	99 (0.9)
Malaysia	●	4-7	99 (0.7)	●	4-7	100 (0.0)	●	4-7	100 (0.0)	●	7	100 (0.0)
Moldova, Rep. of	●	5	r 95 (2.2)	●	5-7	r 95 (2.0)	●	5,7	r 95 (2.1)	●	6	r 94 (2.2)
Morocco	○	--	s 93 (3.2)	●	--	100 (0.0)	●	--	s 100 (0.0)	●	--	s 99 (0.9)
Netherlands	●	K-6	95 (2.0)	●	K-6	95 (2.1)	●	K-6	97 (1.5)	●	K-6	97 (2.7)
New Zealand	●	2-5	98 (1.1)	⦿	8-9	95 (1.5)	●	5-9	98 (0.9)	⦿	6-9	95 (2.3)
Norway	●	4-10	84 (3.1)	●	5-10	85 (2.8)	●	5-10	97 (1.4)	●	6-10	98 (1.2)
Palestinian Nat'l Auth.	●	3-6	99 (0.7)	●	3-6	99 (1.1)	●	3-6	98 (1.2)	●	6-7	99 (1.1)
Philippines	●	--	97 (1.5)	●	--	99 (0.8)	●	--	97 (1.6)	●	7	98 (1.2)
Romania	●	5-8	100 (0.0)	●	4-6	100 (0.0)	●	5-7	100 (0.0)	●	5-9	100 (0.0)
Russian Federation	●	--	– –	●	--	– –	●	--	– –	●	--	– –
Saudi Arabia	●	4-6	95 (1.7)	●	4-8	100 (0.4)	●	4-6	97 (1.9)	●	7	98 (1.1)
Scotland	●	--	96 (2.0)	⦿	--	78 (3.6)	●	--	98 (1.1)	⦿	--	90 (2.6)
Serbia	●	5	93 (2.4)	●	5	93 (2.4)	●	5	94 (2.2)	●	6	94 (2.2)
Singapore	●	4-5	100 (0.3)	●	4-7	100 (0.0)	●	4-5	100 (0.0)	●	7	99 (0.5)
Slovak Republic	●	6	100 (0.0)	●	7	100 (0.0)	●	5	100 (0.0)	●	6	100 (0.0)
Slovenia	●	7	100 (0.0)	●	7	100 (0.0)	●	6	99 (0.6)	●	4	99 (0.8)
South Africa	●	--	r 76 (3.3)	●	--	r 71 (3.8)	●	--	r 68 (3.9)	●	--	r 94 (1.7)
Sweden	●	7	96 (1.0)	○	9	94 (1.3)	●	7	99 (0.4)	●	5	98 (0.9)
Syrian Arab Republic	●	--	– –	●	--	– –	●	--	– –	●	--	– –
Tunisia	●	--	95 (1.9)	●	--	99 (0.6)	●	--	100 (0.0)	●	--	99 (0.6)
United States	●	--	100 (0.0)	●	--	100 (0.3)	●	--	100 (0.3)	●	--	99 (0.5)
‡ England	●	3-5	s 100 (0.0)	●	6-8	98 (1.5)	●	4-8	s 99 (0.6)	●	K-7	s 100 (0.0)
International Avg.			96 (0.2)			97 (0.2)			97 (0.2)			98 (0.2)
Benchmarking Participants												
Basque Country, Spain	●	--	96 (2.3)	●	--	100 (0.0)	●	--	99 (0.8)	●	--	100 (0.0)
Indiana State, US	●	--	99 (1.1)	●	--	100 (0.0)	●	--	99 (0.5)	●	--	98 (1.2)
Ontario Province, Can.	●	4-6	97 (1.8)	●	7-8	96 (2.0)	●	4-8	99 (1.0)	●	7-8	88 (3.0)
Quebec Province, Can.	●	4-7	99 (1.0)	●	5-7	100 (0.0)	●	4-7	99 (0.8)	●	6-8	100 (0.2)

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.

‡ 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 5.8: Intended and Taught TIMSS Number Topics *(...Continued)*

MATHEMATICS Grade 8

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

Number	Ratios			Conversion of percents to fractions or decimals, and vice versa		
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	⦿	--	r 99 (0.5)	●	--	r 100 (0.4)
Australia	○	9-10	75 (3.8)	●	5-7	93 (1.9)
Bahrain	●	6-7	98 (0.6)	●	6-7	100 (0.0)
Belgium (Flemish)	●	--	72 (3.5)	●	--	89 (2.6)
Botswana	○	9	15 (3.2)	●	8	99 (1.0)
Bulgaria	●	6	100 (0.4)	●	5	100 (0.0)
Chile	●	8	83 (2.6)	●	7	74 (2.8)
Chinese Taipei	●	7	99 (0.9)	●	7	99 (0.6)
Cyprus	●	5-8	98 (1.3)	●	4-7	98 (0.1)
Egypt	●	5	96 (1.6)	●	5	99 (0.9)
Estonia	●	7	97 (1.1)	●	6	97 (1.6)
Ghana	●	--	61 (5.0)	●	--	82 (3.7)
Hong Kong, SAR	●	7-9	94 (2.0)	●	7-9	99 (0.7)
Hungary	●	6	100 (0.0)	●	6	100 (0.5)
Indonesia	●	7-8	97 (1.5)	●	6-8	99 (1.1)
Iran, Islamic Rep. of	●	6	94 (2.0)	●	6	87 (2.6)
Israel	●	6-8	88 (2.4)	●	6-8	95 (1.6)
Italy	●	6-7	100 (0.0)	●	6-7	93 (2.1)
Japan	●	6	91 (2.4)	●	5	98 (1.4)
Jordan	●	6-8	100 (0.0)	●	6-8	99 (0.7)
Korea, Rep. of	●	--	s 85 (2.4)	●	--	91 (2.2)
Latvia	●	6-7	s 99 (1.3)	●	6-7	100 (0.0)
Lebanon	●	8	82 (3.5)	●	--	79 (3.6)
Lithuania	●	6	97 (1.7)	●	5-6	100 (0.0)
Macedonia, Rep. of	●	6-7	98 (1.0)	●	6	99 (0.7)
Malaysia	●	8-9	97 (1.9)	●	6-7	99 (0.8)
Moldova, Rep. of	●	6	r 93 (2.5)	●	6-7	r 97 (1.4)
Morocco	○	--	s 89 (3.9)	○	--	87 (4.7)
Netherlands	●	--	91 (3.0)	⦿	--	96 (2.2)
New Zealand	⦿	8-9	66 (4.5)	⦿	6-7	96 (2.5)
Norway	○	9-10	40 (4.7)	●	8-10	82 (3.3)
Palestinian Nat'l Auth.	●	6-7	98 (0.9)	●	6	97 (1.6)
Philippines	●	--	94 (2.2)	●	--	97 (1.6)
Romania	●	5-9	100 (0.0)	●	5-9	100 (0.0)
Russian Federation	●	--	– –	●	--	– –
Saudi Arabia	●	4-8	83 (5.1)	●	--	80 (5.5)
Scotland	⦿	--	87 (2.7)	●	--	94 (1.9)
Serbia	●	7	94 (2.2)	●	6	94 (2.2)
Singapore	●	5-7	100 (0.3)	●	5-7	100 (0.3)
Slovak Republic	●	7	100 (0.0)	●	7	99 (0.6)
Slovenia	●	8	22 (3.9)	●	7	99 (0.6)
South Africa	⦿	--	r 60 (4.1)	●	--	r 73 (3.3)
Sweden	●	8	49 (3.3)	●	7	96 (1.1)
Syrian Arab Republic	●	--	– –	●	--	– –
Tunisia	●	--	74 (3.7)	●	--	75 (3.8)
United States	●	--	98 (0.7)	●	--	99 (0.4)
‡ England	●	4-7	s 98 (1.3)	●	5-6	96 (2.7)
International Avg.			86 (0.4)			94 (0.3)
Benchmarking Participants						
Basque Country, Spain	●	--	95 (2.1)	●	--	96 (2.1)
Indiana State, US	●	--	98 (1.5)	●	--	96 (1.9)
Ontario Province, Can.	●	8-10	71 (4.6)	●	8	89 (2.9)
Quebec Province, Can.	●	7-8	100 (0.0)	●	6-7	97 (1.8)

● 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.

‡ 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.

The algebra topics were included in their intended eighth-grade curricula by somewhat fewer participants, as shown in Exhibit 5.9. The most frequently reported topic – "sums, products, and powers of expressions containing variables" – was included for all or almost all students in 42 of the participating entities. In contrast, "attributes of a graph" was included in the intended curriculum of just 19 participants. Although when most topics were included, they were intended for all or almost all students, "simple linear equations and equalities, and simultaneous (two variables) equations" and "proportional, linear, and nonlinear relationships" were intended for the top-track students only in 9 and 7 entities, respectively. Countries frequently indicated that algebra topics would primarily be taught in later grades. Exhibit 5.9 also shows that the percentages of students whose teachers reported having taught the algebra topics generally is in line with the inclusion of the topics in the intended curriculum. The percentage of students ranged from 88 percent for "sums, products, and powers of expressions containing variables" to 44 percent for "attributes of a graph."

As noted earlier in this chapter, most TIMSS participants included good coverage of measurement in their eighth-grade intended curriculum. Exhibit 5.10 provides more detail, showing that five of the eight measurement topics are included in the intended curriculum of at least 40 of the participants. These topics include standard units of measure, relationship among conversion units, using standard measurement tools, estimation of measurements, and measurement formulas. Also, teachers reported that these topics had been well covered in the classroom, with more than 80 percent of students having been taught each one, on average. The other three topics were included in fewer participants' curricula and had received less attention in the classroom. "Precision of measurements" was included in the intended curriculum of just 22 participants, and on average, 57 percent of students had teachers reporting that the topic had been taught.

With 13 topics, geometry was the TIMSS mathematics content area with the most topics. However, as shown in Exhibit 5.11, just three

Exhibit 5.9: Intended and Taught TIMSS Algebra Topics

MATHEMATICS Grade 8

Algebra	Numeric, algebraic, and geometric patterns or sequences			Sums, products, and powers of expressions containing variables			Simple linear equations and equalities, and simultaneous (two variables) equations			Equivalent representations of functions as ordered pairs, tables, graphs, words, or equations		
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 98 (0.9)	●	--	r 100 (0.0)	●	--	r 99 (0.5)	⦿	--	r 88 (2.6)
Australia	●	5-7	89 (2.7)	●	8-9	76 (3.3)	⦿	9-10	42 (3.9)	●	7-9	72 (3.7)
Bahrain	●	1-8	58 (3.2)	●	7-9	97 (1.4)	●	7-9	28 (3.5)	○	9-12	48 (3.3)
Belgium (Flemish)	●	--	56 (3.8)	●	--	78 (2.4)	●	--	28 (3.4)	●	--	40 (4.2)
Botswana	●	8	70 (4.2)	○	9	47 (4.8)	○	9	16 (3.7)	○	11	13 (3.2)
Bulgaria	○	--	47 (4.5)	●	7-8	99 (0.9)	●	6-8	98 (1.2)	●	8	97 (0.8)
Chile	○	9	67 (3.3)	○	9	76 (3.1)	○	10	58 (3.6)	○	10	54 (3.4)
Chinese Taipei	○	9	76 (3.4)	●	8	99 (0.6)	●	8	98 (1.4)	●	8	97 (1.4)
Cyprus	●	4-8	25 (2.3)	●	6-8	85 (2.3)	⦿	7-9	72 (2.8)	●	5-8	9 (1.9)
Egypt	●	8	84 (3.0)	●	6-7	99 (0.8)	●	6-8	99 (0.7)	●	8	98 (1.3)
Estonia	●	4-9	58 (3.9)	●	8-9	99 (1.0)	●	7-8	98 (1.1)	●	7,9	88 (2.9)
Ghana	●	--	81 (3.8)	●	--	88 (2.8)	●	--	77 (3.8)	●	--	54 (4.1)
Hong Kong, SAR	●	7-9	76 (3.8)	●	7-9	95 (1.8)	●	7-9	89 (2.2)	○	12	70 (4.4)
Hungary	●	4	82 (3.3)	●	5	96 (1.6)	●	7-10	92 (2.2)	●	8	97 (1.4)
Indonesia	●	7-8	60 (4.3)	●	7-8	81 (3.6)	●	7-8	100 (0.2)	●	8-9	97 (1.4)
Iran, Islamic Rep. of	●	8-9	64 (4.1)	●	6-7,9	93 (2.0)	●	8-9	91 (2.3)	○	9-11	67 (4.2)
Israel	●	4-9	91 (2.1)	●	8-9	89 (1.9)	●	8-9	93 (1.8)	●	8-9	58 (3.8)
Italy	●	8-9	62 (3.5)	●	8-10	89 (2.6)	●	8-10	59 (4.0)	●	8-10	69 (3.4)
Japan	●	7	77 (3.5)	●	7-8	96 (1.3)	●	7-8	95 (1.9)	●	7-8	93 (1.8)
Jordan	●	4-11	49 (4.4)	●	7-11	99 (0.7)	●	6-9	97 (1.5)	●	8-10	99 (1.1)
Korea, Rep. of	●	--	s 62 (3.7)	●	--	92 (1.9)	●	--	s 97 (0.9)	●	--	s 97 (1.0)
Latvia	○	9	s 3 (1.7)	●	7	95 (0.5)	●	7	s 64 (4.7)	●	7	s 53 (5.5)
Lebanon	○	11-12	70 (4.3)	●	8	97 (1.5)	○	9	49 (4.5)	○	9-12	56 (4.4)
Lithuania	○	11-12	37 (4.1)	●	8-12	98 (1.3)	●	4-8	82 (3.6)	●	8-12	73 (3.8)
Macedonia, Rep. of	●	7	r 87 (3.1)	●	7	98 (1.0)	●	5-8	99 (0.8)	●	5-8	100 (0.0)
Malaysia	●	7	83 (3.1)	○	9	89 (2.3)	●	8-10	58 (4.3)	○	9	50 (4.5)
Moldova, Rep. of	●	6-7	s 85 (3.6)	●	7	r 97 (1.4)	●	7-8	r 93 (2.4)	●	7-8	r 92 (2.5)
Morocco	○	--	x x	●	--	94 (3.1)	○	--	s 48 (6.5)	○	--	s 28 (5.8)
Netherlands	○	--	67 (5.2)	⦿	--	78 (3.9)	⦿	--	68 (4.6)	●	--	77 (4.3)
New Zealand	●	8-9	92 (2.8)	⦿	8-9	92 (2.6)	⦿	8-10	47 (4.8)	●	4-9	75 (3.9)
Norway	○	9-10	48 (4.2)	●	8-10	30 (4.3)	●	8-10	6 (1.7)	○	9-10	30 (3.8)
Palestinian Nat'l Auth.	●	6-8	46 (4.3)	●	7-8	97 (1.7)	●	7-8	44 (4.5)	○	9	39 (4.6)
Philippines	●	8	65 (4.5)	●	8	94 (2.4)	●	8	98 (1.3)	○	10	93 (2.4)
Romania	●	6-9	83 (3.5)	●	6-9	95 (1.8)	●	7-9	100 (0.0)	●	7-11	98 (1.1)
Russian Federation	○	9	——	●	--	——	●	--	——	●	--	——
Saudi Arabia	○	11	59 (5.9)	●	8	96 (1.8)	●	7-8	40 (4.8)	●	8	85 (3.6)
Scotland	●	--	82 (3.2)	⦿	--	60 (4.8)	⦿	--	r 32 (4.6)	○	--	38 (5.1)
Serbia	●	7	83 (3.2)	●	7	95 (2.1)	●	8	99 (0.9)	●	8	98 (1.2)
Singapore	●	6-8	97 (1.0)	⦿	7-10	96 (1.1)	●	7-8	92 (1.4)	●	8-10	92 (1.4)
Slovak Republic	⦿	9	28 (3.6)	●	8	99 (0.5)	●	7	62 (4.7)	○	9	25 (3.5)
Slovenia	●	4	45 (4.6)	●	6	84 (3.1)	●	7	18 (3.4)	●	7	44 (4.3)
South Africa	●	--	r 76 (3.8)	●	--	r 92 (2.2)	⦿	--	r 59 (3.9)	○	--	r 50 (3.8)
Sweden	○	9	64 (3.9)	○	9	61 (4.0)	⦿	7-9	28 (3.5)	○	9	37 (3.8)
Syrian Arab Republic	●	10	——	●	--	——	○	9	——	○	9	——
Tunisia	●	--	76 (3.8)	●	--	81 (3.5)	○	11	23 (3.5)	○	11	36 (4.0)
United States	●	--	95 (1.3)	●	--	93 (1.2)	⦿	--	80 (2.4)	●	--	85 (1.9)
‡ England	●	6-8	s 95 (2.4)	●	6-7	86 (3.8)	●	6-9	s 63 (5.5)	●	6-7	s 81 (4.4)
International Avg.			68 (0.5)			88 (0.4)			68 (0.5)			68 (0.5)
Benchmarking Participants												
Basque Country, Spain	●	--	70 (4.6)	⦿	10	86 (3.5)	⦿	10	65 (5.6)	⦿	10	40 (5.4)
Indiana State, US	●	--	92 (3.5)	●	--	94 (2.3)	●	--	72 (5.5)	●	--	78 (3.8)
Ontario Province, Can.	●	6-8	89 (2.6)	●	7-8	86 (3.5)	●	7-8	64 (4.0)	●	8	60 (4.8)
Quebec Province, Can.	●	1-7	92 (2.8)	●	8-11	68 (4.7)	●	8-11	22 (3.9)	○	9-11	66 (4.8)

Background data on intended curriculum provided by National Research Coordinators, and on implemented curriculum by teachers at the time of testing.

‡ 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 5.9: Intended and Taught TIMSS Algebra Topics

MATHEMATICS Grade 8

Algebra

Countries	Proportional, linear, and nonlinear relationships			Attributes of a graph		
	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 98 (0.9)	●	--	r 76 (3.6)
Australia	⦿	9-11	46 (3.8)	⦿	9-11	39 (4.6)
Bahrain	●	6-9	18 (2.9)	○	10-12	4 (1.2)
Belgium (Flemish)	●	--	39 (3.5)	○	--	10 (1.8)
Botswana	○	9	7 (2.5)	○	9	1 (1.0)
Bulgaria	●	8	93 (2.1)	●	8	80 (3.2)
Chile	○	11	45 (4.0)	○	--	30 (3.8)
Chinese Taipei	●	8	86 (3.1)	○	9	75 (3.4)
Cyprus	⦿	6-9	6 (2.2)	○	9	4 (1.5)
Egypt	●	5,11	70 (3.2)	●	8	98 (0.9)
Estonia	●	7,9	93 (2.2)	●	6-7, 9	58 (3.2)
Ghana	●	--	28 (4.3)	●	--	27 (4.3)
Hong Kong, SAR	○	10-11	42 (4.9)	○	12	21 (3.4)
Hungary	●	8	97 (1.3)	○	11	90 (2.5)
Indonesia	○	10	56 (4.3)	○	10	38 (4.0)
Iran, Islamic Rep. of	○	9-11	42 (4.2)	○	10-11	32 (3.9)
Israel	○	9	49 (3.6)	●	8-9	30 (3.5)
Italy	○	9-10	59 (3.6)	○	9-13	38 (3.3)
Japan	●	7-8	92 (2.1)	●	8	97 (1.5)
Jordan	●	7-9	24 (3.9)	○	10-12	14 (3.1)
Korea, Rep. of	○	9	s 80 (3.5)	●	--	91 (2.0)
Latvia	●	7	s 75 (4.4)	●	7,9	26 (4.7)
Lebanon	○	9	37 (4.4)	○	10-12	36 (4.8)
Lithuania	●	8-12	79 (3.2)	○	9-12	44 (4.0)
Macedonia, Rep. of	●	7-8	98 (1.1)	●	7-8	99 (0.6)
Malaysia	○	9	27 (3.7)	○	9	14 (3.0)
Moldova, Rep. of	●	7	r 86 (3.2)	●	8	r 79 (3.4)
Morocco	○	--	x x	○	--	10 (4.2)
Netherlands	●	--	62 (4.9)	●	--	75 (4.5)
New Zealand	⦿	8-10	54 (4.9)	⦿	9	43 (4.7)
Norway	○	9-10	8 (2.0)	○	12-13	15 (2.7)
Palestinian Nat'l Auth.	○	9-10	14 (3.0)	○	10	12 (2.8)
Philippines	○	10	76 (4.3)	○	10	81 (3.6)
Romania	●	7-11	91 (2.7)	●	7-11	94 (2.1)
Russian Federation	●	--	– –	●	8-9	– –
Saudi Arabia	●	8	33 (5.0)	○	10,12	14 (2.4)
Scotland	⦿	--	40 (4.5)	○	--	26 (4.2)
Serbia	●	7	96 (1.7)	⦿	8	98 (1.1)
Singapore	●	8-10	88 (1.7)	●	8-10	65 (2.3)
Slovak Republic	●	7	98 (0.8)	⦿	9	10 (2.2)
Slovenia	●	7	38 (4.0)	●	7	9 (2.7)
South Africa	○	--	r 32 (3.8)	○	--	r 34 (3.6)
Sweden	⦿	8-9	49 (3.9)	○	9	18 (2.8)
Syrian Arab Republic	○	9	– –	○	12	– –
Tunisia	○	11	20 (3.2)	○	11	21 (3.7)
United States	●	--	62 (2.5)	●	--	67 (2.2)
‡ England	●	7-12	s 57 (6.0)	●	7-11	54 (5.2)
International Avg.			57 (0.5)			44 (0.5)
Benchmarking Participants						
Basque Country, Spain	⦿	10	60 (5.2)	○	11	20 (4.6)
Indiana State, US	●	--	54 (5.4)	●	--	54 (4.6)
Ontario Province, Can.	●	8	27 (4.7)	○	9	34 (4.4)
Quebec Province, Can.	⦿	10-11	54 (4.3)	○	9	44 (4.5)

○ Not included in the curriculum through eighth grade
⦿ Only the more able students
● All or almost all students

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.

‡ 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 Measurement Topics

MATHEMATICS Grade 8

Measurement

Countries	Standard units for measures of length, area, volume, perimeter, circumference, time, speed, density, angle, mass/weight			Relationships among units of conversions within systems of units, and for rates			Use standard tools to measure length, time, speed, angle, and temperature			Estimations of length, circumference, area, volume, weight, time, angle, and a speed in problem situations		
	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 100 (0.3)	●	--	r 97 (1.4)	●	--	r 99 (0.9)	⊙	--	r 99 (0.5)
Australia	●	5-8	98 (1.0)	●	5-8	92 (2.2)	●	5-8	93 (2.1)	●	5-8	90 (2.1)
Bahrain	●	3-8	88 (2.6)	●	4-6	85 (3.2)	●	3-8	60 (3.4)	●	2-8	69 (3.7)
Belgium (Flemish)	●	--	94 (1.7)	●	--	71 (3.2)	●	--	70 (3.7)	●	--	73 (3.6)
Botswana	●	7	74 (3.8)	●	8	79 (4.1)	●	8	81 (3.6)	●	8	43 (4.5)
Bulgaria	●	4	100 (0.3)	●	4	100 (0.3)	●	4	96 (1.5)	●	6	97 (1.5)
Chile	●	1-8	78 (3.1)	●	1-8	72 (3.6)	●	1-8	64 (3.7)	●	1-8	59 (3.9)
Chinese Taipei	●	6	89 (2.6)	●	6	91 (2.4)	●	6	89 (2.7)	●	6	92 (2.1)
Cyprus	●	4-7	98 (0.8)	●	4-8	74 (2.6)	●	4-8	29 (2.4)	●	4-8	87 (2.1)
Egypt	●	3-5	97 (1.7)	●	3-5	86 (2.9)	●	3-5	86 (3.1)	●	3-5	91 (2.6)
Estonia	●	1-4	99 (0.5)	●	4-6	96 (1.4)	●	1-6	99 (0.8)	○	--	96 (1.6)
Ghana	●	--	74 (4.4)	●	--	55 (4.7)	●	--	64 (5.0)	●	--	56 (4.1)
Hong Kong, SAR	●	6	93 (2.3)	●	5	92 (2.6)	●	6	87 (3.0)	●	6	89 (2.9)
Hungary	●	7	99 (0.7)	●	2-5	100 (0.0)	●	2-6	99 (0.8)	○	--	99 (0.9)
Indonesia	●	5-8	99 (0.8)	●	8-9	79 (4.0)	●	7-8	83 (3.2)	●	7-9	98 (1.1)
Iran, Islamic Rep. of	●	5,7-8	77 (3.5)	●	5,7	62 (4.0)	●	3-5	61 (3.9)	●	7-8	75 (3.3)
Israel	●	2-8	80 (2.9)	●	4,7	77 (3.1)	●	3-6	63 (4.1)	○	--	66 (3.8)
Italy	●	6-7	100 (0.0)	●	4-7	85 (2.6)	●	4-7	92 (1.9)	●	8-10	90 (2.3)
Japan	●	2-6	96 (1.7)	●	2-6	91 (2.5)	●	2-6	90 (2.6)	●	5-6	89 (2.4)
Jordan	●	4-8	96 (2.1)	●	5-6	98 (1.3)	●	4-7	89 (3.1)	○	--	91 (2.7)
Korea, Rep. of	●	--	s 89 (2.6)	●	--	79 (3.1)	●	--	s 69 (3.9)	●	--	s 82 (3.1)
Latvia	●	6-7	s 83 (4.4)	●	--	84 (4.3)	●	6	s 93 (2.7)	●	--	s 64 (6.2)
Lebanon	○	--	91 (2.4)	○	--	74 (3.6)	○	--	76 (4.0)	○	--	76 (3.1)
Lithuania	●	4-12	99 (0.8)	●	5-6	98 (1.3)	●	5-8	97 (1.4)	●	5-12	91 (2.4)
Macedonia, Rep. of	●	3-8	97 (1.5)	●	5-8	96 (1.8)	●	4-8	94 (2.0)	●	7-8	91 (2.1)
Malaysia	●	3-7	93 (2.1)	●	4-7	87 (2.9)	●	4-8	91 (2.5)	●	4-8	85 (3.4)
Moldova, Rep. of	●	5-6	r 91 (2.9)	●	6	r 90 (2.7)	●	6	r 93 (2.5)	●	6	r 83 (4.0)
Morocco	○	--	s 85 (3.9)	●	--	90 (4.1)	○	--	s 82 (5.4)	○	--	s 87 (3.4)
Netherlands	●	--	93 (2.7)	○	--	78 (4.0)	●	--	92 (2.6)	●	--	88 (3.5)
New Zealand	●	4-7	96 (2.5)	●	6-9	93 (2.5)	●	4-7	92 (2.9)	●	6-9	81 (4.5)
Norway	●	2-10	80 (3.6)	●	8-10	83 (3.6)	●	2-10	80 (3.2)	●	8-10	72 (3.8)
Palestinian Nat'l Auth.	●	2-6	96 (1.7)	●	3-6	88 (2.5)	●	4-6	78 (3.7)	●	4-6	79 (3.6)
Philippines	●	7	82 (3.3)	●	7	82 (3.0)	●	7	75 (3.7)	●	7	72 (4.1)
Romania	●	2-5	100 (0.0)	●	2-5	100 (0.0)	●	2-6	99 (0.8)	●	3-8	97 (1.5)
Russian Federation	●	--	– –	●	--	– –	●	--	– –	●	--	– –
Saudi Arabia	●	4-6	87 (2.8)	●	4-6	80 (4.3)	●	3-6	69 (5.9)	○	--	65 (6.0)
Scotland	●	--	95 (1.9)	●	--	89 (2.7)	●	--	94 (2.2)	●	--	80 (3.5)
Serbia	●	4-7	94 (2.1)	●	6	94 (2.0)	●	4-7	91 (2.6)	●	7	95 (1.8)
Singapore	●	2-7	99 (0.5)	●	3-8	98 (0.7)	●	2-6	94 (1.5)	●	2-6	96 (1.0)
Slovak Republic	●	8	100 (0.0)	●	7	100 (0.0)	●	7	98 (1.1)	●	7	97 (1.3)
Slovenia	●	3-5	100 (0.0)	●	6	95 (1.9)	●	5-6	99 (0.7)	●	5-6	80 (3.5)
South Africa	●	--	r 69 (3.6)	○	--	r 50 (4.1)	⊙	--	r 63 (4.2)	⊙	--	r 58 (4.2)
Sweden	●	8	97 (1.2)	●	7	82 (2.6)	●	7	91 (1.8)	●	8	90 (1.9)
Syrian Arab Republic	●	--	– –	●	--	– –	●	--	– –	●	--	– –
Tunisia	●	--	92 (2.4)	○	12	87 (2.7)	●	--	84 (2.9)	○	9	80 (3.1)
United States	●	--	96 (1.2)	●	--	92 (1.4)	●	--	95 (1.2)	●	--	90 (1.8)
‡ England	●	K-8	s 96 (2.6)	●	3-8	89 (3.9)	●	K-6	s 96 (2.6)	●	1-8	s 88 (3.4)
International Avg.			92 (0.3)			86 (0.4)			84 (0.4)			83 (0.5)
Benchmarking Participants												
Basque Country, Spain	●	--	93 (2.4)	●	--	91 (2.9)	○	10	89 (2.9)	⊙	9	83 (3.5)
Indiana State, US	●	--	97 (1.6)	●	--	96 (2.0)	●	--	96 (1.6)	●	--	86 (3.6)
Ontario Province, Can.	●	2-8	99 (0.4)	●	4-8	89 (2.8)	●	2-8	97 (1.6)	●	2-9	95 (1.7)
Quebec Province, Can.	●	1-9	71 (4.7)	●	4-9	93 (2.5)	●	2-6	81 (3.6)	●	2-8	67 (4.6)

● 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.

‡ 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 5.10: **Intended and Taught TIMSS Measurement Topics**

MATHEMATICS Grade 8

Measurement

Countries	Computations with measurements in problem situations			Measurement formulas for perimeter of a rectangle, circumference of a circle, areas of plane figures, surface area and volume of rectangular solids, and rates			Measures of irregular or compound areas			Precision of measurements		
	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 97 (1.6)	⦿	--	r 95 (1.7)	⦿	--	r 81 (3.1)	⦿	--	r 88 (2.6)
Australia	●	5-8	65 (4.4)	⦿	8-10	87 (2.8)	●	5-8	70 (3.6)	●	7-8	33 (4.0)
Bahrain	●	4-8	39 (3.2)	●	4-8	97 (0.8)	●	4-8	48 (3.5)	●	4-8	70 (3.3)
Belgium (Flemish)	⦿	--	59 (3.9)	●	--	95 (1.3)	●	--	44 (3.9)	●	--	42 (4.1)
Botswana	○	9	19 (3.7)	○	9	38 (4.7)	○	11	30 (4.5)	○	11	30 (4.3)
Bulgaria	●	6-7	99 (0.8)	●	5-6	99 (0.7)	●	5-6	87 (3.4)	●	5-6	68 (4.1)
Chile	●	1-8	51 (4.1)	●	8	73 (2.9)	●	7-8	39 (3.1)	●	8	38 (3.9)
Chinese Taipei	●	6	83 (2.7)	●	6	99 (0.9)	●	6	66 (3.7)	●	8	96 (1.6)
Cyprus	●	5-8	19 (2.6)	●	5-8	100 (0.2)	●	5-8	56 (1.9)	⦿	6-9	30 (2.5)
Egypt	○	--	x x	●	4-8	99 (0.7)	●	4	85 (3.2)	○	--	97 (1.9)
Estonia	●	4-12	94 (2.1)	●	4-6	96 (1.7)	●	4-12	80 (3.3)	●	8,10	79 (3.5)
Ghana	●	--	45 (4.8)	●	--	58 (4.7)	●	--	23 (4.0)	●	--	45 (4.7)
Hong Kong, SAR	●	7-9	69 (4.4)	●	7-9	92 (2.5)	●	6	88 (3.1)	●	7-9	76 (3.9)
Hungary	●	2-7	96 (1.6)	●	3-8	99 (0.8)	○	--	92 (2.0)	○	--	100 (0.0)
Indonesia	○	9	94 (2.3)	○	9	98 (0.8)	○	10	77 (3.5)	○	10	73 (3.9)
Iran, Islamic Rep. of	●	7-8	54 (3.8)	●	7	95 (1.6)	○	10-11	56 (4.1)	●	4-9	33 (3.7)
Israel	○	--	51 (4.3)	●	2-9	71 (3.6)	●	4-6	38 (4.0)	○	--	34 (3.7)
Italy	●	6-9	82 (3.2)	●	8-10	99 (0.7)	●	7-9	80 (2.4)	●	7-9	72 (3.5)
Japan	●	5-6	61 (4.1)	●	4-7	95 (1.8)	●	5	70 (3.9)	○	10-12	43 (4.3)
Jordan	●	6-8	74 (3.8)	●	4-8	97 (2.2)	●	7	81 (4.0)	○	--	84 (3.0)
Korea, Rep. of	●	--	s 83 (3.1)	●	--	95 (1.5)	●	--	s 57 (3.5)	●	--	s 96 (1.6)
Latvia	●	--	s 69 (5.2)	●	6-7	41 (4.9)	●	--	s 26 (4.1)	○	--	s 47 (5.3)
Lebanon	●	--	55 (4.3)	○	--	91 (2.5)	○	--	49 (4.6)	○	--	60 (4.2)
Lithuania	●	4-12	92 (2.4)	●	4-6	97 (1.6)	●	6	90 (2.5)	○	--	76 (3.3)
Macedonia, Rep. of	●	5-7	90 (2.4)	●	6-7	95 (1.9)	○	11	79 (3.6)	○	10	74 (3.8)
Malaysia	●	4-8	28 (3.6)	●	4-9	96 (2.1)	●	5-7	46 (4.8)	●	7	47 (4.6)
Moldova, Rep. of	●	6	r 89 (2.6)	●	6	r 83 (3.7)	●	8	r 69 (4.2)	●	6,8	r 52 (4.4)
Morocco	○	--	s 72 (5.6)	○	--	83 (3.9)	○	--	s 62 (5.4)	○	--	s 46 (7.1)
Netherlands	●	--	74 (4.3)	●	--	93 (2.5)	⦿	--	78 (3.8)	○	--	55 (4.9)
New Zealand	●	6-9	72 (4.5)	●	6-9	93 (2.4)	●	6-7	80 (3.6)	●	8-9	34 (5.1)
Norway	●	7-10	85 (3.0)	●	8-10	67 (3.8)	●	8-10	30 (3.8)	○	9-10	31 (4.4)
Palestinian Nat'l Auth.	●	5-6	50 (4.7)	●	6-8	97 (1.6)	●	4-6	58 (4.4)	●	5-6	67 (4.3)
Philippines	●	7	67 (4.5)	●	7	69 (4.3)	●	7	39 (4.2)	●	7	52 (4.3)
Romania	●	3-8	92 (2.1)	●	4-7	99 (1.2)	○	--	80 (3.5)	○	--	87 (3.0)
Russian Federation	●	--	– –	●	4-9	– –	○	--	– –	●	--	– –
Saudi Arabia	●	6	37 (4.4)	●	4-6	75 (5.2)	●	6	50 (5.5)	○	--	63 (4.2)
Scotland	●	--	61 (4.7)	⦿	--	82 (3.2)	●	--	81 (3.6)	○	--	50 (4.2)
Serbia	●	6-7	93 (2.3)	●	6-8	98 (1.3)	⦿	7-8	91 (2.0)	○	9	89 (2.4)
Singapore	●	6-8	93 (1.1)	●	3-8	99 (0.7)	●	3	55 (2.8)	○	--	52 (2.8)
Slovak Republic	○	9	79 (3.3)	⦿	9	99 (0.8)	⦿	9	87 (2.7)	⦿	9	61 (4.1)
Slovenia	●	5-6	64 (4.2)	●	8	65 (4.0)	●	8	69 (4.3)	○	--	75 (3.3)
South Africa	○	--	r 31 (3.3)	⦿	--	r 58 (3.8)	○	--	r 26 (2.9)	○	--	r 32 (3.9)
Sweden	●	8	82 (2.7)	●	8-9	80 (3.1)	●	8	68 (3.2)	●	8	31 (2.9)
Syrian Arab Republic	○	--	– –	●	--	– –	○	12	– –	○	12	– –
Tunisia	○	10	62 (4.2)	●	--	94 (2.1)	○	11	61 (4.0)	○	12	40 (4.2)
United States	●	--	85 (2.3)	●	--	92 (1.4)	●	--	61 (2.9)	●	--	58 (3.0)
‡ England	●	4-8	s 71 (6.1)	●	4-8	96 (2.0)	●	5-7	s 88 (3.9)	⦿	8-10	s 52 (6.0)
International Avg.			69 (0.6)			87 (0.4)			64 (0.6)			59 (0.6)
Benchmarking Participants												
Basque Country, Spain	●	--	73 (4.8)	●	--	86 (3.0)	●	--	48 (5.7)	●	--	39 (4.8)
Indiana State, US	●	--	92 (2.6)	●	--	91 (2.8)	●	--	68 (5.0)	○	--	56 (6.3)
Ontario Province, Can.	●	2-8	86 (3.0)	●	5-9	93 (2.6)	●	5-8	72 (4.4)	●	4-5	58 (4.8)
Quebec Province, Can.	○	--	63 (4.1)	●	6-8	61 (4.4)	●	7-8	46 (4.7)	○	--	44 (4.7)

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.

‡ 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 Geometry Topics

MATHEMATICS Grade 8

Geometry

Countries	Angles-acute, right, straight, obtuse, reflex, complementary, and supplementary			Relationships for angles at a point, angles on a line, vertically opposite angles, angles associated with a transversal cutting parallel lines, and perpendicularity			Properties of angle bisectors and perpendicular bisectors of lines			Properties of geometric shapes: triangles and quadrilaterals		
	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 100 (0.0)	●	--	r 99 (0.6)	●	--	r 100 (0.0)	●	--	r 99 (0.5)
Australia	●	7-8	93 (1.8)	●	8	83 (3.1)	⦿	9	50 (4.0)	●	7-8	89 (2.6)
Bahrain	●	4-5	100 (0.0)	●	5-7	100 (0.0)	●	7-9	95 (1.6)	●	5-9	99 (0.3)
Belgium (Flemish)	●	--	98 (0.8)	●	--	86 (1.8)	●	--	82 (2.0)	●	--	90 (2.0)
Botswana	●	8	70 (3.9)	●	8	49 (5.0)	○	9	11 (2.7)	○	9	60 (4.6)
Bulgaria	●	7	100 (0.0)	●	7	100 (0.0)	●	7	100 (0.0)	●	7	100 (0.0)
Chile	●	3-8	98 (1.1)	●	8	96 (1.5)	○	--	84 (2.3)	●	5-6	93 (1.6)
Chinese Taipei	●	8	99 (0.8)	●	8	79 (3.0)	●	8	93 (2.2)	○	9	93 (2.3)
Cyprus	●	4-8	98 (0.9)	●	4-7	98 (0.9)	⦿	8	95 (1.2)	●	5-8	92 (1.7)
Egypt	●	4-6	100 (0.0)	●	6	99 (0.9)	●	6	100 (0.0)	●	5-8	100 (0.0)
Estonia	●	5,8	96 (1.5)	●	5,8	97 (1.3)	●	6	97 (1.4)	●	6,8	98 (1.3)
Ghana	●	--	85 (3.8)	●	--	73 (4.8)	●	--	74 (3.8)	●	--	75 (4.3)
Hong Kong, SAR	●	7-9	97 (1.4)	●	7-9	98 (1.2)	●	7-9	75 (4.2)	●	7-9	89 (2.7)
Hungary	●	5-6	100 (0.0)	●	6	98 (1.2)	●	6	100 (0.0)	●	6	100 (0.0)
Indonesia	●	7-8	98 (1.1)	○	9	96 (1.5)	○	10	95 (1.9)	○	9	92 (2.4)
Iran, Islamic Rep. of	●	5-6	100 (0.0)	●	6-7	97 (1.5)	●	5-6	99 (0.6)	●	6-8	100 (0.5)
Israel	●	4-8	98 (1.0)	●	8	78 (2.9)	●	7-8	88 (2.6)	●	7-9	74 (3.0)
Italy	●	4-9	100 (0.0)	●	6-9	98 (1.2)	●	6-9	93 (2.0)	●	4-10	100 (0.0)
Japan	●	8	91 (2.3)	●	8	98 (1.1)	●	7	98 (1.2)	●	8	97 (1.5)
Jordan	●	4-5,7	99 (0.7)	●	5,7	97 (1.6)	●	8-10	95 (2.0)	●	6-8	100 (0.0)
Korea, Rep. of	●	--	s 94 (1.7)	●	--	95 (1.7)	●	--	s 94 (1.7)	●	--	s 96 (1.6)
Latvia	●	7	s 99 (1.0)	●	7	100 (0.0)	●	7	s 62 (5.3)	●	7	s 99 (0.9)
Lebanon	○	--	96 (1.8)	○	--	97 (1.4)	○	--	96 (1.6)	●	--	98 (1.2)
Lithuania	●	5-7	100 (0.0)	●	5-8	98 (1.1)	●	7-8	95 (2.0)	●	7-10	100 (0.0)
Macedonia, Rep. of	●	6-7	99 (0.7)	●	6-7	99 (0.7)	●	6	99 (0.7)	●	6-7	99 (0.7)
Malaysia	●	7	88 (2.8)	●	7	88 (2.8)	●	7	96 (1.8)	●	7,9	97 (1.5)
Moldova, Rep. of	●	8	r 95 (2.0)	●	8	r 85 (3.6)	●	8	r 94 (2.2)	●	8	r 95 (2.1)
Morocco	●	--	s 98 (2.0)	●	--	96 (2.7)	●	--	s 99 (0.9)	●	--	x x
Netherlands	⦿	--	94 (2.4)	⦿	--	85 (3.3)	○	--	52 (5.0)	⦿	--	84 (4.1)
New Zealand	●	6-9	96 (2.3)	●	6-8	86 (4.2)	⦿	8-9	45 (5.4)	●	4-8	89 (2.5)
Norway	●	8-10	90 (2.5)	●	8-10	56 (3.9)	●	8-10	90 (2.6)	●	8-10	89 (2.8)
Palestinian Nat'l Auth.	●	3-7	98 (1.1)	●	5-7	98 (1.0)	●	5-7	86 (3.1)	●	2-8	99 (0.9)
Philippines	○	9	52 (4.5)	○	9	36 (4.5)	○	9	28 (4.1)	○	9	35 (4.7)
Romania	●	6-7	100 (0.0)	●	6-8	100 (0.0)	●	6-7	100 (0.0)	●	6-7	100 (0.0)
Russian Federation	●	--	– –	●	--	– –	●	--	– –	●	--	– –
Saudi Arabia	●	4-7	100 (0.2)	●	8	100 (0.0)	●	7	99 (0.9)	●	7-8	100 (0.2)
Scotland	●	--	97 (1.1)	●	--	92 (1.8)	○	--	24 (3.8)	●	--	87 (3.2)
Serbia	●	5	94 (2.2)	●	5	94 (2.2)	●	5-6	94 (2.3)	●	6	94 (2.2)
Singapore	●	3-7	96 (1.1)	●	5-8	97 (0.9)	●	7	84 (1.9)	●	5-7	99 (0.7)
Slovak Republic	●	5	99 (0.8)	●	6	99 (0.9)	●	6	99 (0.8)	●	6	100 (0.0)
Slovenia	●	6	100 (0.1)	●	6	99 (0.7)	●	5	99 (0.8)	●	6	100 (0.0)
South Africa	●	--	r 90 (2.2)	●	--	r 88 (2.5)	○	--	r 46 (4.1)	●	--	r 74 (3.5)
Sweden	●	8	91 (2.1)	⦿	8	55 (3.4)	⦿	8-9	20 (2.6)	●	8	94 (1.6)
Syrian Arab Republic	●	--	– –	●	--	– –	●	--	– –	●	--	– –
Tunisia	●	--	100 (0.0)	●	--	100 (0.0)	●	--	100 (0.0)	●	--	96 (1.6)
United States	●	--	91 (1.8)	●	--	74 (2.5)	●	--	47 (2.9)	●	--	87 (2.2)
‡ England	●	2-6	s 100 (0.3)	●	4-6	96 (1.7)	●	7	s 66 (5.9)	●	K-7	s 94 (3.2)
International Avg.			95 (0.3)			90 (0.3)			81 (0.4)			92 (0.3)
Benchmarking Participants												
Basque Country, Spain	●	--	92 (2.3)	⦿	9	86 (3.6)	⦿	10	76 (3.7)	●	--	91 (2.7)
Indiana State, US	●	4	85 (3.7)	●	--	70 (4.7)	●	--	51 (4.7)	●	--	81 (4.1)
Ontario Province, Can.	●	4-8	97 (2.1)	●	7-8	88 (3.6)	●	7-8	72 (4.7)	●	1-6	97 (1.9)
Quebec Province, Can.	●	4-7	94 (2.7)	●	7-8	83 (4.3)	●	7	86 (3.9)	●	4-6	89 (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.

‡ 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 Geometry Topics** *(Continued...)*

MATHEMATICS Grade 8

Geometry	Properties of other polygons			Construct or draw triangles and rectangles of given dimensions			Pythagorean theorem to find length of a side			Congruent figures and their corresponding measures		
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 99 (0.7)	●	--	r 98 (1.2)	●	--	r 99 (1.0)	●	--	r 99 (1.1)
Australia	●	7-8	65 (4.2)	●	8	72 (3.1)	⦿	9	51 (3.1)	⦿	9	43 (4.5)
Bahrain	●	7	83 (2.5)	●	4-5	96 (0.1)	●	8	97 (1.0)	●	8	99 (0.7)
Belgium (Flemish)	●	--	21 (2.5)	●	--	93 (1.7)	○	--	3 (1.4)	●	--	82 (2.0)
Botswana	●	8	47 (4.5)	○	9	17 (3.5)	○	10	2 (1.1)	○	9	14 (3.2)
Bulgaria	●	6-9	76 (3.9)	●	7	97 (1.5)	○	9	2 (0.8)	●	7	99 (0.6)
Chile	●	8	74 (3.1)	●	8	88 (2.1)	●	8	66 (3.0)	○	9	72 (3.3)
Chinese Taipei	○	9	94 (2.1)	●	8	93 (2.2)	●	8	98 (1.2)	○	9	80 (3.3)
Cyprus	●	5-8	44 (2.7)	●	4-8	84 (1.7)	●	6	100 (0.0)	●	6-8	91 (1.3)
Egypt	●	7	x x	●	4-6	99 (0.9)	●	7	100 (0.0)	●	7	100 (0.0)
Estonia	●	8	75 (3.6)	●	6	98 (1.3)	○	9	3 (1.3)	●	6	67 (3.0)
Ghana	●	--	35 (4.2)	●	--	74 (3.6)	●	--	27 (4.1)	●	--	48 (4.5)
Hong Kong, SAR	○	--	77 (3.5)	●	7-9	80 (3.8)	●	7-9	94 (2.0)	●	7-9	87 (3.1)
Hungary	●	8	95 (1.8)	●	6	100 (0.0)	●	8	97 (1.6)	●	6-7	92 (2.3)
Indonesia	○	10	35 (4.4)	○	11	71 (4.3)	●	8	98 (0.7)	○	9	63 (4.4)
Iran, Islamic Rep. of	○	10	89 (2.5)	●	5-6	96 (1.8)	●	8	99 (0.6)	●	6	98 (1.0)
Israel	○	--	22 (3.0)	○	--	37 (3.4)	○	9	12 (2.6)	●	8	68 (3.2)
Italy	●	4-10	96 (1.4)	●	6-7	96 (1.4)	●	7-9	100 (0.0)	●	7-9	100 (0.3)
Japan	●	8	94 (1.9)	●	7-8	92 (1.9)	○	9	2 (0.0)	●	8	97 (1.5)
Jordan	●	7	88 (3.1)	●	5-6	99 (0.9)	●	8	98 (1.2)	●	7	100 (0.0)
Korea, Rep. of	●	--	s 87 (2.5)	●	--	91 (2.2)	○	9	s 28 (3.8)	●	--	s 97 (1.4)
Latvia	○	--	s 22 (4.3)	○	9	85 (3.2)	○	9	s 92 (2.9)	●	7	s 78 (4.7)
Lebanon	○	--	29 (4.4)	○	--	96 (1.6)	●	--	86 (3.0)	○	--	91 (2.6)
Lithuania	○	9-10	24 (3.4)	⦿	6-8	97 (1.2)	●	8	99 (1.0)	●	7	99 (0.9)
Macedonia, Rep. of	●	7	99 (0.9)	●	6	99 (0.7)	●	7-8	100 (0.0)	●	6	100 (0.0)
Malaysia	○	9	62 (4.2)	●	8	90 (2.8)	●	8	95 (1.9)	●	8	88 (2.9)
Moldova, Rep. of	●	8	r 83 (3.0)	●	8	r 96 (1.7)	●	8	r 97 (1.6)	●	8	r 96 (1.8)
Morocco	○	--	s 29 (6.2)	●	--	87 (4.5)	○	--	x x	○	--	x x
Netherlands	○	--	38 (4.6)	○	--	88 (3.2)	●	--	91 (2.9)	⦿	--	46 (4.9)
New Zealand	●	6-8	64 (4.8)	●	6-9	62 (4.8)	○	9-10	23 (3.9)	●	6-9	40 (5.0)
Norway	○	9-10	13 (2.8)	●	8-10	94 (1.9)	○	9-10	5 (2.0)	○	10	10 (2.6)
Palestinian Nat'l Auth.	●	6	76 (4.0)	●	6-7	97 (1.6)	●	7	100 (0.0)	●	7	99 (0.8)
Philippines	○	9	32 (4.4)	○	9	30 (3.9)	○	9	34 (4.4)	○	9	29 (4.1)
Romania	●	7	93 (2.1)	●	3-7	100 (0.0)	●	7-9	100 (0.0)	●	--	100 (0.0)
Russian Federation	○	9	– –	●	--	– –	●	--	– –	●	--	– –
Saudi Arabia	○	10	52 (5.4)	●	5-8	99 (0.8)	○	9	8 (2.6)	●	8	98 (1.3)
Scotland	⦿	--	37 (4.4)	●	--	87 (2.6)	⦿	--	33 (4.6)	●	--	44 (5.2)
Serbia	●	7	94 (2.2)	●	6	94 (2.2)	●	7	96 (1.8)	●	6	95 (2.0)
Singapore	●	8	97 (0.9)	●	5-7	92 (1.4)	⦿	8	64 (3.2)	●	8-9	81 (2.1)
Slovak Republic	⦿	9	75 (3.1)	●	7	100 (0.0)	●	7	100 (0.0)	●	7	96 (1.8)
Slovenia	●	8	88 (2.7)	●	7	100 (0.1)	●	8	37 (4.0)	●	7	82 (3.1)
South Africa	○	--	r 44 (4.2)	⦿	--	r 58 (4.1)	⦿	--	r 54 (3.6)	○	--	r 32 (4.0)
Sweden	○	9	31 (3.8)	●	8	92 (1.9)	○	9	7 (1.7)	○	11	36 (3.8)
Syrian Arab Republic	●	8	– –	●	--	– –	○	9	– –	○	10	– –
Tunisia	○	9	49 (4.2)	○	9	98 (1.2)	○	10	7 (1.9)	○	10	90 (2.6)
United States	●	--	77 (2.4)	●	--	64 (3.2)	●	--	81 (2.5)	●	--	81 (2.7)
‡ England	●	7-10	s 85 (4.2)	●	4-8	89 (3.8)	⦿	8-10	r 71 (5.3)	●	6-10	s 60 (5.3)
International Avg.			63 (0.5)			86 (0.4)			63 (0.4)			77 (0.4)
Benchmarking Participants												
Basque Country, Spain	●	--	84 (3.3)	●	--	81 (4.2)	⦿	9	88 (3.2)	●	--	84 (3.6)
Indiana State, US	○	--	68 (5.8)	●	--	61 (5.1)	●	--	71 (5.1)	●	--	67 (5.0)
Ontario Province, Can.	●	6-8	86 (2.7)	●	5-6	84 (3.8)	●	8	71 (4.6)	●	2-7	85 (3.7)
Quebec Province, Can.	●	7-8	66 (4.6)	●	7	90 (3.2)	○	9-11	9 (2.6)	●	8-9	69 (4.8)

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.

‡ 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 Geometry Topics** *(...Continued)*

MATHEMATICS Grade 8

Geometry	Similar triangles and recall their properties			Cartesian plane-ordered pairs, equations, intercepts, and gradient			Relationships between two-dimensional and three-dimensional shapes			Line and rotational symmetry for two-dimensional shapes		
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 99 (1.0)	●	--	r 94 (2.1)	◉	--	r 54 (3.9)	◉	--	r 87 (2.9)
Australia	◉	9	33 (4.7)	◉	9-10	46 (4.6)	●	5-8	52 (4.1)	●	5-8	58 (3.2)
Bahrain	○	9	26 (3.1)	●	8	52 (3.7)	●	6-8	33 (3.7)	●	7-9	38 (2.9)
Belgium (Flemish)	○	--	50 (3.8)	●	--	8 (1.9)	●	--	22 (2.8)	●	--	70 (2.8)
Botswana	○	11	24 (4.0)	○	9	2 (1.5)	○	9	3 (1.7)	●	8	25 (4.1)
Bulgaria	○	9	8 (2.3)	●	6	65 (3.9)	●	6,10	25 (3.5)	●	8	67 (4.4)
Chile	○	10	56 (3.6)	○	10	36 (3.6)	●	1-8	30 (3.3)	○	9	21 (2.8)
Chinese Taipei	○	9	16 (3.1)	●	8	57 (4.0)	●	8	75 (3.7)	●	8	42 (4.1)
Cyprus	◉	8	1 (0.0)	○	9	1 (0.0)	●	8	32 (2.7)	●	8	19 (1.9)
Egypt	●	8	97 (1.8)	●	7	99 (0.7)	●	8,11	67 (3.9)	●	8	78 (3.5)
Estonia	○	9	14 (2.9)	●	6-10	75 (3.4)	○	12	42 (4.0)	○	--	76 (3.6)
Ghana	●	--	51 (4.7)	●	--	33 (4.3)	●	--	31 (4.0)	●	--	37 (4.8)
Hong Kong, SAR	●	7-9	87 (3.1)	●	7-9	45 (4.3)	●	7-9	54 (4.6)	●	7-9	80 (3.1)
Hungary	○	9	50 (4.0)	●	7-11	39 (4.6)	●	6	54 (4.2)	●	6-7	66 (3.7)
Indonesia	○	9	47 (4.4)	○	10	95 (1.8)	○	10	18 (3.4)	○	10	85 (3.1)
Iran, Islamic Rep. of	●	8	99 (0.6)	●	7-8	95 (1.7)	○	11-12	46 (4.3)	●	7	81 (2.7)
Israel	◉	10	17 (2.8)	●	7-10	44 (4.1)	○	--	12 (2.5)	○	--	17 (3.0)
Italy	●	7-9	83 (2.8)	●	8-13	73 (3.1)	●	5-10	73 (3.0)	○	9-13	45 (3.4)
Japan	○	9	4 (1.2)	●	7-8	96 (1.6)	●	7	51 (3.8)	●	7	88 (2.7)
Jordan	●	7	99 (0.6)	●	8-10	83 (3.7)	○	10	44 (4.3)	○	9	16 (3.7)
Korea, Rep. of	●	--	s 96 (1.6)	●	--	96 (1.6)	●	--	86 (2.3)	●	--	73 (3.1)
Latvia	○	9	s 57 (5.7)	○	--	47 (5.1)	○	9	3 (1.8)	○	9	13 (3.6)
Lebanon	○	9	48 (5.0)	○	--	38 (4.7)	●	--	35 (5.1)	○	--	67 (4.6)
Lithuania	○	9-10	39 (4.1)	●	6-12	69 (3.9)	●	3-6	31 (3.6)	●	8	95 (2.0)
Macedonia, Rep. of	●	8	100 (0.0)	●	8	99 (0.6)	●	8	93 (1.9)	●	5	99 (1.0)
Malaysia	○	9	91 (2.5)	●	8	50 (3.8)	○	10	46 (4.1)	●	8	71 (3.9)
Moldova, Rep. of	●	8	r 88 (2.4)	○	11	r 83 (3.6)	●	8	r 49 (5.0)	●	7,11	r 55 (5.2)
Morocco	○	--	s 5 (3.0)	○	--	12 (5.0)	○	--	25 (6.0)	○	--	27 (6.8)
Netherlands	◉	--	53 (4.6)	○	--	27 (4.0)	●	--	24 (4.1)	●	--	74 (4.8)
New Zealand	●	6-9	32 (4.6)	◉	8-12	52 (5.1)	●	5-7	56 (4.5)	●	4-7	83 (2.3)
Norway	○	10	16 (2.8)	●	8-10	31 (4.3)	○	11-13	7 (2.1)	○	11-13	16 (3.1)
Palestinian Nat'l Auth.	●	7	96 (1.8)	○	9	23 (4.0)	○	9	27 (3.8)	○	9	13 (2.4)
Philippines	○	9	28 (3.9)	○	9	77 (3.5)	○	9	16 (3.5)	○	9	15 (3.2)
Romania	●	4-7	100 (0.0)	●	--	93 (2.4)	○	9-10	98 (1.0)	●	4-10	97 (1.4)
Russian Federation	●	8 or 9	– –	●	--	– –	○	--	– –	●	--	– –
Saudi Arabia	○	9-10	35 (4.6)	○	9-10	53 (4.6)	○	12	14 (3.5)	●	8	14 (2.8)
Scotland	●	--	8 (2.3)	○	--	14 (3.1)	○	--	67 (4.8)	●	--	91 (2.3)
Serbia	●	7	93 (2.3)	●	7-8	94 (2.1)	●	8	88 (2.5)	●	5-6	92 (2.5)
Singapore	●	8-9	77 (2.1)	●	7-9	75 (2.2)	●	6	55 (2.8)	●	7-8	94 (1.3)
Slovak Republic	●	8	28 (3.3)	◉	9	24 (3.1)	◉	9	37 (4.2)	◉	9	41 (4.3)
Slovenia	○	9	12 (2.7)	○	9	14 (3.0)	○	9	12 (3.0)	●	4	63 (4.2)
South Africa	○	--	r 36 (4.0)	○	--	r 31 (3.8)	○	--	r 25 (3.4)	○	--	r 28 (2.9)
Sweden	○	9	47 (3.8)	○	9	21 (3.3)	○	11	9 (1.9)	○	11	4 (1.5)
Syrian Arab Republic	○	9	– –	○	12	– –	○	12	– –	○	--	– –
Tunisia	○	9	60 (4.3)	○	11	13 (2.8)	○	11	32 (4.1)	○	11	23 (3.7)
United States	●	--	77 (2.6)	●	--	75 (2.5)	●	--	52 (2.6)	●	--	63 (2.9)
‡ England	◉	8-10	s 44 (4.7)	●	4-10	61 (5.4)	●	3-8	51 (6.2)	●	K-6	99 (0.8)
International Avg.			52 (0.5)			54 (0.5)			41 (0.6)			56 (0.5)
Benchmarking Participants												
Basque Country, Spain	○	10	63 (5.6)	◉	9	41 (4.7)	○	10	32 (4.8)	○	10	13 (2.8)
Indiana State, US	●	--	63 (4.9)	●	--	69 (4.9)	●	--	53 (6.3)	●	--	58 (5.7)
Ontario Province, Can.	●	8	80 (4.1)	●	5-9	22 (3.6)	●	3-8	75 (4.0)	●	2-6	64 (4.5)
Quebec Province, Can.	●	8-9	54 (4.7)	○	10-11	61 (4.3)	●	4-12	13 (2.8)	●	4	44 (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.

‡ 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 5.11: **Intended and Taught TIMSS Geometry Topics**

MATHEMATICS Grade 8

Geometry

Translation, reflection, rotation, and enlargement

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
Armenia	◉	--	r 60 (3.8)
Australia	◉	9	58 (3.6)
Bahrain	●	7-9	16 (2.7)
Belgium (Flemish)	●	--	85 (2.3)
Botswana	●	8	15 (3.6)
Bulgaria	●	8	65 (4.6)
Chile	○	9-10	16 (2.2)
Chinese Taipei	●	8	25 (3.6)
Cyprus	◉	4-6,10	8 (1.6)
Egypt	●	8	94 (2.1)
Estonia	○	--	53 (4.0)
Ghana	●	--	22 (3.8)
Hong Kong, SAR	●	7-9	83 (3.1)
Hungary	●	7-9	79 (3.2)
Indonesia	○	9	4 (1.4)
Iran, Islamic Rep. of	●	7-11	89 (2.6)
Israel	○	--	16 (2.8)
Italy	○	9-10	47 (3.4)
Japan	○	9	67 (4.2)
Jordan	○	9	15 (3.5)
Korea, Rep. of	●	--	s 65 (3.5)
Latvia	○	--	s 28 (5.1)
Lebanon	○	9-11	42 (4.5)
Lithuania	○	--	35 (4.0)
Macedonia, Rep. of	●	5,7	99 (0.7)
Malaysia	●	8-9	76 (3.5)
Moldova, Rep. of	●	7,11	r 48 (5.0)
Morocco	○	--	– –
Netherlands	○	--	69 (4.6)
New Zealand	●	2-9	82 (2.7)
Norway	●	2-10	13 (2.6)
Palestinian Nat'l Auth.	○	9	5 (1.9)
Philippines	○	9	10 (2.8)
Romania	●	4-10	47 (4.1)
Russian Federation	●	8 or 9	– –
Saudi Arabia	●	5-8	68 (5.1)
Scotland	●	--	50 (4.6)
Serbia	◉	5-6	81 (3.4)
Singapore	◉	8-10	54 (3.1)
Slovak Republic	◉	9	22 (3.3)
Slovenia	●	7	83 (3.2)
South Africa	○	--	r 21 (3.0)
Sweden	○	9	11 (2.3)
Syrian Arab Republic	○	11	– –
Tunisia	○	10	11 (2.7)
United States	●	--	64 (3.1)
‡ England	●	2-10	s 89 (3.2)
International Avg.			47 (0.5)
Benchmarking Participants			
Basque Country, Spain	○	10	14 (3.8)
Indiana State, US	●	--	60 (6.0)
Ontario Province, Can.	●	2-8	62 (4.5)
Quebec Province, Can.	●	4-8	94 (2.2)

○ Not included in the curriculum through eighth grade
◉ Only the more able students
● All or almost all students

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.

‡ 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.

of these topics were included in the intended curricula of almost all participants and taught to virtually all students (90% or more). These topics were: "angles – acute, right, straight, obtuse, reflex, complementary, and supplementary," "relationships for angles on a point or on a line," and "properties of geometric shapes: triangles and quadrilaterals." Two other topics were included in most participants' curricula and taught to more than 80 percent of students: "construct or draw triangles or rectangles of given dimensions," and "properties of angle bisectors and perpendicular bisectors of lines." Inclusion of the other geometry topics in the intended curriculum was more varied, as was the percentage of students taught the topics. The topics with least coverage in the classroom were "translation, reflection, rotation, and enlargement," and "relationships between two-dimensional and three-dimensional shapes," where less than half the students (47% and 41% , respectively) were taught the topics. In countries where geometry topics were not in the intended curriculum at eighth grade, they often were intended primarily for later grades.

As shown in Exhibit 5.12, only two of the eight TIMSS data topics – "organizing a set of data by one or more characteristics using a tally chart, table, or graph" and "drawing and interpreting graphs, tables, pictographs, bar graphs, pie charts, and line graphs" – were included in the intended eighth-grade mathematics curriculum for more than half of the participants. These topics also were the only ones taught to more than half of the students (68 and 72 percent, respectively). TIMSS participants varied considerably in the extent to which they included the other data topics in their intended curriculum and taught them in the classroom. The two topics receiving least attention, in both the intended and implemented curriculum, were "sources of error in collecting and organizing data" and "evaluating interpretations of data with respect to correctness and completeness of interpretation." These were included in the curriculum of just a few countries, and had been taught to relatively few students, on average (32% and 29%, respectively).

At the fourth grade, 12 of the 42 TIMSS mathematics topics were in the number content area. As shown in Exhibit 5.13, there was generally good coverage of the topics both in the intended curriculum and in the classroom. Five of the topics – "whole numbers including place value and ordering," "represent whole numbers using words, diagrams, or symbols," "properties of whole numbers," "computation with whole numbers," and "estimation with whole numbers" – appear in the intended curricula of almost all participants and have been taught to almost all students (more than 90%). Four of the number topics appear in the intended curricula of less than half the participants – "equivalent fractions," "compare and order fractions," "adding and subtracting fractions with the same denominator," and "simple and proportional reasoning." These topics were taught to between one half and two-thirds of the students, on average.

As shown in Exhibit 5.14, of the six TIMSS patterns and relationships topics, only "missing number in an equation" was included in the intended fourth-grade curriculum of almost all TIMSS participants. Practically all students had been taught this topic, including those in the countries where it was not part of the intended curriculum! "Patterns of numbers or shapes" and "pairs of numbers following a given rule" were in the intended curriculum of at least half of the participants, and were taught to 81 percent and 76 percent of students, respectively. "Simple equations" and "finding a rule for a relationship given some pairs of numbers" were included in the curriculum of relatively few participants (10 and 12, respectively) but were taught to surprisingly large percentages of students (87% and 71%).

As described earlier in this chapter, the fourth-grade mathematics curriculum included a strong emphasis on measurement topics in many countries. Exhibit 5.15 shows that four of the six TIMSS measurement topics were included in the intended curriculum of almost all participating entities. These included "standard units to measure length, area, mass/weight, angle, and time," "non-standard units to measure length, area, volume, and time," conversion factors between standard

Exhibit 5.12: Intended and Taught TIMSS Data Topics

MATHEMATICS Grade 8

Data

Countries	Organizing a set of data by one or more characteristics using a tally chart, table, or graph			Sources of error in collecting and organizing data			Data collection methods			Drawing and interpreting graphs, tables, pictographs, bar graphs, pie charts, and line graphs		
	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 83 (3.2)	●	--	60 (4.8)	●	--	s 72 (4.1)	●	--	r 74 (3.6)
Australia	●	4-7	83 (3.5)	⦿	9-10	45 (4.5)	●	5-8	66 (3.9)	●	5-8	86 (3.1)
Bahrain	●	1-8	75 (3.2)	○	--	5 (1.7)	●	7-8	11 (2.2)	●	4-8,10	87 (2.9)
Belgium (Flemish)	●	--	73 (3.2)	⦿	--	8 (2.2)	●	--	7 (2.0)	●	--	73 (3.7)
Botswana	●	7	12 (2.5)	○	Tertiary	3 (1.7)	○	Tertiary	8 (2.4)	○	9	13 (3.0)
Bulgaria	●	5-6	59 (4.3)	○	--	18 (3.8)	○	--	19 (3.5)	○	10-11	56 (4.5)
Chile	●	6-7	68 (3.6)	○	--	36 (3.5)	●	6	57 (3.4)	●	7-8	67 (3.6)
Chinese Taipei	○	9	12 (2.9)	○	11	9 (2.5)	○	11	7 (2.1)	○	11	8 (2.3)
Cyprus	⦿	4-6,12	8 (1.5)	○	12	2 (1.1)	○	12	3 (1.5)	⦿	4-6,12	1 (0.6)
Egypt	●	2-5	96 (1.7)	○	--	24 (3.3)	○	--	29 (3.4)	●	3-5	83 (3.2)
Estonia	●	6,12	84 (2.9)	○	12	59 (4.5)	○	12	62 (4.1)	●	6,12	90 (2.5)
Ghana	●	--	76 (3.7)	○	--	52 (4.3)	●	--	65 (4.3)	●	--	73 (3.6)
Hong Kong, SAR	●	6-8	75 (3.7)	○	10-11	45 (4.2)	○	--	69 (4.0)	●	6-9	79 (3.3)
Hungary	●	6	80 (3.5)	○	--	39 (4.4)	○	--	39 (4.4)	●	6	85 (3.0)
Indonesia	●	8-9	87 (2.7)	○	10	45 (4.3)	○	11	64 (4.1)	●	8-11	93 (2.3)
Iran, Islamic Rep. of	●	6-10	71 (3.9)	○	10	34 (4.2)	○	10	35 (3.8)	●	6,8,10	74 (3.2)
Israel	●	3-10	68 (3.9)	○	--	25 (3.3)	●	3-10	37 (3.8)	●	3-10	54 (3.9)
Italy	●	6	78 (3.4)	○	9-13	24 (3.1)	●	6-7	60 (3.5)	●	4,7-9	86 (3.0)
Japan	●	3-5	24 (3.9)	○	10-12	12 (2.9)	○	10-12	19 (3.4)	●	3-5	55 (4.5)
Jordan	○	9	58 (4.8)	○	11	16 (3.4)	○	11	26 (3.6)	●	6-7	85 (3.2)
Korea, Rep. of	●	--	s 84 (2.7)	○	--	55 (3.7)	○	--	s 59 (3.8)	●	--	s 74 (3.2)
Latvia	●	7	s 70 (5.2)	○	--	27 (5.0)	○	--	s 37 (4.9)	●	6-7	s 94 (2.0)
Lebanon	●	--	63 (4.8)	○	--	29 (4.2)	○	--	47 (4.9)	●	8	49 (5.0)
Lithuania	●	4-10	96 (1.6)	○	--	54 (4.0)	○	--	85 (2.8)	●	6-12	96 (1.4)
Macedonia, Rep. of	○	--	– –	○	--	– –	○	--	– –	○	--	– –
Malaysia	●	8	69 (4.1)	○	10	33 (4.3)	○	10	49 (4.0)	●	6,8-9	80 (3.8)
Moldova, Rep. of	○	--	r 75 (4.3)	○	--	r 51 (5.4)	○	--	r 69 (4.3)	○	--	r 74 (4.7)
Morocco	●	--	s 53 (6.0)	○	--	x x	○	--	x x	○	--	s 61 (5.5)
Netherlands	●	--	83 (3.9)	○	--	11 (3.7)	○	--	28 (5.1)	●	--	96 (1.8)
New Zealand	●	3-9	90 (2.4)	●	6-9	52 (3.8)	●	6-9	73 (4.3)	●	3-9	88 (2.4)
Norway	●	7-10	71 (4.1)	●	8-10	48 (4.9)	●	8-10	54 (4.5)	●	6-10	83 (3.2)
Palestinian Nat'l Auth.	●	2-6	64 (4.0)	○	10	12 (2.9)	○	10	28 (4.1)	●	3-8	97 (1.7)
Philippines	○	10	42 (4.7)	○	10	29 (4.2)	○	10	30 (4.2)	○	10	50 (4.1)
Romania	●	4-12	89 (2.8)	○	11-12	44 (4.3)	○	10-12	61 (4.7)	●	4-12	81 (3.2)
Russian Federation	○	--	– –	○	--	– –	○	--	– –	●	--	– –
Saudi Arabia	○	10	41 (6.2)	○	--	7 (2.8)	○	10	9 (3.0)	●	5-6	40 (5.1)
Scotland	●	--	96 (1.5)	⦿	--	31 (4.5)	●	--	74 (3.9)	●	--	95 (1.6)
Serbia	●	8	86 (3.1)	○	12	58 (3.7)	○	12	56 (3.8)	○	12	90 (2.5)
Singapore	●	1-8	92 (1.2)	○	--	30 (2.1)	○	--	62 (2.8)	●	3-8	94 (1.0)
Slovak Republic	⦿	9	25 (4.0)	⦿	9	10 (2.8)	⦿	9	15 (3.2)	●	7	42 (4.3)
Slovenia	●	3-4	71 (4.2)	○	--	18 (2.9)	●	4-5	31 (3.6)	●	3-4	76 (3.7)
South Africa	⦿	--	r 55 (3.9)	○	--	r 36 (3.7)	○	--	r 44 (3.7)	⦿	--	r 55 (3.8)
Sweden	●	8	75 (3.0)	⦿	8	23 (3.5)	●	8	45 (3.7)	●	8	84 (2.8)
Syrian Arab Republic	○	11	– –	○	--	– –	○	--	– –	○	--	– –
Tunisia	○	--	58 (3.9)	○	--	23 (3.3)	○	--	33 (3.9)	○	--	55 (4.3)
United States	●	--	96 (1.2)	●	--	65 (2.6)	●	--	80 (2.3)	●	--	97 (1.0)
‡ England	●	K-6	s 99 (0.8)	⦿	8-10	55 (6.6)	●	6-10	s 80 (5.4)	●	6-10	s 100 (0.0)
International Avg.			68 (0.5)			32 (0.6)			44 (0.6)			72 (0.5)
Benchmarking Participants												
Basque Country, Spain	●	--	45 (5.2)	○	10	17 (4.6)	○	10	39 (5.9)	⦿	9	43 (5.4)
Indiana State, US	●	--	92 (2.9)	●	--	69 (5.7)	●	--	80 (4.2)	●	--	94 (2.2)
Ontario Province, Can.	●	1-8	97 (1.7)	●	5-8	76 (3.9)	●	3-8	91 (3.0)	●	1-8	94 (2.4)
Quebec Province, Can.	●	1-7,9-10	84 (3.6)	○	10-11	23 (3.7)	●	1-6,10	50 (5.2)	●	1-7,10	81 (4.0)

● 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.

‡ 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 Data Topics**

MATHEMATICS Grade 8

Data	Characteristics of data sets including mean, median, range, and shape of distribution			Interpreting data sets			Evaluating interpretations of data with respect to correctness and completeness of interpretation			Simple probability including using data from experiments to estimate probabilities for favorable outcomes		
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 64 (4.3)	⦿	--	65 (4.3)	⦿	--	s 58 (4.2)	⦿	--	s 43 (5.1)
Australia	●	8	63 (4.9)	⦿	9-10	45 (4.6)	⦿	9-10	30 (4.0)	●	7-10	33 (3.6)
Bahrain	●	6-7,10	23 (2.8)	●	2-8,10	10 (1.9)	●	5-8	12 (1.3)	○	11	4 (1.2)
Belgium (Flemish)	⦿	--	56 (4.1)	⦿	--	25 (3.7)	⦿	--	23 (3.5)	⦿	--	13 (2.8)
Botswana	○	9	5 (2.0)	○	Tertiary	4 (1.9)	○	Tertiary	2 (1.1)	○	10	0 (0.0)
Bulgaria	○	10-11	21 (3.3)	○	10-11	11 (2.5)	○	--	5 (1.6)	○	10	6 (1.8)
Chile	●	6-8	51 (3.8)	○	12	47 (4.1)	○	12	32 (3.7)	○	10	21 (3.0)
Chinese Taipei	○	11	5 (1.8)	○	11	3 (1.4)	○	11	4 (1.5)	○	11	2 (1.0)
Cyprus	⦿	4-6,12	1 (0.6)	⦿	5-6,12	9 (1.4)	⦿	5-6,12	7 (1.2)	⦿	4-6,9,12	2 (0.4)
Egypt	●	8	100 (0.1)	○	--	50 (4.4)	○	--	39 (4.5)	●	8	63 (3.8)
Estonia	○	12	56 (4.5)	○	12	33 (4.0)	○	12	35 (4.4)	○	12	76 (3.5)
Ghana	●	--	73 (3.7)	●	--	35 (4.5)	○	--	31 (4.6)	●	--	38 (4.8)
Hong Kong, SAR	●	7-9	25 (4.1)	○	--	30 (4.3)	○	10-11	23 (3.7)	●	7-9	9 (2.7)
Hungary	●	8	53 (3.8)	●	8	60 (3.8)	○	--	46 (4.4)	●	7	33 (3.4)
Indonesia	○	10-12	91 (2.5)	○	11	52 (4.6)	○	11	36 (4.4)	○	10	73 (3.9)
Iran, Islamic Rep. of	○	10	47 (3.7)	○	10	34 (3.6)	○	10	25 (3.2)	○	10	24 (3.6)
Israel	●	7,10	43 (3.6)	⦿	10	36 (3.5)	⦿	7	r 23 (3.0)	●	8-11	39 (3.7)
Italy	●	8-10	42 (3.3)	●	8-13	36 (3.5)	○	10-13	35 (3.6)	●	8-10	38 (3.5)
Japan	○	10-12	9 (2.5)	○	10-12	6 (2.2)	○	10-12	4 (1.8)	●	8	33 (3.7)
Jordan	●	6-10	42 (4.7)	○	11	32 (4.3)	○	--	29 (4.2)	●	8-12	66 (4.1)
Korea, Rep. of	○	--	s 53 (4.0)	●	--	41 (3.6)	○	--	s 39 (4.0)	●	--	s 66 (3.8)
Latvia	●	6	s 62 (5.6)	○	--	34 (4.9)	○	--	s 29 (5.1)	○	9	s 36 (5.4)
Lebanon	○	9-12	36 (4.1)	○	11-12	42 (4.4)	○	--	23 (4.0)	○	11-12	18 (3.3)
Lithuania	●	8-12	91 (2.4)	○	--	60 (4.4)	○	--	42 (4.4)	●	8-12	27 (3.7)
Macedonia, Rep. of	○	--	– –	○	--	– –	○	--	– –	⦿	12	45 (4.4)
Malaysia	○	10	27 (3.7)	●	8-9	26 (4.0)	○	10	23 (3.8)	○	11	9 (2.2)
Moldova, Rep. of	○	--	r 51 (5.3)	○	--	r 57 (5.3)	○	--	r 46 (5.5)	●	8	r 43 (5.3)
Morocco	○	--	x x	○	--	15 (5.0)	○	--	s 33 (6.4)	○	--	x x
Netherlands	●	--	43 (5.2)	●	--	26 (4.2)	○	--	11 (3.2)	⦿	--	45 (5.2)
New Zealand	●	6-9	85 (2.8)	●	6-10	55 (5.1)	●	8-9	39 (5.3)	●	5-9	69 (4.4)
Norway	●	8-10	82 (3.2)	●	8-10	39 (4.2)	●	8-10	30 (4.3)	○	9-10	18 (3.3)
Palestinian Nat'l Auth.	●	8	97 (1.6)	○	9	25 (3.8)	○	9	22 (4.0)	●	8	89 (2.8)
Philippines	○	10	29 (3.8)	○	10	21 (3.2)	○	10	22 (3.5)	○	--	18 (3.5)
Romania	○	10-12	35 (3.7)	●	6-10	32 (3.6)	○	--	48 (4.4)	●	4-12	86 (2.9)
Russian Federation	○	--	– –	○	--	– –	○	--	– –	○	--	– –
Saudi Arabia	○	10	9 (2.5)	○	--	10 (2.6)	○	--	20 (4.3)	○	11	8 (2.2)
Scotland	⦿	--	74 (3.9)	●	--	45 (4.0)	⦿	--	28 (4.0)	⦿	--	56 (4.8)
Serbia	○	12	72 (3.9)	○	12	61 (4.0)	○	12	59 (3.8)	○	12	39 (4.0)
Singapore	●	8	89 (1.6)	○	--	34 (2.5)	○	--	25 (2.1)	⦿	10	5 (1.1)
Slovak Republic	●	8	10 (2.6)	⦿	9	7 (2.1)	⦿	9	7 (1.6)	●	7	29 (4.1)
Slovenia	○	9	17 (2.8)	○	9	19 (3.4)	○	--	15 (3.4)	○	10	4 (1.9)
South Africa	○	--	r 38 (3.9)	○	--	r 39 (3.6)	○	--	r 34 (3.6)	○	--	r 22 (3.4)
Sweden	●	8	64 (3.9)	○	9	34 (3.6)	⦿	8	18 (2.8)	○	9	29 (3.3)
Syrian Arab Republic	○	--	– –	○	--	– –	○	--	– –	○	11	– –
Tunisia	○	--	r 18 (3.1)	○	--	37 (3.9)	○	--	45 (4.2)	○	--	26 (3.4)
United States	●	--	96 (1.0)	●	--	84 (2.3)	●	--	67 (2.8)	●	--	80 (2.1)
‡ England	●	5-10	s 98 (1.3)	●	6-10	65 (5.4)	⦿	8-10	s 35 (4.9)	●	4-8	s 97 (1.8)
International Avg.			50 (0.5)			35 (0.6)			29 (0.6)			36 (0.5)
Benchmarking Participants												
Basque Country, Spain	○	9	27 (4.7)	○	10	27 (4.7)	⦿	9	25 (4.4)	⦿	9	21 (4.3)
Indiana State, US	●	--	95 (2.4)	●	--	78 (4.3)	●	--	69 (5.1)	●	--	79 (4.0)
Ontario Province, Can.	●	5-8	88 (3.3)	●	1-8	85 (3.3)	●	5-8	71 (4.6)	●	2-8	56 (4.8)
Quebec Province, Can.	○	9-11	18 (3.4)	●	1-7,9-10	28 (4.1)	○	9-11	14 (2.8)	●	8,11	35 (4.8)

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.

‡ 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 Number Topics**

MATHEMATICS Grade 4

Number	Whole numbers including place value and ordering			Represent whole numbers using words, diagrams, or symbols			Properties of whole numbers such as odd and even, multiples, or factors			Computation with whole numbers		
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	●	--	r 100 (0.0)	●	--	r 92 (2.1)	●	--	r 95 (1.6)	●	--	r 99 (1.1)
Australia	●	--	100 (0.3)	●	--	96 (1.4)	●	--	97 (1.1)	●	--	100 (0.1)
Belgium (Flemish)	●	--	99 (0.6)	●	--	94 (1.9)	●	--	97 (1.4)	●	--	100 (0.0)
Chinese Taipei	●	3	100 (0.0)	●	1	92 (2.4)	●	4	53 (4.1)	●	3	100 (0.0)
Cyprus	●	3-7	100 (0.3)	●	2-7	99 (0.7)	●	2-7	93 (2.3)	⦿	6	99 (0.7)
England	●	K-4	r 100 (0.0)	●	K-4	r 95 (2.1)	●	K-4	r 100 (0.0)	●	K-4	r 100 (0.0)
Hong Kong, SAR	●	3	100 (0.0)	●	3	83 (3.5)	●	4	99 (0.8)	●	3	100 (0.0)
Hungary	●	1	99 (0.6)	●	1	98 (1.2)	●	3	100 (0.0)	●	4	99 (0.6)
Iran, Islamic Rep. of	●	4	99 (0.6)	●	2-3	98 (1.2)	●	3-4	90 (3.0)	●	2-4	84 (2.9)
Italy	●	2-5	99 (0.6)	●	1-5	97 (1.2)	●	1-8	95 (1.3)	●	1-8	100 (0.4)
Japan	●	1-4	100 (0.0)	●	1-3	84 (3.2)	○	5-6	24 (3.4)	●	1-4	100 (0.0)
Latvia	●	--	s 96 (2.4)	●	--	s 96 (1.8)	●	--	s 95 (1.6)	●	--	s 99 (1.0)
Lithuania	●	1-4	99 (0.5)	●	1-6	91 (2.4)	○	5-6	91 (1.8)	●	1	100 (0.5)
Moldova, Rep. of	●	--	r 96 (1.7)	●	--	r 93 (2.3)	●	--	r 97 (1.7)	●	--	r 97 (1.6)
Morocco	⦿	--	x x	⦿	--	x x	⦿	--	x x	⦿	--	x x
Netherlands	●	--	99 (0.7)	●	--	r 83 (3.9)	○	6	88 (3.1)	●	--	100 (0.0)
New Zealand	●	K-5	100 (0.0)	●	K-5	98 (1.0)	⦿	3	93 (1.5)	●	K-5	100 (0.2)
Norway	●	2-7	100 (0.3)	●	2-7	74 (3.6)	●	2-7	88 (2.7)	●	2-7	100 (0.0)
Philippines	●	--	100 (0.0)	●	--	97 (1.7)	●	--	98 (1.3)	●	--	99 (1.1)
Russian Federation	●	--	– –	●	--	– –	●	--	– –	●	--	– –
Scotland	●	--	r 100 (0.0)	●	--	s 87 (3.7)	●	--	r 99 (0.8)	●	--	r 100 (0.3)
Singapore	●	1-5	100 (0.0)	●	1-5	98 (1.0)	●	3-4	99 (0.9)	●	1-5	100 (0.0)
Slovenia	●	2	99 (0.9)	●	2	97 (1.3)	●	3	98 (1.3)	●	2	100 (0.0)
Tunisia	●	--	r 98 (1.3)	○	7	r 91 (2.6)	●	--	98 (1.0)	●	--	r 98 (1.4)
United States	●	--	100 (0.0)	●	--	98 (0.7)	●	--	98 (0.8)	●	--	100 (0.0)
Yemen	●	--	– –	●	--	– –	●	2,5	– –	●	--	– –
International Avg.			99 (0.2)			93 (0.5)			91 (0.4)			99 (0.2)
Benchmarking Participants												
Indiana State, US	●	--	100 (0.0)	●	--	100 (0.0)	●	--	97 (2.0)	●	--	100 (0.0)
Ontario Province, Can.	●	1-6	100 (0.0)	●	1-6	99 (1.0)	●	3,6-7	93 (2.5)	●	1-6	100 (0.0)
Quebec Province, Can.	●	1-6	99 (0.8)	●	1-6	100 (0.2)	●	1-6	90 (2.9)	●	1-6	100 (0.1)

● 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 5.13: **Intended and Taught TIMSS Number Topics** *(Continued...)*

MATHEMATICS Grade 4

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

Number	Estimation with whole numbers			Fractions			Equivalent fractions			Compare and order fractions		
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	●	--	r 81 (3.1)	●	--	r 96 (1.7)	●	4	r 92 (2.3)	⦿	--	r 98 (1.1)
Australia	●	--	98 (0.6)	●	--	83 (2.7)	○	6	50 (4.4)	●	--	57 (4.3)
Belgium (Flemish)	●	--	99 (0.8)	●	--	99 (0.6)	●	--	91 (2.2)	⦿	5	95 (1.9)
Chinese Taipei	●	4	96 (1.5)	●	2	98 (1.0)	○	5	64 (4.2)	●	4	94 (1.7)
Cyprus	⦿	6	99 (0.8)	●	2-7	100 (0.0)	●	4-7	98 (1.2)	⦿	6	93 (2.2)
England	●	K-4	r 100 (0.0)	●	2-4	r 100 (0.4)	●	2-4	r 91 (2.7)	●	3-4	r 90 (3.3)
Hong Kong, SAR	●	4	96 (2.5)	●	3	95 (1.7)	●	4	95 (2.0)	●	4	92 (2.6)
Hungary	●	1	99 (0.6)	●	4	86 (3.2)	○	5	71 (3.7)	○	5	71 (3.7)
Iran, Islamic Rep. of	○	6	64 (4.2)	●	3,6	76 (3.9)	○	8	86 (2.9)	●	4-6	49 (4.7)
Italy	●	3	78 (3.2)	●	4	98 (1.0)	●	4-8	88 (2.5)	●	4-8	91 (2.1)
Japan	●	4	89 (2.4)	●	4	64 (3.9)	○	5	32 (3.7)	○	5-6	48 (4.3)
Latvia	○	--	s 89 (3.8)	●	--	s 68 (4.6)	○	5	s 69 (5.4)	○	5	s 23 (4.2)
Lithuania	○	5	83 (2.8)	●	4-6	92 (2.2)	○	6	84 (2.7)	⦿	6	87 (2.1)
Moldova, Rep. of	●	--	r 97 (1.5)	●	--	r 99 (0.6)	●	--	r 96 (1.8)	●	--	r 99 (1.0)
Morocco	⦿	--	x x	⦿	--	x x	⦿	--	x x	⦿	--	x x
Netherlands	●	--	100 (0.4)	○	5	85 (3.5)	○	5	54 (4.8)	○	5	36 (4.9)
New Zealand	●	K-9	96 (1.3)	●	3	87 (2.2)	○	7	58 (3.3)	⦿	7	71 (3.1)
Norway	●	3-7	82 (3.4)	●	4-7	43 (4.1)	○	5-7	17 (2.9)	○	5-7	26 (3.8)
Philippines	●	--	98 (1.3)	●	--	99 (1.0)	●	--	97 (1.5)	●	--	96 (1.7)
Russian Federation	●	--	– –	○	--	– –	○	--	– –	○	--	– –
Scotland	●	--	r 99 (0.8)	●	--	r 88 (3.3)	⦿	--	r 50 (4.2)	⦿	--	r 62 (4.9)
Singapore	●	4-5	96 (1.6)	●	2-3	100 (0.0)	●	3	100 (0.0)	●	2-3	100 (0.0)
Slovenia	○	5	93 (2.1)	●	4	47 (4.3)	○	7	3 (1.5)	○	7	11 (2.8)
Tunisia	○	--	r 64 (4.2)	○	6	r 2 (1.0)	○	6	r 1 (0.9)	○	6	r 1 (0.9)
United States	●	--	99 (0.4)	●	--	88 (1.9)	●	--	75 (2.2)	●	--	68 (2.6)
Yemen	●	4,5	– –	●	2,3	– –	●	2,3	– –	●	3-5	– –
International Avg.			91 (0.5)			82 (0.5)			68 (0.6)			68 (0.6)
Benchmarking Participants												
Indiana State, US	●	--	100 (0.0)	●	--	90 (2.0)	●	--	60 (4.9)	●	--	52 (4.6)
Ontario Province, Can.	●	2-6	98 (0.9)	●	1-3	78 (4.2)	○	5	61 (5.1)	●	2-6	61 (5.2)
Quebec Province, Can.	●	1-6	92 (2.5)	●	4-7	81 (3.4)	○	5-7	50 (4.9)	●	4-7	50 (4.6)

● 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.

Exhibit 5.13: **Intended and Taught TIMSS Number Topics** *(...Continued)*

MATHEMATICS Grade 4

Number	Fractions or decimals represented by words, numbers or models			Adding and subtracting fractions with the same denominator			Adding and subtracting with decimals			Simple and proportional reasoning		
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	r 91 (1.8)	●	4	r 99 (0.7)	⦿	6	r 96 (1.9)	●	4	r 46 (4.6)
Australia	●	--	76 (3.2)	○	6	34 (4.2)	○	6	52 (4.5)	○	5	47 (4.5)
Belgium (Flemish)	⦿	6	91 (2.7)	⦿	5	84 (3.3)	⦿	6	95 (2.0)	⦿	5	66 (4.0)
Chinese Taipei	●	4	97 (1.5)	●	4	97 (1.5)	●	4	94 (2.0)	○	5-6	45 (4.4)
Cyprus	●	4-7	86 (3.1)	●	4-7	96 (1.3)	●	4-7	89 (2.5)	●	4-8	83 (3.4)
England	●	3-4	r 89 (3.2)	○	5 on	r 49 (5.0)	●	4	r 77 (4.5)	●	4	r 59 (4.8)
Hong Kong, SAR	●	3	82 (3.3)	●	4	97 (1.4)	●	4	83 (3.6)	●	4	55 (4.7)
Hungary	○	6	34 (4.3)	○	6	23 (3.6)	○	6	2 (1.1)	●	4	29 (4.0)
Iran, Islamic Rep. of	○	6	99 (0.9)	●	4	10 (2.8)	○	5	31 (4.6)	●	4	45 (5.0)
Italy	●	4-6	95 (1.6)	●	4-6	72 (2.9)	●	4-8	97 (1.2)	○	6-8	42 (3.6)
Japan	●	4	51 (3.8)	○	5	14 (2.8)	●	4	76 (3.5)	●	4	25 (3.7)
Latvia	○	--	s 40 (5.4)	○	5	s 62 (5.7)	○	5	s 17 (3.9)	●	--	s 48 (5.7)
Lithuania	⦿	4-6	72 (3.3)	○	6	34 (3.2)	○	5-6	50 (3.4)	⦿	4-6	38 (3.9)
Moldova, Rep. of	●	4	r 95 (1.8)	●	--	r 98 (1.0)	●	4	r 93 (2.4)	○	6	r 63 (4.7)
Morocco	⦿	--	x x	⦿	--	x x	●	--	x x	⦿	--	x x
Netherlands	○	5	31 (4.6)	○	5	29 (4.7)	○	5	9 (2.6)	●	--	54 (4.9)
New Zealand	●	4-5	70 (3.0)	○	9	42 (2.8)	⦿	5	52 (3.3)	⦿	4-9	42 (3.4)
Norway	●	4-7	29 (3.8)	○	5-7	16 (3.0)	●	4-7	51 (4.1)	●	2-7	16 (3.1)
Philippines	●	--	91 (2.6)	●	--	98 (1.2)	●	--	97 (1.5)	○	--	71 (4.7)
Russian Federation	○	--	– –	○	--	– –	○	--	– –	●	--	– –
Scotland	●	--	r 54 (4.7)	○	--	r 24 (4.1)	○	--	r 28 (3.9)	○	--	r 10 (2.9)
Singapore	●	2-4	98 (1.2)	●	4	100 (0.0)	●	4	97 (1.4)	●	3-4	78 (3.5)
Slovenia	●	4	15 (2.8)	○	7	2 (1.1)	○	6	5 (1.4)	●	4	70 (4.1)
Tunisia	○	5	r 1 (0.9)	○	5	r 1 (0.9)	○	5	r 18 (3.6)	○	7	r 14 (3.1)
United States	●	--	76 (2.4)	●	--	66 (2.7)	●	--	70 (2.8)	●	--	59 (2.8)
Yemen	●	--	– –	●	3	– –	●	4,5	– –	○	6	– –
International Avg.			68 (0.7)			54 (0.6)			60 (0.6)			48 (0.9)
Benchmarking Participants												
Indiana State, US	●	--	71 (5.4)	●	--	63 (6.4)	●	--	66 (5.7)	●	--	45 (6.1)
Ontario Province, Can.	●	2-6	61 (4.9)	○	7	38 (5.0)	●	4	58 (4.6)	○	7-8	51 (4.6)
Quebec Province, Can.	●	3-4	36 (4.1)	○	5-7	28 (3.9)	●	4-7	26 (4.1)	○	8	52 (4.2)

● 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.

units," and "instruments to measure length, area, mass/weight, angle, and time." Less often included in participants' intended curricula were "calculating areas and perimeters of squares" and "estimating length, area, volume, weight, and time." Regardless of whether they were in the intended curriculum or not, the measurement topics were widely taught, with no fewer than 80 percent of students being taught each one.

Although there are 11 geometry topics in the TIMSS fourth-grade mathematics assessment, their inclusion in participants' curricula varies widely, as does the percentage of students taught each of the topics. Exhibit 5.16 shows that only one geometry topic – "angles greater than, equal to, or less than a right angle" – was included in the intended curriculum of more than half the participants, and that three topics – "congruent triangles," "similar triangles," and "translation, reflection, and rotation" – were included by very few participants indeed. The percentage of students taught the geometry topics also was generally lower than in areas such as number or measurement. Percentages ranged from 74 percent for the aforementioned angles topic to just 33 percent for "translation, reflection, and rotation." For many countries, geometry topics not included in the fourth-grade curriculum were intended for later grades.

As shown in Exhibit 5.17, three of the seven TIMSS data topics were included in the intended fourth-grade mathematics curriculum of more than half the participating entities. Furthermore, these three topics, "organizing a set of data by one characteristic," "reading data directly from tables, pictographs, and bar graphs," and "display data using tables, pictographs, and bar graphs," were each taught to more than 85 percent of students. "Comparing and matching different representations of the same data" was in the curriculum of the fewest participants (11), yet was taught to 65 percent of students, on average.

Exhibit 5.14: Intended and Taught TIMSS Patterns and Relationships Topics

MATHEMATICS Grade 4

Patterns and Relationships	Patterns of numbers or shapes			Equality using equations, areas, volumes, masses/weights			Missing number in an equation			Simple equations		
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	⦿	8	r 53 (4.3)	●	4	r 80 (3.4)	●	--	r 100 (0.4)	●	--	r 97 (1.0)
Australia	●	--	91 (3.4)	●	--	69 (5.1)	●	--	97 (1.0)	●	--	93 (3.5)
Belgium (Flemish)	●	--	93 (2.3)	⦿	6	51 (4.3)	●	--	98 (1.0)	⦿	5	97 (1.2)
Chinese Taipei	●	4	89 (2.7)	●	4	63 (4.2)	●	3	98 (1.3)	○	7	81 (3.5)
Cyprus	●	3-7	96 (1.3)	⦿	6	77 (3.4)	●	2-6	98 (1.0)	●	4-7	96 (1.6)
England	⦿	4	r 94 (2.5)	⦿	4	r 79 (3.4)	●	K-4	r 98 (1.2)	⦿	5 on	r 56 (5.2)
Hong Kong, SAR	○	6	66 (4.9)	○	5	54 (4.2)	●	4	72 (3.8)	○	5	50 (4.5)
Hungary	●	2	96 (1.7)	●	2	61 (4.4)	●	2	100 (0.0)	○	5	96 (1.5)
Iran, Islamic Rep. of	●	1-2	52 (5.0)	●	3-5	52 (4.5)	●	1-2	88 (2.6)	○	7	78 (3.9)
Italy	●	2-3	85 (2.6)	○	6-8	28 (2.8)	●	2-3	95 (1.6)	○	8-10	74 (3.1)
Japan	●	4	58 (4.1)	●	3-4	47 (4.0)	●	2-4	91 (2.5)	●	3-4	97 (1.5)
Latvia	○	--	s 84 (3.9)	●	--	s 81 (4.7)	●	--	s 98 (1.1)	○	--	s 99 (0.8)
Lithuania	●	4	73 (3.6)	●	4-12	77 (3.3)	●	3-4	100 (0.0)	⦿	4-5	97 (1.0)
Moldova, Rep. of	●	--	r 90 (2.8)	●	--	r 92 (2.6)	●	--	r 99 (0.8)	●	--	r 98 (1.2)
Morocco	⦿	--	x x	⦿	--	x x	⦿	--	x x	○	--	x x
Netherlands	○	7	61 (4.7)	○	7	35 (4.5)	○	7	98 (1.3)	○	7	90 (3.1)
New Zealand	●	K-5	91 (2.1)	●	2-5	66 (3.8)	●	4-5	95 (1.7)	⦿	4-5	95 (1.6)
Norway	●	4-7	67 (3.7)	●	3-7	27 (3.5)	●	3-7	90 (2.7)	○	8-10	61 (4.1)
Philippines	○	--	75 (4.4)	○	--	64 (4.8)	○	--	87 (3.2)	○	--	80 (4.1)
Russian Federation	●	--	– –	●	--	– –	●	--	– –	●	--	– –
Scotland	●	--	r 97 (1.9)	⦿	--	r 67 (4.7)	●	--	r 100 (0.0)	○	--	r 86 (3.2)
Singapore	●	1-5	99 (0.6)	○	7	79 (3.4)	●	2-5	98 (0.9)	○	7	84 (3.0)
Slovenia	○	5	96 (1.8)	○	5	55 (4.3)	●	3	98 (0.9)	●	4	98 (0.9)
Tunisia	○	6	r 68 (4.1)	○	6	r 88 (2.9)	●	--	r 96 (1.8)	○	6	r 97 (1.7)
United States	●	--	96 (1.0)	●	--	68 (2.8)	●	--	99 (0.6)	●	--	97 (1.1)
Yemen	●	2-3	– –	●	4,6-7	– –	●	1-3	– –	○	6-7	– –
International Avg.			81 (0.7)			64 (0.8)			95 (0.4)			87 (0.6)
Benchmarking Participants												
Indiana State, US	●	--	97 (1.8)	⦿	5	63 (5.8)	●	--	99 (1.3)	●	--	95 (3.1)
Ontario Province, Can.	●	1-8	97 (1.8)	●	2-8	65 (4.0)	●	3-6	88 (3.2)	●	4-8	91 (3.2)
Quebec Province, Can.	●	1-7	97 (1.3)	○	8	56 (4.8)	●	1-6	98 (1.0)	○	8	99 (0.2)

● 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 Patterns and Relationships Topics**

MATHEMATICS Grade 4

Patterns and Relationships	Pairs of numbers following a given rule			Finding a rule for a relationship given some pairs of numbers		
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	●	--	r 92 (2.1)	●	--	r 91 (2.2)
Australia	●	--	62 (4.9)	○	5	62 (4.8)
Belgium (Flemish)	○	6	80 (2.9)	○	6	78 (3.2)
Chinese Taipei	○	5	72 (3.7)	○	5	76 (3.5)
Cyprus	●	4-7	86 (2.4)	●	4-7	72 (3.8)
England	●	4	r 78 (4.1)	●	4	r 75 (4.6)
Hong Kong, SAR	○	7-9	40 (4.8)	○	7-9	45 (4.9)
Hungary	●	2	97 (1.4)	●	2	99 (0.7)
Iran, Islamic Rep. of	○	8	69 (4.1)	○	8	50 (4.8)
Italy	●	3-4	76 (3.4)	●	3-4	81 (2.9)
Japan	●	4	43 (3.5)	●	4	41 (3.8)
Latvia	●	--	s 84 (4.0)	○	--	s 88 (3.7)
Lithuania	◉	4	81 (3.1)	○	11-12	70 (3.7)
Moldova, Rep. of	●	--	r 94 (2.1)	●	--	r 88 (3.0)
Morocco	◉	--	x x	◉	--	x x
Netherlands	○	7	65 (4.4)	○	6	56 (4.6)
New Zealand	●	4	78 (2.5)	●	4	79 (2.9)
Norway	○	9-10	40 (4.0)	○	9-10	34 (3.8)
Philippines	○	--	68 (4.4)	○	--	66 (4.8)
Russian Federation	●	--	– –	○	--	– –
Scotland	○	--	r 80 (3.6)	○	--	r 75 (4.7)
Singapore	○	7	91 (2.2)	○	7	73 (3.7)
Slovenia	●	4	92 (2.4)	●	4	75 (4.2)
Tunisia	○	7	r 83 (3.2)	○	7	r 77 (3.9)
United States	●	--	86 (1.8)	◉	--	85 (2.0)
Yemen	○	6-7	– –	○	--	– –
International Avg.			76 (0.7)			71 (0.8)
Benchmarking Participants						
Indiana State, US	●	--	82 (4.5)	●	--	68 (6.0)
Ontario Province, Can.	●	3-6	76 (3.7)	●	4-9	84 (3.8)
Quebec Province, Can.	●	3-4	76 (3.6)	●	3-4	69 (4.5)

● 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 5.15: **Intended and Taught TIMSS Measurement Topics**

MATHEMATICS Grade 4

Measurement	Non-standard units to measure lengths, area, volume, and time			Standard units to measure length, area, mass/weight, angle, and time			Conversion factors between standard units			Instruments to measure length, area, mass/weight, angle, and time		
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	●	--	r 82 (3.6)	●	4	r 97 (1.6)	●	--	r 94 (2.0)	●	--	r 90 (2.7)
Australia	●	--	96 (1.5)	●	--	98 (1.1)	●	--	82 (3.9)	●	--	96 (1.2)
Belgium (Flemish)	●	--	90 (2.4)	●	--	100 (0.3)	●	--	99 (0.5)	●	--	98 (0.7)
Chinese Taipei	●	1-4	94 (1.9)	●	2-4	99 (0.6)	○	5	98 (1.0)	●	2-3	96 (1.7)
Cyprus	●	2-6	88 (3.0)	⦿	6	99 (0.6)	⦿	6	99 (0.4)	●	2-6	93 (2.2)
England	●	K-4	r 93 (2.4)	●	1-4	r 99 (0.6)	●	3-4	r 88 (2.7)	●	K-3	r 97 (1.1)
Hong Kong, SAR	●	K-4	80 (4.1)	●	K-4	87 (2.9)	●	4	85 (3.4)	●	K-4	90 (2.7)
Hungary	●	1	72 (4.4)	●	2-5	98 (1.3)	●	2	100 (0.0)	●	2	100 (0.0)
Iran, Islamic Rep. of	●	2-5	77 (4.1)	●	2-5	84 (3.3)	●	4-5,7	77 (4.1)	●	2-5	95 (1.6)
Italy	●	2-5	74 (3.1)	●	4-7	86 (2.7)	●	4-7	84 (2.4)	●	4-7	73 (3.3)
Japan	●	1-4	58 (4.2)	●	2-4	92 (1.9)	●	2-4	96 (1.7)	●	2-3	98 (1.3)
Latvia	●	--	s 69 (5.2)	●	--	s 96 (1.8)	●	--	s 99 (0.7)	●	--	s 96 (1.9)
Lithuania	○	--	72 (3.4)	●	1-6	97 (1.5)	●	4	98 (1.2)	●	1-4	95 (1.7)
Moldova, Rep. of	○	--	r 96 (1.4)	●	--	r 99 (0.7)	●	--	r 98 (1.2)	●	--	r 98 (1.3)
Morocco	⦿	--	x x	⦿	--	x x	●	--	x x	⦿	--	x x
Netherlands	●	--	75 (3.8)	●	--	93 (2.3)	●	--	87 (3.0)	●	--	87 (2.7)
New Zealand	●	K-1	91 (1.9)	●	2-5	96 (1.1)	⦿	5	81 (2.5)	●	2-7	90 (2.1)
Norway	●	3-7	75 (3.0)	●	3-7	94 (1.8)	○	5-7	77 (3.7)	●	3-7	92 (2.3)
Philippines	●	--	76 (4.0)	●	--	80 (3.8)	●	--	82 (3.4)	●	--	76 (4.1)
Russian Federation	●	--	– –	●	--	– –	●	--	– –	●	--	– –
Scotland	●	--	r 93 (2.9)	●	--	r 89 (3.3)	●	--	r 86 (3.7)	●	--	s 90 (3.3)
Singapore	●	1-4	90 (2.3)	●	2-4	97 (1.2)	●	3	98 (0.6)	●	2-4	95 (1.9)
Slovenia	●	4	62 (4.0)	●	4	91 (2.7)	●	4	69 (3.7)	●	4	67 (4.3)
Tunisia	○	--	64 (4.1)	●	--	r 78 (3.6)	●	--	97 (1.4)	●	--	r 86 (2.9)
United States	●	--	83 (2.2)	●	--	82 (2.3)	●	--	67 (2.4)	●	--	89 (1.7)
Yemen	●	1-3	– –	●	2-3	– –	●	--	– –	●	4-6	– –
International Avg.			80 (0.7)			93 (0.4)			89 (0.5)			91 (0.5)
Benchmarking Participants												
Indiana State, US	●	--	82 (3.8)	●	--	86 (4.2)	●	--	68 (4.9)	●	--	88 (3.5)
Ontario Province, Can.	●	1-2	92 (2.5)	●	2-6	92 (2.0)	●	2-6	73 (4.5)	●	2-6	89 (2.7)
Quebec Province, Can.	●	1-4	83 (3.3)	●	2-6	84 (3.6)	○	5-7	56 (4.5)	●	2-6	60 (4.4)

● 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 5.15: **Intended and Taught TIMSS Measurement Topics**

MATHEMATICS Grade 4

Measurement	Calculating areas and perimeters of squares			Estimating length, area, volume, weight, and time		
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	●	--	r 100 (0.3)	●	--	r 96 (1.6)
Australia	●	--	79 (3.5)	●	--	86 (4.0)
Belgium (Flemish)	⦿	5	78 (3.6)	⦿	5	91 (2.5)
Chinese Taipei	○	5	93 (2.2)	○	5	93 (2.1)
Cyprus	●	--	98 (1.2)	⦿	6	91 (2.4)
England	●	3-4	r 97 (1.5)	●	1-3	r 95 (2.4)
Hong Kong, SAR	●	4	82 (3.5)	○	7-9	81 (3.4)
Hungary	●	4	81 (3.3)	●	1	84 (3.4)
Iran, Islamic Rep. of	●	3-4	96 (1.5)	○	6	x x
Italy	●	4-6	60 (3.2)	●	4-10	47 (3.4)
Japan	●	4	88 (2.4)	○	6	47 (4.4)
Latvia	●	--	s 99 (0.7)	●	--	s 98 (1.6)
Lithuania	●	3-4	100 (0.0)	●	1-4	94 (1.7)
Moldova, Rep. of	●	--	r 100 (0.0)	●	--	r 99 (0.7)
Morocco	⦿	--	x x	⦿	--	x x
Netherlands	○	5	65 (4.9)	●	--	61 (5.0)
New Zealand	⦿	5	71 (3.0)	●	K-5	82 (2.5)
Norway	○	5-7	67 (4.4)	●	3-7	59 (4.9)
Philippines	○	--	80 (4.1)	○	--	72 (4.1)
Russian Federation	●	--	– –	●	--	– –
Scotland	○	--	r 69 (4.6)	⦿	--	r 87 (3.0)
Singapore	●	3-4	97 (1.5)	●	1-4	93 (2.2)
Slovenia	●	4-5	0 (0.0)	●	4	63 (4.0)
Tunisia	●	--	x x	○	6	r 88 (2.9)
United States	●	--	87 (1.7)	●	--	76 (2.5)
Yemen	●	--	– –	●	4-6	– –
International Avg.			81 (0.6)			81 (0.7)
Benchmarking Participants						
Indiana State, US	●	--	79 (4.6)	●	--	67 (5.3)
Ontario Province, Can.	●	4-5	90 (2.8)	●	3-8	83 (3.7)
Quebec Province, Can.	○	5-7	77 (3.8)	●	1-6	62 (4.1)

● 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 5.16: Intended and Taught TIMSS Geometry Topics

MATHEMATICS Grade 4

Geometry	Angles greater than, equal to, or less than a right angle			Parallel and perpendicular lines			Familiar two- and three-dimensional shapes and their properties			Congruent triangles		
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	●	--	r 92 (2.4)	●	--	r 70 (4.0)	●	--	r 58 (4.1)	⦿	--	r 37 (4.6)
Australia	○	5	76 (2.9)	○	5	63 (4.2)	●	--	98 (1.0)	○	5	46 (4.5)
Belgium (Flemish)	●	--	95 (1.8)	●	--	99 (0.7)	⦿	5	69 (3.5)	○	5	63 (4.1)
Chinese Taipei	●	4	71 (3.8)	●	4	70 (4.0)	●	3	88 (2.8)	○	6	65 (4.0)
Cyprus	⦿	6	90 (2.5)	⦿	6	80 (3.2)	⦿	6	93 (1.9)	○	7	65 (4.1)
England	●	2-4	r 94 (2.3)	●	4 on	r 86 (3.2)	●	K-4	r 98 (1.5)	○	6 on	r 93 (2.2)
Hong Kong, SAR	○	7-9	62 (4.2)	○	7-9	68 (4.2)	●	4	83 (3.2)	○	7-9	59 (4.6)
Hungary	●	4	75 (3.6)	○	5	96 (1.8)	●	3	72 (3.8)	○	6-7	55 (5.0)
Iran, Islamic Rep. of	●	4-5	98 (1.2)	●	4	100 (0.0)	●	3-4	42 (4.5)	○	6	83 (3.3)
Italy	●	4,6,9	96 (1.3)	●	4,6,9	99 (0.7)	●	4-10	69 (3.1)	●	4,6,9	79 (2.9)
Japan	●	4	99 (1.0)	○	5	17 (3.2)	●	3	27 (3.6)	○	8	20 (3.5)
Latvia	●	--	s 84 (4.5)	○	--	s 36 (5.1)	○	--	s 64 (4.8)	○	--	s 46 (5.5)
Lithuania	●	4	82 (3.0)	○	5-6	65 (3.6)	○	6	74 (3.5)	○	7	86 (2.6)
Moldova, Rep. of	●	--	r 99 (0.6)	●	--	r 99 (0.8)	●	--	r 82 (3.3)	○	--	r 73 (4.1)
Morocco	●	--	x x	●	--	x x	⦿	--	x x	⦿	--	x x
Netherlands	○	7	2 (1.5)	○	7	5 (2.0)	○	7	7 (2.4)	○	7	12 (3.3)
New Zealand	●	4-5	47 (3.3)	●	4-5	66 (3.8)	●	4-5	90 (2.1)	●	K-7	46 (3.4)
Norway	○	7	19 (3.4)	●	4-7	20 (3.0)	○	9-10	43 (4.1)	○	8-10	21 (3.6)
Philippines	●	--	92 (2.6)	○	--	93 (2.3)	○	--	74 (4.3)	○	--	90 (3.0)
Russian Federation	●	--	– –	○	5	– –	●	--	– –	○	7	– –
Scotland	●	--	r 60 (4.5)	○	--	r 13 (3.3)	●	--	r 96 (1.7)	○	--	r 46 (4.6)
Singapore	●	3-4	95 (1.8)	●	4	94 (2.0)	●	4-8	70 (3.8)	○	8	29 (3.7)
Slovenia	○	6	1 (1.0)	●	4	12 (1.7)	●	4	39 (4.4)	○	7	92 (2.5)
Tunisia	○	7	r 89 (2.8)	○	7	r 98 (1.3)	○	8	r 55 (4.4)	○	7	r 24 (3.6)
United States	●	--	78 (2.1)	●	--	88 (1.9)	●	--	86 (1.9)	⦿	--	82 (2.1)
Yemen	●	3	– –	●	--	– –	○	11-12	– –	○	6-7	– –
International Avg.			74 (0.6)			67 (0.6)			69 (0.7)			57 (0.8)
Benchmarking Participants												
Indiana State, US	●	--	66 (4.9)	●	--	77 (4.0)	●	--	71 (4.5)	○	5	71 (4.8)
Ontario Province, Can.	●	4-5	75 (4.3)	●	3	83 (3.9)	●	1-8	93 (2.6)	●	4-7	81 (3.5)
Quebec Province, Can.	●	4-6	71 (3.9)	●	3-4	81 (3.5)	●	1-6	87 (2.8)	●	1-2	60 (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 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.

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Exhibit 5.16: **Intended and Taught TIMSS Geometry Topics** *(Continued...)*

MATHEMATICS Grade 4

Geometry	Similar triangles			Points in a plane			Relationships between two-dimensional and three-dimensional shapes			Informal coordinate systems		
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	⦿	--	r 21 (3.7)	●	--	r 49 (4.4)	⦿	--	r 25 (3.9)	○	--	r 25 (4.0)
Australia	○	5	60 (4.1)	○	5	22 (3.8)	●	--	84 (2.9)	●	--	69 (3.9)
Belgium (Flemish)	○	5	65 (3.8)	○	6	61 (4.4)	○	6	32 (4.0)	○	6	52 (3.4)
Chinese Taipei	○	6	51 (3.9)	○	7	61 (4.3)	○	5	59 (4.4)	○	6	48 (4.2)
Cyprus	○	7	56 (4.5)	○	7	70 (3.8)	⦿	6	67 (3.6)	⦿	9	78 (3.1)
England	○	8 on	r 87 (2.9)	●	4 on	r 91 (3.0)	●	3-4	r 71 (4.2)	●	2-4	r 90 (2.9)
Hong Kong, SAR	○	7-9	56 (4.6)	○	7-9	45 (4.6)	○	7-9	39 (5.0)	○	7-9	18 (3.0)
Hungary	○	9	59 (4.3)	●	3	56 (3.9)	○	6	43 (4.2)	●	3	7 (2.5)
Iran, Islamic Rep. of	○	8,10	x x	○	7	59 (4.8)	○	5,7	14 (3.3)	○	7	17 (3.4)
Italy	●	4,6,9	72 (2.8)	●	4-6	81 (2.8)	○	5-10	47 (3.6)	○	5-8	49 (3.9)
Japan	○	9	12 (2.7)	○	5	30 (3.8)	○	6	4 (1.6)	●	4	17 (3.1)
Latvia	○	--	s 53 (4.8)	○	--	s 69 (5.4)	○	--	s 28 (3.9)	○	--	s 12 (3.5)
Lithuania	○	9-10	83 (2.9)	○	6	65 (3.7)	●	3-4	49 (3.6)	○	6	27 (3.1)
Moldova, Rep. of	○	--	r 73 (4.0)	●	--	r 68 (4.7)	●	--	r 58 (4.4)	○	--	r 44 (5.1)
Morocco	⦿	--	x x	●	--	x x	●	--	x x	●	--	– –
Netherlands	○	7	8 (2.5)	○	7	2 (1.1)	○	5	14 (3.3)	●	--	32 (4.5)
New Zealand	●	K-7	56 (3.3)	○	5-10	35 (3.6)	●	4-5	72 (2.6)	⦿	5	56 (3.1)
Norway	○	8-10	24 (4.1)	●	3-10	20 (3.6)	○	8-10	18 (3.7)	●	3-7	45 (4.5)
Philippines	○	--	88 (3.0)	○	--	79 (3.9)	○	--	60 (4.6)	○	--	36 (4.6)
Russian Federation	○	8-9	– –	○	5-7	– –	○	--	– –	○	--	– –
Scotland	○	--	r 45 (4.8)	○	--	r 78 (3.7)	○	--	r 79 (4.4)	●	--	r 90 (3.3)
Singapore	○	8	34 (4.0)	○	9	20 (3.0)	○	6	28 (3.4)	○	--	16 (3.0)
Slovenia	○	7	75 (3.9)	●	4	47 (4.0)	●	3	29 (4.6)	●	4	12 (2.7)
Tunisia	○	7	r 25 (3.9)	○	7	76 (3.9)	○	11	32 (4.1)	○	11	r 5 (1.9)
United States	●	--	79 (2.3)	⦿	--	54 (2.7)	●	--	60 (2.4)	⦿	--	65 (2.6)
Yemen	○	9	– –	○	7	– –	○	7	– –	○	7	– –
International Avg.			54 (0.8)			54 (0.8)			44 (0.8)			40 (0.7)
Benchmarking Participants												
Indiana State, US	○	6	67 (5.1)	●	--	34 (6.0)	○	6	40 (4.9)	●	--	43 (4.7)
Ontario Province, Can.	●	4-10	76 (3.9)	●	3-6	38 (4.7)	●	4-8	78 (4.3)	●	2-4	72 (3.5)
Quebec Province, Can.	○	8-10	61 (4.7)	●	1-4	46 (4.4)	●	4-9	55 (4.3)	●	1-4	32 (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.

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Exhibit 5.16: **Intended and Taught TIMSS Geometry Topics** *(...Continued)*

MATHEMATICS Grade 4

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

Geometry	Symmetry about a line			Two-dimensional symmetrical figures			Translation, reflection, and rotation		
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
Armenia	○	--	r 22 (4.0)	●	--	r 18 (3.5)	●	--	r 7 (2.0)
Australia	●	--	87 (2.9)	●	--	86 (2.9)	○	6	68 (4.4)
Belgium (Flemish)	●	--	68 (3.5)	⦿	5	55 (4.2)	○	6	27 (3.4)
Chinese Taipei	○	5	25 (3.9)	○	5	33 (4.4)	○	6	13 (2.9)
Cyprus	⦿	7	94 (1.5)	⦿	7	65 (3.8)	⦿	7	33 (3.8)
England	●	K-4	r 95 (2.4)	●	1-4	r 91 (3.1)	⦿	2-4	r 65 (4.6)
Hong Kong, SAR	○	6	69 (4.4)	○	7-9	67 (4.2)	○	7-9	13 (2.9)
Hungary	○	6	75 (3.7)	○	6	86 (3.1)	○	7	45 (4.2)
Iran, Islamic Rep. of	●	4,5,7	78 (3.7)	●	4,5,7	56 (5.0)	○	7,11	32 (5.0)
Italy	●	4-6,9	80 (2.9)	●	4-6,9	69 (3.5)	○	5-10	55 (3.7)
Japan	○	7	1 (1.0)	○	7	1 (0.7)	○	-9	1 (0.7)
Latvia	○	--	s 39 (5.5)	○	--	s 43 (5.0)	○	--	s 20 (3.9)
Lithuania	○	8	68 (4.0)	○	8	67 (4.1)	○	--	23 (3.2)
Moldova, Rep. of	●	--	r 84 (3.0)	●	--	r 64 (4.3)	○	--	r 42 (4.7)
Morocco	●	--	x x	●	--	x x	○	--	x x
Netherlands	●	--	14 (3.3)	●	--	19 (3.2)	○	7	34 (4.3)
New Zealand	●	K-5	84 (2.4)	●	K-5	85 (2.3)	●	K-5	80 (2.3)
Norway	●	2-7	59 (4.2)	●	2-7	39 (4.2)	●	4-7	44 (4.2)
Philippines	○	--	61 (5.0)	○	--	53 (4.6)	○	--	44 (4.9)
Russian Federation	○	5	– –	○	5	– –	○	8-9	– –
Scotland	⦿	--	r 94 (2.6)	●	--	r 83 (4.0)	○	--	r 28 (4.2)
Singapore	●	4	90 (2.4)	●	4	73 (3.6)	○	8	11 (2.3)
Slovenia	●	2	22 (3.6)	●	2	34 (3.7)	○	7	12 (3.0)
Tunisia	○	10	r 34 (4.0)	○	10	r 34 (4.1)	○	10	r 6 (2.1)
United States	⦿	--	81 (2.3)	●	--	74 (2.6)	●	--	64 (2.9)
Yemen	○	7,10	– –	○	--	– –	○	7	– –
International Avg.			62 (0.7)			56 (0.8)			33 (0.8)
Benchmarking Participants									
Indiana State, US	○	5	65 (5.7)	○	5	58 (6.1)	○	6	41 (6.0)
Ontario Province, Can.	●	2-5	81 (3.9)	●	2-5	84 (3.7)	●	2-7	58 (5.0)
Quebec Province, Can.	●	3-4	59 (4.8)	●	3-4	66 (4.0)	●	3-7	34 (4.3)

● All or almost all students ⦿ Only the more able students ○ Not included in the curriculum through fourth grade

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Exhibit 5.17: **Intended and Taught TIMSS Data Topics** *(Continued...)*

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

Data	Recognizing what various numbers, symbols, and points mean in data display			Organizing a set of data by one characteristic			Reading data directly from tables, pictographs, and bar graphs			Display data using tables, pictographs, and bar graphs		
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	●	--	r 80 (3.1)	●	--	r 75 (3.6)	●	--	r 61 (4.2)	●	--	r 55 (4.0)
Australia	●	--	71 (4.7)	●	--	90 (3.8)	●	--	90 (2.8)	●	--	95 (1.5)
Belgium (Flemish)	○	6	86 (2.6)	○	6	84 (2.8)	○	6	94 (1.8)	⦿	6	84 (2.7)
Chinese Taipei	●	4	81 (3.5)	●	4	89 (2.6)	●	3	95 (1.8)	●	4	95 (1.8)
Cyprus	⦿	6	96 (1.4)	⦿	6	86 (3.0)	⦿	6	97 (1.4)	●	2-6	89 (2.4)
England	●	1-4	r 86 (3.0)	●	K-4	r 93 (2.5)	●	K-4	r 99 (1.2)	●	K-2	r 100 (0.0)
Hong Kong, SAR	○	7-9	74 (4.1)	●	4	79 (3.2)	●	4,7-9	96 (1.8)	○	7-9	95 (1.6)
Hungary	●	2	74 (3.5)	●	1	91 (2.5)	●	2-4	74 (4.0)	●	2	62 (4.5)
Iran, Islamic Rep. of	○	5,6, 8,10	79 (2.6)	●	4,6, 8,10	82 (3.7)	●	3-4,6, 8,10	57 (4.4)	●	4,6, 8	63 (4.3)
Italy	●	3	89 (2.4)	●	2-3	94 (1.6)	●	4-6,9	88 (2.5)	●	4-6,9	85 (2.6)
Japan	●	3-4	76 (3.7)	●	3-4	92 (2.1)	●	3	76 (3.4)	●	3	91 (2.3)
Latvia	○	--	s 88 (3.6)	●	--	s 98 (1.1)	●	--	s 95 (2.2)	●	--	s 95 (1.7)
Lithuania	●	2-4	82 (3.4)	●	2-4	94 (1.8)	●	3-4	93 (2.0)	●	3-4	87 (3.1)
Moldova, Rep. of	●	--	r 88 (3.0)	●	--	r 90 (2.8)	●	--	r 95 (1.8)	●	--	r 94 (2.0)
Morocco	○	--	x x	⦿	--	x x	⦿	--	x x	○	--	x x
Netherlands	●	--	73 (4.0)	●	--	75 (4.3)	●	4-5	95 (2.1)	●	--	82 (3.8)
New Zealand	●	K-5	87 (2.2)	●	K-5	91 (1.9)	●	K-7	95 (1.3)	●	K-5	95 (1.4)
Norway	○	5-7	57 (4.1)	○	5-7	73 (3.2)	○	7-10	70 (3.9)	○	7-10	65 (4.1)
Philippines	○	--	80 (3.5)	●	--	76 (4.3)	●	--	74 (4.1)	●	--	73 (3.9)
Russian Federation	○	--	– –	●	--	– –	●	--	– –	○	--	– –
Scotland	●	--	r 79 (3.9)	●	--	r 95 (1.8)	●	--	r 94 (1.7)	●	--	r 97 (1.4)
Singapore	●	1-7	92 (2.3)	●	1-6	89 (2.6)	●	1-6	96 (1.6)	●	1-4	94 (2.1)
Slovenia	●	3	77 (3.4)	●	2	95 (2.0)	●	2	90 (2.9)	●	2	90 (2.9)
Tunisia	○	10	r 85 (3.2)	○	10	r 90 (2.8)	○	10	r 51 (4.5)	○	10	x x
United States	●	--	87 (1.9)	⦿	--	92 (1.7)	●	--	98 (0.8)	●	--	96 (1.1)
Yemen	○	6	– –	●	4,6	– –	○	6	– –	○	6	– –
International Avg.			81 (0.7)			88 (0.6)			86 (0.6)			86 (0.6)
Benchmarking Participants												
Indiana State, US	●	--	79 (4.8)	●	--	91 (2.9)	●	--	99 (0.9)	●	--	94 (2.0)
Ontario Province, Can.	●	1-8	92 (2.9)	●	1	95 (2.5)	●	1-8	98 (1.5)	●	2-8	97 (1.6)
Quebec Province, Can.	●	1-6	83 (3.6)	●	1-6	86 (2.9)	●	1-6	74 (4.0)	●	1-6	71 (3.5)

● All or almost all students ⦿ Only the more able students ○ Not included in the curriculum through fourth grade

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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 5.17: **Intended and Taught TIMSS Data Topics** *(...Continued)*

MATHEMATICS Grade 4

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

Data	Comparing and matching different representations of the same data			Characteristics of related data sets			Drawing conclusions from data displays		
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
Armenia	●	--	r 60 (4.1)	●	--	r 68 (4.2)	●	--	r 75 (3.4)
Australia	●	--	63 (4.4)	●	--	74 (4.1)	●	--	84 (3.3)
Belgium (Flemish)	○	6	55 (3.9)	⦿	6	68 (3.3)	○	6	83 (2.6)
Chinese Taipei	○	6	82 (3.5)	●	4	91 (2.5)	○	5	86 (2.9)
Cyprus	⦿	6	65 (4.0)	●	3-10	76 (3.6)	⦿	9	91 (2.1)
England	⦿	5	r 76 (4.3)	●	4	r 81 (3.6)	●	4	r 92 (2.7)
Hong Kong, SAR	○	7-11	70 (4.0)	○	7-9	81 (3.6)	●	4-12	86 (3.1)
Hungary	●	3	61 (4.5)	●	3	77 (3.9)	●	3	79 (3.5)
Iran, Islamic Rep. of	○	10	59 (4.7)	●	4,6, 8,10	75 (3.7)	○	6,8,10	67 (4.3)
Italy	●	4-10	69 (3.1)	●	3-10	71 (3.1)	●	3-10	86 (2.3)
Japan	●	3	43 (4.3)	●	3-4	48 (4.6)	●	3-4	58 (4.0)
Latvia	●	--	s 72 (5.1)	●	--	s 79 (5.0)	●	--	s 85 (3.2)
Lithuania	○	--	81 (3.2)	●	2-4	84 (3.0)	●	3-4	88 (2.4)
Moldova, Rep. of	●	--	r 86 (3.3)	○	--	r 79 (3.9)	○	--	r 93 (2.3)
Morocco	○	--	x x	⦿	--	x x	⦿	--	x x
Netherlands	○	5	34 (4.4)	○	6	51 (4.9)	●	--	60 (4.9)
New Zealand	⦿	6-9	73 (2.7)	⦿	4-9	79 (2.7)	●	K-5	90 (1.8)
Norway	●	4-10	24 (3.5)	○	6-8	45 (4.4)	○	6-10	48 (4.0)
Philippines	○	--	66 (4.5)	○	--	72 (4.3)	●	--	63 (4.9)
Russian Federation	○	--	– –	○	--	– –	○	--	– –
Scotland	○	--	s 69 (4.8)	○	--	r 74 (4.6)	●	--	r 90 (2.5)
Singapore	○	--	84 (3.1)	○	--	90 (2.6)	●	3-6	86 (2.7)
Slovenia	●	4	73 (4.1)	●	3	81 (3.4)	○	5	82 (3.7)
Tunisia	○	10	r 48 (4.2)	○	10	79 (3.5)	○	10	r 73 (4.1)
United States	●	--	80 (2.3)	●	--	83 (2.3)	⦿	--	92 (1.6)
Yemen	○	7	– –	●	3	– –	○	6-7	– –
International Avg.			65 (0.8)			74 (0.8)			80 (0.7)
Benchmarking Participants									
Indiana State, US	●	--	68 (4.9)	●	--	87 (3.7)	●	--	94 (2.7)
Ontario Province, Can.	○	5-6	81 (4.0)	●	3-8	83 (3.5)	○	5-8	90 (3.0)
Quebec Province, Can.	○	--	50 (4.5)	●	1-6	60 (4.6)	●	1-6	57 (4.7)

● 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.


6

Chapter 6

Teachers of Mathematics

Since the teacher is central in creating a classroom environment that supports learning mathematics, Chapter 6 presents information about the preparation and background of mathematics teachers in the participating countries. The chapter begins with information about the licensing and/or certification requirements for teaching mathematics 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 mathematics 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 mathematics 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 their teacher to complete the questionnaire. At the fourth grade, students often only have one teacher for all subjects, so this teacher is their mathematics teacher and the one who completed the questionnaire. In either case, 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 Mathematics Teacher?

Exhibit 6.1 presents the country-level responses about the requirements for being certified or licensed to teach mathematics 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, 70 percent of the TIMSS countries (33 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 mathematics teacher. In more than half of the countries (28 out of 47) and all of the benchmarking participants, certification required passing an examination. A probationary period was required in 23 countries and two benchmarking entities. Of the TIMSS countries, 11 required completion of an induction program as did two 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 all three of the benchmarking participants required some type of practicum for certification. Eighteen of the countries participating at the fourth grade and all three of the benchmarking participants required two or more of the following for certification – passing an examination, a university degree, or completion of a probationary 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 mathematics teachers. Across participants at the eighth grade, universities or colleges were most likely to be responsible for granting certification (55% 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 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.

Exhibit 6.1: Current Requirements for Being a Mathematics 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.	●	●	●	●	●

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

Background data provided by National Research Coordinators.

● Country reported Yes for the particular option

○ Country reported No for the particular option

Exhibit 6.1: Current Requirements for Being a Mathematics Teacher

MATHEMATICS Grade 4

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.

Exhibit 6.2: Licensing/Certification Authority for Mathematics Teachers

MATHEMATICS Grade 8

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.	○	○	●	○

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

Background data provided by National Research Coordinators.

● Country reported Yes for the particular option

○ Country reported No for the particular option

Exhibit 6.2: Licensing/Certification Authority for Mathematics 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.

What Are the Background Characteristics of Mathematics Teachers?

Exhibit 6.3 presents a considerable amount of information about the background characteristics of mathematics 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 mathematics by female teachers than male teachers, particularly at the fourth grade. At the eighth grade, on average, internationally, 58 percent of the students were taught mathematics by females and 42 percent by males, and similar percentages were found in a number of countries. However, at least 85 percent of students had female teachers in Armenia, Bulgaria, Estonia, Hungary, Latvia, Lithuania, Moldova, the Russian Federation, and Slovenia. By contrast, only in Egypt and Ghana were as many as 85 percent of the students taught mathematics by male teachers. At the fourth grade, on average, internationally, four-fifths of the mathematics teaching force was female. Across the participants, in each country, with the exception of Morocco and Tunisia at least 50 percent, and often a much higher percentage, of the fourth-grade students were taught by female teachers.

Looking to the last column of Exhibit 6.3, it can be seen that, in general, the mathematics teaching force around the world is quite experienced. At both the eighth and fourth grades, mathematics teachers reported 16 years of teaching experience, on average, internationally.

Given their years of teaching experience, it follows that the majority of the eighth-grade and the fourth-grade students were taught mathematics 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. Very few countries, however, had a comparatively younger teaching force at either the eighth or fourth grades. At the eighth grade, on average, internationally, only 17 percent of students were taught by teachers younger than age 30. The five countries with

the most students (more than 40 percent) taught by younger teachers were Botswana, Ghana, the Palestinian National Authority, Saudi Arabia, and Singapore. The pattern was very similar at the fourth grade. On average, internationally, 19 percent of the students were taught by teachers younger than 30 years old, and with the exception of Singapore (41%), this percentage was usually well under 40 percent.

At the other end of the age distribution, 23 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 several countries. More than half of the students in Italy, Moldova, and Serbia 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, 88 percent of the eighth-grade students and 85 percent of the fourth-grade students were taught mathematics by certified teachers. Of course, the situation varied dramatically across the TIMSS countries. For example, in South Africa only 45 percent of the eighth-grade students and in Tunisia only 21 percent of the fourth-grade students were taught mathematics by a fully certified teacher.

Exhibit 6.3: Mathematics Teachers' Gender, Age, Certification, and Number of Years of Teaching

MATHEMATICS Grade 8

Countries	Percentage of Students by Teacher Characteristics							
	Gender		Age				Have Full Certificate*	Number of Years of Teaching
	Female	Male	29 Years or Under	30-39 Years	40-49 Years	50 Years or Older		
Armenia	87 (2.4)	13 (2.4)	3 (0.9)	35 (3.6)	37 (3.5)	25 (3.0)	94 (1.9)	r 19 (0.7)
Australia	49 (4.7)	51 (4.7)	13 (2.6)	26 (4.4)	37 (5.1)	24 (3.7)	89 (2.9)	16 (0.8)
Bahrain	50 (0.5)	50 (0.5)	36 (3.3)	44 (4.0)	17 (3.3)	3 (1.4)	84 (3.1)	11 (0.7)
Belgium (Flemish)	75 (2.6)	25 (2.6)	24 (3.1)	22 (2.9)	36 (3.6)	18 (2.9)	– –	18 (0.8)
Botswana	27 (4.0)	73 (4.0)	49 (4.4)	45 (4.3)	4 (1.8)	2 (1.2)	96 (1.7)	r 6 (0.5)
Bulgaria	88 (3.0)	12 (3.0)	5 (1.9)	15 (2.9)	46 (3.9)	34 (3.6)	100 (0.0)	21 (0.7)
Chile	54 (3.7)	46 (3.7)	7 (1.7)	15 (2.9)	38 (3.5)	39 (3.1)	87 (2.3)	22 (0.7)
Chinese Taipei	46 (4.1)	54 (4.1)	19 (2.9)	42 (4.2)	21 (3.4)	18 (3.3)	96 (1.4)	14 (0.9)
Cyprus	63 (3.0)	37 (3.0)	5 (1.2)	37 (3.3)	31 (2.8)	27 (2.7)	– –	12 (0.6)
Egypt	14 (2.9)	86 (2.9)	11 (2.3)	56 (4.0)	31 (4.0)	1 (0.4)	99 (0.3)	14 (0.4)
Estonia	89 (2.5)	11 (2.5)	12 (2.6)	16 (3.4)	32 (3.6)	40 (4.3)	91 (2.2)	22 (1.2)
Ghana	11 (3.3)	89 (3.3)	48 (3.9)	31 (4.3)	17 (3.5)	5 (1.9)	r 71 (4.4)	8 (0.6)
Hong Kong, SAR	53 (4.3)	47 (4.3)	29 (3.7)	41 (4.4)	19 (3.1)	10 (2.3)	77 (3.3)	12 (0.7)
Hungary	85 (2.6)	15 (2.6)	5 (1.4)	21 (3.1)	39 (3.6)	35 (3.8)	– –	22 (0.8)
Indonesia	53 (4.0)	47 (4.0)	12 (3.0)	49 (3.8)	32 (3.6)	7 (1.9)	100 (0.0)	14 (0.6)
Iran, Islamic Rep. of	39 (4.2)	61 (4.2)	23 (2.8)	41 (3.8)	29 (3.8)	6 (1.8)	69 (3.5)	14 (0.5)
Israel	79 (2.6)	21 (2.6)	14 (2.4)	35 (3.3)	35 (2.8)	16 (2.6)	96 (1.3)	16 (0.6)
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	32 (3.8)	68 (3.8)	13 (2.6)	35 (3.9)	35 (4.0)	16 (3.1)	99 (0.7)	17 (0.7)
Jordan	49 (2.0)	51 (2.0)	31 (4.0)	47 (4.8)	19 (3.6)	3 (1.5)	76 (3.9)	11 (0.6)
Korea, Rep. of	r 67 (3.6)	33 (3.6)	s 17 (2.7)	39 (3.3)	36 (3.6)	7 (1.9)	s 98 (0.8)	s 13 (0.5)
Latvia	92 (2.5)	8 (2.5)	5 (2.0)	23 (3.8)	39 (4.1)	33 (4.0)	– –	22 (0.9)
Lebanon	46 (4.6)	54 (4.6)	22 (3.1)	31 (4.1)	29 (4.0)	18 (3.1)	r 51 (4.6)	15 (0.8)
Lithuania	91 (2.5)	9 (2.5)	7 (2.0)	26 (3.5)	40 (4.0)	26 (3.4)	100 (0.0)	20 (0.8)
Macedonia, Rep. of	68 (3.8)	32 (3.8)	2 (0.6)	25 (3.6)	36 (3.9)	38 (3.4)	x x	21 (0.9)
Malaysia	72 (3.9)	28 (3.9)	26 (3.4)	44 (4.2)	28 (3.5)	2 (1.3)	80 (3.5)	11 (0.6)
Moldova, Rep. of	r 87 (3.0)	13 (3.0)	r 11 (2.5)	13 (2.9)	24 (4.5)	52 (4.8)	r 91 (2.4)	r 26 (0.9)
Morocco	s 15 (4.6)	85 (4.6)	s 8 (3.9)	21 (5.0)	60 (6.8)	11 (3.8)	s 100 (0.0)	x x
Netherlands	32 (4.7)	68 (4.7)	17 (3.3)	14 (3.1)	45 (4.6)	25 (3.8)	– –	17 (1.0)
New Zealand	45 (4.7)	55 (4.7)	12 (3.9)	28 (4.6)	34 (4.9)	26 (3.0)	79 (4.8)	14 (1.0)
Norway	36 (3.8)	64 (3.8)	13 (2.6)	22 (3.3)	21 (3.3)	43 (4.2)	96 (1.9)	18 (1.0)
Palestinian Nat'l Auth.	49 (3.1)	51 (3.1)	41 (4.3)	29 (4.1)	27 (3.6)	3 (1.5)	70 (3.8)	10 (0.7)
Philippines	73 (3.9)	27 (3.9)	18 (3.6)	44 (4.7)	24 (3.5)	14 (2.9)	93 (2.3)	11 (0.7)
Romania	51 (4.2)	49 (4.2)	13 (3.0)	17 (3.4)	22 (3.3)	48 (4.1)	96 (1.8)	24 (1.0)
Russian Federation	95 (1.6)	5 (1.6)	9 (1.8)	19 (2.3)	33 (4.3)	40 (3.7)	97 (1.4)	24 (0.9)
Saudi Arabia	42 (3.1)	58 (3.1)	43 (5.8)	38 (5.9)	14 (3.1)	5 (2.0)	96 (1.3)	10 (0.8)
Scotland	50 (4.7)	50 (4.7)	15 (3.8)	22 (4.0)	34 (4.1)	29 (3.9)	– –	r 16 (1.0)
Serbia	58 (3.9)	42 (3.9)	7 (2.2)	17 (3.3)	21 (3.5)	55 (4.0)	89 (2.6)	22 (0.9)
Singapore	67 (2.3)	33 (2.3)	43 (2.5)	22 (2.2)	15 (1.8)	20 (2.1)	97 (0.7)	12 (0.7)
Slovak Republic	79 (3.6)	21 (3.6)	11 (2.6)	22 (3.9)	28 (3.9)	39 (4.3)	91 (2.1)	21 (1.1)
Slovenia	87 (3.1)	13 (3.1)	8 (2.4)	24 (3.4)	48 (4.4)	20 (3.6)	91 (2.4)	20 (0.8)
South Africa	40 (3.3)	60 (3.3)	19 (2.7)	55 (3.4)	21 (3.1)	5 (1.6)	r 45 (3.2)	11 (0.6)
Sweden	44 (3.6)	56 (3.6)	13 (2.7)	28 (3.1)	22 (2.8)	37 (3.2)	86 (2.5)	14 (0.8)
Tunisia	32 (4.0)	68 (4.0)	23 (3.2)	42 (3.8)	23 (3.1)	12 (2.5)	91 (2.5)	s 12 (0.9)
United States	65 (2.7)	35 (2.7)	13 (2.0)	26 (2.8)	29 (2.9)	32 (2.9)	93 (1.8)	15 (0.7)
‡ England	r 54 (6.2)	46 (6.2)	r 24 (5.0)	19 (5.0)	36 (6.5)	20 (4.9)	– –	r 15 (1.5)
International Avg.	58 (0.5)	42 (0.5)	17 (0.4)	30 (0.6)	30 (0.6)	23 (0.5)	88 (0.4)	16 (0.1)
Benchmarking Participants								
Basque Country, Spain	74 (5.0)	26 (5.0)	5 (2.4)	20 (4.0)	38 (4.9)	36 (4.3)	– –	21 (0.9)
Indiana State, US	60 (5.9)	40 (5.9)	22 (5.2)	29 (5.1)	12 (3.6)	38 (6.3)	99 (0.0)	– –
Ontario Province, Can.	46 (5.0)	54 (5.0)	24 (4.4)	42 (4.9)	16 (3.0)	18 (3.3)	96 (1.7)	11 (0.9)
Quebec Province, Can.	47 (5.1)	53 (5.1)	21 (4.1)	36 (4.7)	15 (3.5)	28 (3.9)	92 (3.0)	15 (1.0)

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: Mathematics Teachers' Gender, Age, Certification, and Number of Years of Teaching

MATHEMATICS Grade 4

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		88 (2.6)	12 (2.6)		8 (1.9)	25 (3.2)	38 (3.8)	30 (4.0)	r	92 (2.2)			20 (0.9)	
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)		78 (2.7)	22 (2.7)		23 (2.9)	37 (3.1)	27 (2.9)	14 (2.1)		100 (0.0)			16 (0.7)	
Chinese Taipei		80 (2.9)	20 (2.9)		26 (3.4)	44 (4.0)	23 (3.0)	7 (2.2)		88 (2.6)			11 (0.7)	
Cyprus		79 (3.3)	21 (3.3)		39 (4.3)	50 (4.3)	5 (1.7)	7 (2.2)		– –			11 (0.7)	
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 (4.3)	27 (4.3)		34 (4.5)	34 (4.3)	15 (2.8)	17 (3.9)		89 (2.6)			13 (1.1)	
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		63 (3.8)	37 (3.8)		11 (2.8)	27 (3.3)	39 (4.1)	23 (3.6)		99 (1.0)			19 (0.8)	
Latvia		99 (0.6)	1 (0.6)		6 (1.8)	38 (3.9)	31 (4.0)	25 (3.5)		– –			20 (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	r	36 (4.5)	64 (4.5)	r	24 (3.7)	20 (4.1)	47 (4.6)	9 (2.4)	s	96 (1.8)		s	15 (0.7)	
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)		24 (2.8)	26 (3.2)	31 (2.9)	19 (2.3)		85 (2.5)			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		82 (3.1)	18 (3.1)		41 (3.8)	38 (3.6)	7 (2.2)	15 (2.6)		97 (1.4)			10 (0.9)	
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		85 (2.0)	15 (2.0)		20 (1.8)	28 (2.1)	21 (2.2)	31 (2.7)		91 (1.6)			14 (0.6)	
International Avg.		80 (0.6)	20 (0.6)		19 (0.6)	31 (0.7)	29 (0.7)	21 (0.7)		85 (0.6)			16 (0.2)	
Benchmarking Participants														
Indiana State, US		88 (3.6)	12 (3.6)		16 (3.8)	22 (4.9)	22 (5.2)	40 (5.3)		100 (0.0)			– –	
Ontario Province, Can.		76 (3.8)	24 (3.8)		22 (4.1)	23 (3.9)	27 (4.6)	28 (4.5)		92 (3.0)			13 (0.9)	
Quebec Province, Can.		93 (2.0)	7 (2.0)		14 (3.3)	31 (4.1)	19 (3.6)	36 (4.4)		84 (3.6)			18 (0.9)	

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 Mathematics?

Exhibits 6.4 through 6.8 present teachers' reports about their preparation to teach mathematics, 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 teacher's 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 mathematics by teachers having at least a university degree or equivalent. At the eighth grade, 59 percent of the students were taught by teachers with a university degree and another 17 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, the Russian Federation, Tunisia, and the United States. In contrast, 72 percent of the eighth-grade students in Morocco 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 mathematics 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, Morocco, Norway, and Sweden.

Teachers' reports about their major area or areas of study during their postsecondary education can be found also, in Exhibit 6.5. At the eighth grade, on average, internationally, the majority studied mathematics education (54%) or mathematics (70%) or both (since 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 mathematics 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). On average, for the primary education majors, about one-fourth (26%) reported specializing in mathematics, 4 percent in science, and half (50%) not having any particular specialization. Countries with more than half the fourth-grade students being taught by mathematics specialists were Latvia, Moldova, and the Russian Federation.

In today's fast-paced world of frequent important discoveries and new technologies in the fields of pedagogy and mathematics, 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 6.6 through 6.8 contain information about teachers' opportunities for and participation in professional development activities.

Exhibit 6.6 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.

Exhibit 6.4: Highest Educational Level of Mathematics Teachers*

MATHEMATICS Grade 8

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		83 (3.0)	17 (3.0)	0 (0.0)	1 (0.5)	0 (0.0)
Australia		50 (4.0)	43 (4.1)	7 (2.2)	0 (0.0)	0 (0.0)
Bahrain		6 (2.0)	84 (3.5)	9 (2.8)	0 (0.0)	0 (0.0)
Belgium (Flemish)		0 (0.0)	0 (0.0)	100 (0.0)	0 (0.0)	0 (0.0)
Botswana		0 (0.0)	8 (2.4)	89 (2.3)	3 (1.4)	0 (0.0)
Bulgaria		57 (4.4)	33 (4.3)	10 (2.3)	0 (0.0)	0 (0.0)
Chile		2 (1.0)	93 (1.5)	5 (1.3)	1 (0.6)	0 (0.0)
Chinese Taipei		18 (3.1)	81 (3.1)	1 (1.0)	0 (0.0)	0 (0.0)
Cyprus		11 (1.8)	89 (1.8)	0 (0.0)	0 (0.0)	0 (0.0)
Egypt		1 (0.6)	99 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)
Estonia		19 (3.4)	68 (4.0)	8 (2.4)	4 (1.6)	0 (0.0)
Ghana		0 (0.0)	8 (2.5)	82 (3.6)	10 (3.0)	0 (0.0)
Hong Kong, SAR		17 (3.3)	68 (4.5)	15 (3.2)	0 (0.0)	0 (0.0)
Hungary		20 (2.8)	80 (2.8)	0 (0.0)	0 (0.0)	0 (0.0)
Indonesia		0 (0.0)	54 (4.4)	43 (4.4)	3 (1.4)	0 (0.0)
Iran, Islamic Rep. of		1 (0.8)	38 (3.4)	59 (3.4)	1 (0.9)	0 (0.0)
Israel		25 (2.7)	72 (2.9)	2 (0.9)	0 (0.4)	0 (0.0)
Italy		7 (1.9)	93 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)
Japan		5 (1.9)	95 (2.0)	1 (0.6)	0 (0.0)	0 (0.0)
Jordan		7 (2.3)	72 (3.5)	21 (3.0)	0 (0.0)	0 (0.0)
Korea, Rep. of	r	25 (3.2)	75 (3.2)	0 (0.0)	0 (0.0)	0 (0.0)
Latvia		0 (0.0)	95 (1.7)	1 (0.0)	4 (1.6)	0 (0.0)
Lebanon		– –	– –	– –	– –	– –
Lithuania		39 (4.0)	57 (4.2)	4 (1.6)	0 (0.0)	0 (0.0)
Macedonia, Rep. of		0 (0.0)	8 (2.3)	92 (2.3)	0 (0.0)	0 (0.0)
Malaysia		0 (0.0)	53 (4.3)	18 (3.4)	28 (3.6)	0 (0.0)
Moldova, Rep. of	r	2 (1.2)	94 (2.1)	0 (0.0)	4 (1.4)	1 (0.1)
Morocco	s	2 (2.3)	5 (3.7)	7 (3.0)	72 (6.7)	13 (4.6)
Netherlands		9 (2.4)	– –	85 (3.4)	6 (2.3)	0 (0.0)
New Zealand		32 (4.7)	51 (5.2)	18 (3.2)	0 (0.0)	0 (0.0)
Norway		11 (2.5)	64 (4.0)	23 (3.2)	1 (0.7)	2 (1.0)
Palestinian Nat'l Auth.		7 (2.5)	78 (3.8)	15 (3.0)	0 (0.0)	0 (0.0)
Philippines		8 (2.3)	92 (2.3)	0 (0.0)	0 (0.0)	0 (0.0)
Romania		3 (1.4)	73 (3.6)	24 (3.3)	0 (0.0)	0 (0.0)
Russian Federation		75 (3.8)	23 (3.7)	2 (0.8)	0 (0.4)	0 (0.0)
Saudi Arabia		6 (2.5)	84 (3.1)	9 (2.2)	0 (0.0)	0 (0.0)
Scotland		11 (2.8)	89 (2.8)	0 (0.0)	0 (0.0)	0 (0.0)
Serbia		1 (0.0)	27 (3.8)	72 (3.9)	1 (0.9)	0 (0.0)
Singapore		5 (1.1)	80 (2.1)	10 (1.5)	4 (1.2)	0 (0.3)
Slovak Republic		17 (2.8)	82 (2.9)	0 (0.0)	1 (0.0)	0 (0.0)
Slovenia		20 (3.7)	76 (3.8)	1 (0.8)	2 (1.1)	0 (0.0)
South Africa	r	10 (2.7)	24 (3.0)	61 (3.4)	5 (1.6)	0 (0.0)
Sweden		29 (3.3)	62 (3.7)	4 (1.4)	4 (1.6)	0 (0.0)
Tunisia		61 (3.6)	32 (3.7)	2 (1.2)	5 (1.8)	0 (0.0)
United States		61 (2.7)	39 (2.7)	0 (0.0)	0 (0.0)	0 (0.0)
‡ England	s	17 (4.2)	83 (4.2)	0 (0.0)	0 (0.0)	0 (0.0)
International Avg.		17 (0.4)	59 (0.5)	20 (0.3)	4 (0.2)	0 (0.1)
Benchmarking Participants						
Basque Country, Spain		35 (5.2)	65 (5.2)	0 (0.0)	0 (0.0)	0 (0.0)
Indiana State, US		– –	– –	– –	– –	– –
Ontario Province, Can.		17 (4.2)	81 (4.2)	2 (1.3)	0 (0.0)	0 (0.0)
Quebec Province, Can.		9 (2.6)	91 (2.6)	0 (0.0)	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 Mathematics Teachers*

MATHEMATICS Grade 4

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	79 (2.9)	12 (2.4)	6 (1.9)	2 (1.1)	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	5 (1.8)	77 (3.8)	12 (2.8)	6 (2.2)	0 (0.0)
Cyprus	19 (3.1)	81 (3.1)	1 (0.4)	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)	51 (4.9)	44 (5.0)	0 (0.0)	1 (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)	83 (3.1)	14 (2.9)	0 (0.0)	0 (0.0)
Latvia	0 (0.0)	84 (3.2)	3 (1.4)	13 (3.0)	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	1 (0.8)	23 (4.6)	4 (2.9)	54 (5.7)	18 (3.5)
Netherlands	1 (0.5)	– –	98 (1.0)	1 (0.9)	0 (0.0)
New Zealand	10 (2.0)	54 (3.2)	36 (3.3)	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	3 (1.7)	40 (4.0)	41 (3.9)	16 (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	52 (2.6)	47 (2.6)	0 (0.0)	0 (0.0)	0 (0.0)
International Avg.	13 (0.4)	52 (0.7)	22 (0.5)	11 (0.4)	1 (0.2)
Benchmarking Participants					
Indiana State, US	– –	– –	– –	– –	– –
Ontario Province, Can.	9 (2.8)	84 (3.6)	7 (2.3)	0 (0.0)	0 (0.0)
Quebec Province, Can.	9 (2.6)	88 (2.9)	4 (1.1)	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 Mathematics

Countries	Teachers Receive Specific Preparation in How to Teach the Intended Mathematics Curriculum		Teachers' Major Area of Study in Their Postsecondary Education[1]					
			Education-Mathematics	Mathematics	Education-Science	Science	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	●	●	42 (4.1)	82 (2.6)	– –	24 (3.1)	r 13 (3.0)	r 25 (4.2)
Australia	●	●	58 (4.3)	61 (3.7)	25 (3.5)	37 (4.5)	38 (4.4)	42 (4.1)
Bahrain	●	●	88 (2.6)	49 (3.3)	10 (2.5)	14 (2.5)	14 (2.3)	7 (1.9)
Belgium (Flemish)	●	●	– –	96 (1.1)	– –	– –	11 (2.2)	24 (3.0)
Botswana	●	●	51 (5.1)	77 (4.0)	7 (2.3)	25 (4.0)	28 (4.4)	28 (4.4)
Bulgaria	●	●	82 (3.8)	97 (1.6)	42 (4.0)	43 (3.8)	66 (3.9)	39 (4.4)
Chile	○	○	29 (2.7)	51 (3.5)	4 (1.5)	8 (2.1)	64 (3.2)	r 23 (3.5)
Chinese Taipei	●	●	63 (4.3)	80 (3.3)	26 (3.4)	25 (3.8)	58 (3.8)	24 (3.6)
Cyprus	○	●	23 (2.1)	98 (1.0)	0 (0.0)	8 (1.5)	5 (1.5)	10 (1.7)
Egypt	●	●	80 (3.5)	85 (3.1)	1 (1.0)	11 (2.2)	16 (2.4)	7 (1.9)
Estonia	●	●	67 (3.8)	78 (3.6)	12 (2.6)	13 (2.9)	37 (3.9)	22 (3.4)
Ghana	●	●	r 53 (5.0)	r 58 (5.0)	r 31 (4.7)	r 34 (4.7)	r 67 (4.6)	r 46 (4.7)
Hong Kong, SAR	●	●	57 (4.4)	63 (3.7)	25 (3.8)	36 (4.4)	53 (4.3)	54 (4.4)
Hungary	●	●	92 (2.3)	40 (4.5)	47 (4.1)	27 (3.7)	6 (1.9)	35 (3.6)
Indonesia	●	●	80 (3.6)	59 (4.2)	14 (3.1)	19 (3.1)	27 (4.1)	19 (3.5)
Iran, Islamic Rep. of	●	●	33 (3.9)	78 (3.6)	1 (0.5)	5 (1.8)	7 (2.0)	16 (3.1)
Israel	●	●	66 (3.1)	74 (3.4)	9 (1.7)	21 (2.9)	33 (3.6)	33 (3.6)
Italy	○	●	– –	21 (3.5)	– –	70 (3.8)	0 (0.0)	11 (2.3)
Japan	●	●	58 (4.6)	81 (3.2)	3 (1.6)	12 (2.8)	33 (4.1)	27 (3.9)
Jordan	○	●	28 (4.2)	72 (4.2)	0 (0.3)	5 (1.8)	1 (0.0)	7 (2.2)
Korea, Rep. of	○	○	s 66 (3.2)	s 37 (3.8)	s 1 (0.9)	s 1 (0.5)	s 7 (2.1)	s 5 (1.5)
Latvia	●	●	83 (2.8)	97 (1.3)	16 (3.0)	32 (4.0)	79 (3.1)	56 (4.6)
Lebanon	●	●	x x	x x	x x	x x	x x	x x
Lithuania	○	○	41 (3.9)	92 (2.2)	5 (1.5)	6 (1.9)	27 (3.7)	r 15 (3.0)
Macedonia, Rep. of	●	●	40 (4.1)	60 (4.3)	9 (2.6)	8 (2.2)	2 (1.0)	1 (1.1)
Malaysia	●	●	48 (4.6)	46 (4.4)	15 (2.9)	20 (3.3)	13 (2.2)	46 (3.7)
Moldova, Rep. of	○	○	r 44 (5.0)	r 87 (2.9)	r 13 (3.1)	r 14 (3.2)	r 27 (4.1)	r 23 (3.9)
Morocco	○	○	x x	x x	x x	x x	x x	x x
Netherlands	●	●	67 (4.8)	49 (4.3)	21 (3.9)	– –	25 (3.9)	27 (4.7)
New Zealand	●	●	24 (4.4)	51 (4.6)	13 (2.8)	28 (3.9)	38 (4.5)	53 (4.6)
Norway	○	○	r 3 (1.3)	r 37 (4.4)	r 8 (2.7)	r 50 (4.6)	r 32 (3.7)	r 64 (4.8)
Palestinian Nat'l Auth.	○	●	43 (3.6)	51 (4.0)	2 (1.3)	7 (2.2)	5 (2.1)	5 (2.0)
Philippines	○	●	54 (4.3)	62 (4.5)	3 (1.6)	5 (2.0)	11 (2.4)	14 (3.3)
Romania	●	●	24 (3.6)	97 (1.7)	6 (2.1)	14 (3.0)	17 (3.0)	10 (2.3)
Russian Federation	●	●	– –	96 (1.6)	18 (2.7)	24 (2.8)	– –	– –
Saudi Arabia	●	●	66 (6.1)	93 (2.3)	2 (1.2)	9 (2.4)	19 (3.5)	7 (2.6)
Scotland	●	●	61 (4.3)	76 (4.1)	r 15 (3.6)	r 32 (4.3)	r 34 (4.2)	r 37 (5.3)
Serbia	●	○	60 (4.2)	96 (1.7)	14 (2.9)	19 (3.0)	52 (4.2)	30 (3.6)
Singapore	●	●	57 (2.8)	86 (1.8)	21 (2.4)	46 (2.5)	38 (2.2)	44 (3.0)
Slovak Republic	●	○	61 (4.4)	60 (4.5)	44 (4.2)	33 (3.6)	16 (3.8)	29 (3.6)
Slovenia	●	●	73 (4.0)	80 (3.5)	24 (3.7)	18 (3.5)	14 (2.7)	19 (3.4)
South Africa	○	●	40 (3.8)	r 68 (3.6)	r 21 (3.5)	42 (3.9)	32 (3.6)	r 39 (4.0)
Sweden	○	○	58 (3.7)	65 (3.6)	55 (3.8)	55 (3.2)	38 (3.5)	37 (3.9)
Tunisia	●	●	39 (4.4)	83 (2.8)	1 (1.0)	7 (2.2)	4 (1.6)	10 (2.5)
United States	●	--	55 (2.7)	48 (3.3)	9 (1.8)	15 (1.9)	– –	35 (3.2)
‡ England	●	●	r 58 (6.1)	r 76 (5.7)	s 9 (3.5)	r 24 (4.8)	r 36 (5.6)	s 38 (5.6)
International Avg.			54 (0.6)	70 (0.5)	15 (0.4)	22 (0.5)	27 (0.5)	27 (0.5)
Benchmarking Participants								
Basque Country, Spain	○	●	37 (5.4)	25 (4.7)	42 (5.3)	23 (4.5)	22 (4.5)	22 (4.4)
Indiana State, US	●	○	– –	– –	– –	– –	– –	– –
Ontario Province, Can.	●	○	15 (3.5)	12 (3.0)	14 (3.6)	29 (4.5)	62 (5.0)	77 (4.0)
Quebec Province, Can.	●	●	56 (4.7)	36 (4.6)	16 (4.0)	14 (3.3)	33 (4.9)	r 39 (4.9)

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. An "x" indicates data are available for less than 50% of the students.

Exhibit 6.5: Preparation to Teach Mathematics

MATHEMATICS Grade 4

Countries	Teachers Receive Specific Preparation in How to Teach the Intended Mathematics Curriculum		Teachers' Major Area of Study in Their Postsecondary Education				
			Primary/Elementary Education with a Major or Specialization in Mathematics	Primary/Elementary Education with a Major or Specialization in Science but Not in Mathematics	Mathematics or Science Major or Specialization without a Major in Primary/Elementary Education	Primary/Elementary Education without a Major or Specialization in Mathematics or Science	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	●	●	9 (2.3)	0 (0.0)	86 (2.7)	2 (0.9)	3 (1.1)
Australia	●	●	17 (3.5)	6 (1.7)	1 (0.5)	72 (4.1)	4 (1.4)
Belgium (Flemish)	●	●	34 (3.5)	3 (1.2)	2 (1.1)	59 (3.2)	1 (0.6)
Chinese Taipei	●	●	29 (3.7)	3 (1.3)	11 (2.8)	36 (4.2)	22 (3.4)
Cyprus	●	○	18 (2.8)	11 (2.3)	1 (0.5)	68 (3.6)	2 (1.0)
England	●	●	r 8 (3.1)	7 (2.6)	5 (1.8)	64 (4.3)	16 (2.7)
Hong Kong, SAR	●	●	37 (4.4)	1 (0.9)	11 (3.2)	34 (4.7)	17 (3.5)
Hungary	●	●	x x	x x	x x	x x	x x
Iran, Islamic Rep. of	●	●	s 50 (5.5)	2 (1.2)	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	●	●	15 (3.0)	7 (2.1)	1 (0.7)	56 (3.9)	22 (3.4)
Latvia	●	●	63 (3.7)	2 (1.2)	3 (1.4)	24 (3.4)	7 (2.6)
Lithuania	●	●	14 (2.5)	2 (1.1)	3 (1.0)	78 (3.2)	4 (1.3)
Moldova, Rep. of	○	○	51 (4.6)	2 (1.3)	5 (1.7)	32 (4.4)	10 (2.5)
Morocco	●	●	x x	x x	x x	x x	x x
Netherlands	●	●	12 (3.1)	9 (2.7)	– –	76 (3.7)	2 (1.7)
New Zealand	●	●	21 (2.6)	10 (2.3)	1 (0.5)	63 (3.2)	6 (1.4)
Norway	○	○	– –	– –	– –	– –	– –
Philippines	●	●	24 (4.0)	7 (2.2)	4 (2.2)	54 (4.3)	11 (2.9)
Russian Federation	●	●	57 (3.5)	2 (1.3)	1 (0.8)	35 (3.7)	5 (1.6)
Scotland	●	●	r 8 (2.4)	5 (1.9)	1 (0.1)	79 (3.6)	7 (2.3)
Singapore	●	●	48 (4.2)	4 (1.6)	8 (2.1)	24 (2.7)	16 (3.1)
Slovenia	●	●	34 (4.2)	2 (1.6)	0 (0.0)	63 (4.4)	0 (0.0)
Tunisia	●	●	15 (3.0)	0 (0.4)	6 (1.8)	67 (4.1)	12 (2.7)
United States	●	--	8 (1.5)	6 (1.4)	3 (0.8)	72 (2.8)	12 (1.9)
International Avg.			26 (0.7)	4 (0.3)	7 (0.4)	50 (0.8)	13 (0.5)
Benchmarking Participants							
Indiana State, US	●	○	– –	– –	– –	– –	– –
Ontario Province, Can.	●	○	6 (2.2)	4 (1.5)	5 (2.1)	63 (5.1)	21 (4.0)
Quebec Province, Can.	●	●	15 (2.9)	2 (0.9)	4 (1.7)	68 (4.2)	12 (2.7)

● 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: 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					
	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 6.6: 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 6.6: 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)

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.

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 6.6: 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 6.6: 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 6.6: Professional Development Opportunities for Teachers in Mathematics and Science

MATHEMATICS Grade 4

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 6.7: Teachers' Participation in Professional Development in Mathematics

MATHEMATICS Grade 8

Countries	Percentage of Students by Their Teachers' Participation in Professional Development in Mathematics in the Past Two Years											
	Mathematics Content		Mathematics Pedagogy/ Instruction		Mathematics Curriculum		Integrating Information Technology into Mathematics		Improving Students' Critical Thinking or Problem Solving Skills		Mathematics Assessment	
Armenia	12	(2.4)	r 29	(3.3)	r 28	(3.0)	r 15	(3.1)	r 30	(4.1)	r 40	(4.6)
Australia	68	(3.7)	56	(4.0)	71	(3.7)	70	(4.0)	47	(4.8)	57	(4.4)
Bahrain	24	(2.6)	37	(3.4)	19	(2.3)	31	(3.7)	41	(4.0)	42	(3.7)
Belgium (Flemish)	53	(3.6)	40	(3.6)	42	(3.8)	76	(3.2)	24	(3.2)	20	(3.4)
Botswana	39	(4.0)	24	(4.6)	18	(3.8)	17	(3.6)	50	(5.2)	40	(4.7)
Bulgaria	r 19	(3.5)	r 9	(2.7)	r 20	(3.7)	r 13	(3.7)	r 9	(2.7)	r 10	(2.7)
Chile	78	(3.2)	75	(3.4)	50	(4.1)	50	(3.8)	54	(3.9)	54	(3.7)
Chinese Taipei	86	(3.1)	89	(2.3)	85	(2.8)	81	(3.2)	47	(4.1)	69	(4.0)
Cyprus	71	(2.1)	65	(2.9)	74	(2.6)	64	(2.7)	45	(3.5)	50	(3.1)
Egypt	28	(3.8)	49	(4.1)	28	(3.5)	48	(4.2)	80	(3.3)	60	(4.3)
Estonia	63	(4.1)	74	(3.6)	74	(3.7)	70	(3.7)	49	(3.9)	50	(4.1)
Ghana	50	(4.3)	40	(4.4)	41	(4.4)	20	(3.8)	52	(4.4)	57	(4.0)
Hong Kong, SAR	61	(3.9)	64	(4.1)	62	(4.2)	79	(3.7)	46	(4.0)	42	(4.5)
Hungary	49	(4.2)	44	(3.6)	48	(3.6)	17	(3.0)	26	(3.3)	29	(3.8)
Indonesia	57	(4.3)	64	(4.1)	59	(4.2)	21	(3.1)	49	(4.3)	48	(4.3)
Iran, Islamic Rep. of	53	(3.6)	58	(3.3)	40	(3.8)	22	(3.6)	38	(4.4)	41	(4.2)
Israel	63	(3.7)	68	(3.4)	63	(4.0)	50	(3.9)	52	(3.8)	48	(4.0)
Italy	22	(3.1)	28	(3.3)	15	(2.7)	52	(3.8)	13	(2.3)	20	(3.1)
Japan	63	(3.9)	71	(3.7)	41	(4.0)	27	(4.2)	30	(4.1)	57	(4.3)
Jordan	48	(4.2)	69	(4.0)	45	(4.5)	35	(4.1)	58	(4.3)	47	(5.1)
Korea, Rep. of	s 32	(3.4)	s 36	(3.3)	s 29	(3.4)	s 43	(3.5)	s 12	(2.1)	s 21	(2.7)
Latvia	80	(3.5)	72	(3.9)	83	(3.0)	48	(4.4)	65	(4.1)	72	(4.1)
Lebanon	60	(4.6)	61	(4.6)	59	(4.2)	39	(4.0)	62	(4.4)	73	(3.8)
Lithuania	86	(2.7)	76	(3.1)	67	(3.8)	63	(3.7)	43	(4.1)	55	(4.0)
Macedonia, Rep. of	64	(4.3)	67	(4.0)	63	(3.7)	16	(3.0)	41	(3.9)	42	(4.3)
Malaysia	69	(3.9)	64	(4.3)	65	(3.9)	48	(4.4)	72	(3.8)	29	(3.7)
Moldova, Rep. of	r 41	(5.0)	r 45	(5.0)	r 49	(5.0)	r 50	(4.8)	r 75	(4.2)	r 75	(4.2)
Morocco	x	x	x	x	x	x	s 16	(4.9)	s 48	(6.5)	x	x
Netherlands	38	(4.5)	43	(4.6)	15	(3.2)	42	(4.9)	29	(4.0)	11	(3.0)
New Zealand	82	(2.9)	61	(3.9)	78	(3.4)	53	(5.4)	52	(4.0)	79	(4.0)
Norway	28	(4.1)	33	(4.2)	16	(3.3)	30	(4.2)	15	(3.2)	27	(3.8)
Palestinian Nat'l Auth.	84	(3.1)	79	(3.6)	78	(3.6)	33	(4.6)	59	(4.7)	63	(4.2)
Philippines	82	(3.3)	68	(4.1)	77	(3.5)	44	(4.5)	67	(4.1)	61	(4.7)
Romania	71	(4.0)	68	(3.8)	65	(4.3)	33	(3.7)	54	(4.0)	77	(4.0)
Russian Federation	70	(4.0)	64	(4.1)	70	(3.8)	52	(2.8)	53	(4.4)	55	(3.5)
Saudi Arabia	43	(5.5)	61	(5.7)	38	(4.6)	19	(4.5)	49	(6.3)	43	(4.7)
Scotland	68	(4.5)	77	(3.3)	57	(4.6)	83	(3.6)	42	(5.1)	40	(4.5)
Serbia	66	(4.0)	45	(4.3)	60	(4.2)	31	(3.4)	41	(3.8)	43	(4.1)
Singapore	76	(2.3)	78	(2.3)	59	(2.4)	88	(1.6)	70	(2.4)	58	(2.6)
Slovak Republic	50	(4.4)	41	(4.5)	50	(3.8)	34	(3.9)	35	(4.5)	36	(4.4)
Slovenia	86	(2.8)	88	(3.0)	79	(3.0)	46	(4.0)	53	(4.0)	69	(3.6)
South Africa	r 61	(4.6)	r 43	(4.0)	r 59	(3.7)	r 34	(3.9)	r 58	(4.2)	r 77	(3.4)
Sweden	44	(3.8)	50	(3.6)	35	(3.3)	12	(2.7)	35	(3.6)	31	(3.4)
Tunisia	26	(3.5)	42	(3.9)	22	(3.3)	16	(3.0)	46	(4.2)	46	(4.3)
United States	83	(2.5)	75	(2.7)	83	(2.5)	74	(3.0)	76	(2.4)	74	(2.7)
‡ England	r 66	(5.8)	r 83	(4.1)	r 78	(4.6)	r 63	(5.4)	r 52	(6.1)	r 55	(5.4)
International Avg.	57	(0.6)	57	(0.6)	52	(0.6)	43	(0.6)	47	(0.6)	49	(0.6)
Benchmarking Participants												
Basque Country, Spain	35	(5.1)	44	(5.0)	34	(4.6)	53	(4.8)	40	(4.7)	35	(4.7)
Indiana State, US	r 72	(6.2)	r 69	(6.0)	r 76	(5.2)	r 60	(6.3)	r 64	(6.6)	r 58	(5.4)
Ontario Province, Can.	81	(4.0)	74	(4.4)	81	(3.5)	48	(5.1)	63	(4.5)	67	(4.3)
Quebec Province, Can.	36	(4.7)	51	(4.6)	43	(4.9)	40	(4.4)	42	(5.4)	28	(4.1)

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. 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 6.7: Teachers' Participation in Professional Development in Mathematics

MATHEMATICS Grade 4

Countries	Percentage of Students by Their Teachers' Participation in Professional Development in Mathematics in the Past Two Years					
	Mathematics Content	Mathematics Pedagogy/ Instruction	Mathematics Curriculum	Integrating Information Technology into Mathematics	Improving Students' Critical Thinking or Problem Solving Skills	Mathematics Assessment
Armenia	r 12 (2.7)	r 26 (3.7)	r 23 (3.4)	r 9 (2.2)	r 38 (4.3)	r 37 (3.7)
Australia	63 (3.6)	57 (3.5)	58 (4.0)	36 (4.3)	57 (3.5)	53 (4.2)
Belgium (Flemish)	31 (3.5)	21 (2.8)	4 (1.3)	12 (2.2)	28 (3.4)	18 (3.6)
Chinese Taipei	57 (4.0)	73 (3.7)	61 (3.7)	45 (3.5)	37 (4.2)	49 (4.0)
Cyprus	73 (3.3)	52 (3.5)	34 (4.2)	44 (3.8)	49 (3.8)	23 (3.9)
England	r 76 (3.6)	r 88 (2.7)	r 78 (4.1)	r 60 (4.3)	r 72 (4.0)	r 51 (4.7)
Hong Kong, SAR	55 (4.2)	65 (4.3)	55 (4.3)	68 (4.8)	49 (4.0)	39 (4.4)
Hungary	35 (4.0)	37 (4.1)	26 (4.0)	9 (2.6)	23 (3.8)	20 (3.5)
Iran, Islamic Rep. of	39 (4.8)	41 (4.9)	30 (4.9)	12 (3.0)	33 (4.1)	33 (4.3)
Italy	29 (3.4)	30 (3.4)	20 (3.1)	37 (3.4)	12 (2.1)	10 (2.2)
Japan	40 (3.9)	43 (4.0)	19 (3.2)	16 (3.2)	22 (3.8)	30 (4.1)
Latvia	49 (4.2)	53 (4.2)	53 (4.5)	26 (3.8)	68 (3.8)	69 (3.7)
Lithuania	40 (3.6)	48 (4.0)	38 (3.8)	42 (3.5)	57 (3.9)	47 (3.6)
Moldova, Rep. of	36 (4.3)	42 (4.2)	39 (4.3)	40 (4.3)	63 (4.5)	66 (4.2)
Morocco	x x	x x	x x	x x	x x	x x
Netherlands	19 (4.0)	30 (4.3)	10 (2.5)	33 (4.7)	27 (4.2)	22 (3.2)
New Zealand	64 (3.5)	57 (3.3)	58 (3.4)	28 (3.1)	59 (3.6)	59 (3.5)
Norway	18 (2.8)	21 (3.1)	8 (2.1)	10 (2.0)	12 (2.4)	6 (1.6)
Philippines	62 (4.6)	53 (4.9)	70 (4.4)	51 (5.1)	67 (4.6)	56 (4.6)
Russian Federation	56 (4.1)	60 (4.0)	67 (3.4)	34 (3.7)	57 (4.0)	54 (3.9)
Scotland	r 42 (5.3)	r 47 (5.4)	s 39 (4.6)	r 42 (5.8)	r 45 (5.2)	r 28 (4.7)
Singapore	60 (3.7)	68 (3.9)	43 (4.3)	56 (4.1)	73 (3.6)	47 (3.9)
Slovenia	54 (4.2)	41 (4.3)	49 (4.1)	25 (3.7)	37 (4.4)	53 (4.0)
Tunisia	r 21 (4.0)	27 (4.0)	r 25 (3.7)	r 9 (2.7)	51 (4.4)	52 (4.5)
United States	65 (2.9)	54 (2.9)	66 (2.8)	41 (2.9)	58 (2.9)	54 (2.6)
International Avg.	46 (0.8)	47 (0.8)	41 (0.8)	33 (0.8)	46 (0.8)	41 (0.8)
Benchmarking Participants						
Indiana State, US	44 (5.5)	40 (5.6)	58 (5.3)	34 (3.6)	49 (5.6)	36 (5.8)
Ontario Province, Can.	62 (4.7)	53 (5.1)	59 (5.0)	33 (4.2)	54 (4.6)	55 (4.7)
Quebec Province, Can.	53 (4.5)	57 (4.3)	67 (4.4)	26 (4.2)	39 (4.2)	39 (4.4)

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 6.8: Types of Interactions Among Mathematics Teachers

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	49 (4.3)	43 (4.1)	8 (2.3)	34 (3.7)	40 (3.5)	26 (3.4)
Australia	52 (4.1)	38 (3.7)	10 (2.5)	51 (4.7)	39 (4.2)	10 (2.5)
Bahrain	64 (3.7)	31 (3.5)	6 (1.4)	51 (3.3)	33 (3.4)	16 (2.6)
Belgium (Flemish)	45 (4.1)	37 (3.9)	17 (3.0)	15 (2.7)	44 (3.7)	41 (3.9)
Botswana	73 (3.9)	25 (3.8)	3 (1.5)	65 (3.9)	27 (3.5)	8 (2.3)
Bulgaria	46 (4.3)	40 (4.2)	14 (3.6)	53 (4.7)	29 (3.6)	19 (3.6)
Chile	42 (3.5)	35 (3.3)	24 (3.3)	45 (3.8)	27 (3.2)	27 (3.7)
Chinese Taipei	51 (4.0)	42 (4.0)	7 (1.8)	16 (3.4)	36 (3.7)	48 (4.6)
Cyprus	75 (2.3)	24 (2.3)	1 (0.4)	63 (2.9)	29 (2.7)	8 (1.2)
Egypt	84 (3.4)	14 (3.1)	2 (1.3)	59 (3.9)	37 (3.8)	4 (1.8)
Estonia	59 (4.5)	34 (4.3)	7 (2.1)	52 (4.0)	36 (4.0)	12 (2.3)
Ghana	37 (4.4)	38 (4.7)	25 (4.3)	52 (4.8)	26 (3.9)	22 (3.7)
Hong Kong, SAR	38 (4.5)	51 (4.6)	11 (3.0)	20 (3.5)	49 (4.1)	31 (4.1)
Hungary	48 (4.5)	46 (4.5)	5 (1.9)	40 (4.1)	41 (3.8)	18 (3.2)
Indonesia	58 (4.4)	38 (4.3)	4 (1.6)	78 (3.4)	17 (3.4)	4 (1.7)
Iran, Islamic Rep. of	39 (4.3)	55 (4.3)	6 (1.9)	26 (3.9)	56 (4.1)	18 (3.2)
Israel	51 (3.5)	42 (3.6)	8 (2.0)	44 (4.0)	46 (3.9)	10 (1.9)
Italy	33 (3.4)	46 (3.8)	21 (2.9)	23 (3.1)	44 (3.3)	33 (3.4)
Japan	34 (3.9)	42 (4.4)	24 (3.9)	19 (3.3)	37 (3.8)	44 (4.4)
Jordan	52 (4.3)	38 (4.1)	10 (2.5)	33 (4.1)	47 (5.1)	20 (3.9)
Korea, Rep. of	s 18 (2.4)	49 (3.3)	34 (3.4)	s 35 (3.2)	47 (3.2)	18 (2.5)
Latvia	47 (4.4)	45 (4.3)	8 (2.9)	32 (4.4)	55 (4.8)	13 (3.1)
Lebanon	40 (4.0)	46 (4.6)	14 (3.3)	38 (4.6)	32 (4.1)	30 (4.2)
Lithuania	41 (4.0)	46 (3.8)	13 (2.8)	36 (3.9)	50 (4.1)	14 (2.9)
Macedonia, Rep. of	56 (3.9)	35 (3.9)	8 (2.2)	47 (4.3)	42 (4.4)	11 (2.7)
Malaysia	58 (4.2)	39 (4.4)	2 (1.2)	25 (3.5)	59 (4.0)	17 (3.0)
Moldova, Rep. of	r 49 (5.1)	38 (4.9)	13 (3.1)	r 58 (5.0)	25 (4.0)	17 (3.5)
Morocco	s 25 (5.3)	35 (6.6)	40 (7.2)	x x	x x	x x
Netherlands	25 (3.9)	55 (4.6)	21 (3.4)	9 (2.8)	50 (4.7)	42 (4.6)
New Zealand	57 (5.1)	32 (4.6)	11 (2.9)	38 (4.7)	41 (4.9)	21 (3.5)
Norway	54 (4.3)	37 (4.0)	9 (2.1)	36 (4.5)	48 (4.5)	15 (3.0)
Palestinian Nat'l Auth.	70 (3.8)	26 (4.0)	4 (1.7)	50 (4.6)	42 (4.7)	8 (2.2)
Philippines	63 (4.2)	34 (4.1)	3 (1.5)	64 (4.3)	27 (4.2)	9 (2.3)
Romania	64 (4.1)	32 (3.9)	4 (1.6)	63 (4.2)	30 (4.3)	7 (2.2)
Russian Federation	59 (3.9)	37 (3.7)	4 (1.5)	45 (3.8)	45 (4.0)	9 (2.2)
Saudi Arabia	57 (5.9)	30 (4.2)	13 (4.8)	42 (5.4)	43 (4.4)	16 (4.7)
Scotland	40 (4.4)	44 (4.7)	17 (3.5)	28 (4.2)	56 (4.3)	16 (3.4)
Serbia	60 (4.0)	32 (3.9)	8 (2.3)	44 (3.9)	43 (3.6)	12 (2.9)
Singapore	42 (2.6)	46 (2.8)	12 (2.0)	43 (2.4)	36 (2.4)	21 (2.0)
Slovak Republic	54 (4.7)	45 (4.6)	1 (0.7)	43 (4.1)	45 (4.5)	12 (2.9)
Slovenia	47 (4.0)	38 (3.8)	15 (3.0)	29 (4.0)	37 (3.9)	34 (4.1)
South Africa	56 (3.6)	36 (3.5)	8 (2.3)	61 (3.5)	28 (3.4)	11 (2.5)
Sweden	60 (3.5)	34 (3.4)	6 (1.6)	50 (3.6)	33 (3.4)	18 (3.0)
Tunisia	55 (4.2)	29 (3.6)	16 (2.8)	29 (4.1)	39 (4.5)	32 (4.0)
United States	39 (2.9)	42 (2.8)	18 (2.2)	43 (3.0)	30 (3.1)	27 (2.8)
‡ England	r 32 (5.4)	56 (6.0)	11 (3.3)	r 40 (6.1)	43 (6.0)	17 (4.0)
International Avg.	50 (0.6)	39 (0.6)	11 (0.4)	42 (0.6)	39 (0.6)	19 (0.5)
Benchmarking Participants						
Basque Country, Spain	56 (5.1)	26 (4.2)	18 (3.6)	51 (5.0)	32 (4.7)	17 (3.8)
Indiana State, US	34 (5.0)	45 (6.3)	21 (5.4)	36 (5.3)	37 (5.6)	27 (5.2)
Ontario Province, Can.	44 (5.3)	38 (4.6)	18 (3.7)	37 (5.0)	40 (4.8)	23 (3.9)
Quebec Province, Can.	50 (5.2)	28 (4.1)	23 (4.0)	43 (4.9)	36 (5.3)	22 (4.1)

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: Types of Interactions Among Mathematics Teachers

MATHEMATICS Grade 8

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	22 (3.0)	67 (3.4)	12 (2.2)	11 (2.8)	63 (4.1)	26 (3.3)
Australia	2 (1.0)	13 (2.7)	85 (2.8)	5 (2.0)	16 (3.0)	80 (3.5)
Bahrain	2 (1.1)	46 (2.7)	52 (2.9)	6 (2.1)	34 (3.1)	60 (3.2)
Belgium (Flemish)	0 (0.0)	1 (0.8)	99 (0.8)	5 (1.9)	2 (0.9)	93 (2.2)
Botswana	7 (2.3)	51 (5.0)	42 (4.9)	9 (2.6)	49 (4.7)	42 (4.7)
Bulgaria	3 (1.4)	18 (3.4)	79 (3.7)	1 (0.8)	16 (3.1)	83 (3.3)
Chile	6 (2.1)	7 (2.0)	87 (2.2)	13 (2.5)	15 (3.0)	72 (3.4)
Chinese Taipei	3 (1.4)	27 (3.7)	70 (3.8)	1 (0.0)	8 (2.5)	91 (2.6)
Cyprus	6 (1.8)	17 (1.9)	77 (2.3)	25 (2.8)	21 (2.8)	54 (2.8)
Egypt	37 (3.7)	40 (4.1)	22 (3.4)	9 (2.4)	32 (3.9)	59 (4.4)
Estonia	8 (1.9)	29 (3.6)	64 (3.8)	7 (1.8)	28 (3.1)	65 (3.4)
Ghana	30 (3.9)	41 (4.4)	30 (4.3)	34 (4.2)	43 (4.3)	23 (3.7)
Hong Kong, SAR	1 (1.0)	22 (4.1)	76 (4.2)	1 (1.0)	14 (3.3)	84 (3.4)
Hungary	3 (1.5)	42 (4.1)	55 (4.3)	1 (1.0)	23 (3.3)	76 (3.3)
Indonesia	35 (4.2)	17 (3.4)	48 (4.1)	23 (3.4)	18 (3.4)	59 (4.6)
Iran, Islamic Rep. of	2 (1.2)	14 (2.9)	84 (3.0)	2 (1.1)	22 (3.1)	75 (3.4)
Israel	1 (0.6)	12 (2.8)	87 (2.9)	3 (1.4)	15 (2.8)	82 (3.0)
Italy	2 (1.0)	3 (1.6)	95 (1.9)	11 (2.5)	15 (2.9)	75 (3.1)
Japan	9 (2.4)	18 (3.0)	74 (3.7)	8 (2.3)	14 (3.0)	78 (3.7)
Jordan	10 (3.0)	52 (4.7)	38 (3.8)	8 (2.7)	33 (4.2)	59 (4.5)
Korea, Rep. of	s 2 (1.1)	11 (2.5)	87 (2.7)	s 2 (1.2)	9 (2.0)	89 (2.3)
Latvia	6 (2.0)	41 (3.7)	54 (3.4)	6 (2.2)	26 (4.2)	68 (4.5)
Lebanon	8 (2.5)	25 (3.8)	67 (3.7)	12 (2.5)	39 (4.6)	50 (4.7)
Lithuania	3 (1.3)	34 (3.9)	63 (3.9)	3 (1.5)	33 (3.7)	64 (3.9)
Macedonia, Rep. of	8 (2.5)	40 (3.9)	52 (4.2)	5 (2.0)	44 (4.0)	51 (4.1)
Malaysia	8 (2.4)	32 (4.0)	60 (4.0)	7 (2.1)	43 (4.1)	50 (4.4)
Moldova, Rep. of	r 20 (3.6)	56 (4.8)	24 (4.5)	r 16 (3.8)	47 (5.0)	38 (4.7)
Morocco	s 0 (0.0)	11 (4.6)	89 (4.6)	x x	x x	x x
Netherlands	2 (1.1)	11 (3.2)	87 (3.3)	3 (1.4)	11 (3.2)	87 (3.4)
New Zealand	2 (1.0)	22 (2.8)	75 (3.1)	7 (2.2)	41 (5.2)	52 (4.7)
Norway	10 (2.6)	13 (2.4)	77 (3.4)	20 (3.3)	17 (2.9)	63 (4.0)
Palestinian Nat'l Auth.	2 (1.4)	51 (4.1)	47 (4.2)	3 (1.3)	35 (4.0)	62 (4.1)
Philippines	6 (2.2)	27 (4.2)	67 (4.5)	13 (3.0)	54 (4.4)	34 (4.2)
Romania	10 (2.5)	60 (4.1)	30 (3.6)	30 (3.9)	45 (4.3)	25 (3.6)
Russian Federation	12 (2.7)	69 (3.6)	19 (2.6)	6 (1.7)	59 (3.4)	35 (3.3)
Saudi Arabia	2 (1.3)	51 (4.8)	47 (4.6)	4 (1.9)	17 (3.3)	80 (3.6)
Scotland	9 (3.0)	14 (3.1)	77 (4.1)	9 (2.7)	24 (4.4)	67 (4.8)
Serbia	15 (3.0)	20 (3.4)	66 (3.9)	15 (3.1)	24 (3.4)	61 (3.7)
Singapore	3 (0.8)	14 (1.8)	83 (2.0)	3 (1.0)	27 (2.6)	70 (2.6)
Slovak Republic	1 (0.8)	23 (2.9)	76 (2.9)	1 (0.6)	27 (3.6)	72 (3.7)
Slovenia	0 (0.0)	6 (2.1)	94 (2.1)	2 (1.4)	7 (2.3)	91 (2.7)
South Africa	7 (1.9)	36 (3.5)	57 (3.5)	13 (2.4)	40 (3.3)	47 (3.4)
Sweden	4 (1.2)	7 (1.5)	89 (1.8)	5 (1.2)	12 (2.7)	83 (2.7)
Tunisia	1 (1.0)	8 (2.3)	91 (2.5)	1 (1.1)	7 (1.9)	92 (2.2)
United States	4 (1.2)	11 (2.0)	85 (2.3)	4 (1.2)	17 (2.5)	79 (2.5)
‡ England	s 5 (2.4)	25 (5.0)	71 (5.7)	s 3 (1.5)	35 (5.7)	63 (5.9)
International Avg.	7 (0.3)	27 (0.5)	65 (0.5)	8 (0.3)	27 (0.5)	65 (0.6)
Benchmarking Participants						
Basque Country, Spain	3 (1.9)	8 (3.0)	89 (3.5)	6 (2.5)	6 (2.4)	88 (3.5)
Indiana State, US	2 (2.1)	4 (1.9)	94 (2.8)	2 (2.1)	11 (3.9)	87 (4.4)
Ontario Province, Can.	4 (1.9)	20 (4.1)	76 (4.5)	5 (2.4)	18 (3.7)	77 (4.3)
Quebec Province, Can.	2 (1.3)	1 (0.3)	97 (1.3)	0 (0.0)	4 (2.1)	96 (2.1)

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: Types of Interactions Among Mathematics Teachers

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		47 (3.6)	48 (3.7)	5 (1.3)	r	30 (4.1)	55 (4.3)	15 (2.1)
Australia		51 (4.2)	37 (4.8)	12 (2.7)		54 (4.6)	31 (4.9)	15 (2.9)
Belgium (Flemish)		52 (3.5)	40 (3.5)	9 (2.0)		41 (3.8)	37 (3.6)	23 (2.6)
Chinese Taipei		54 (4.1)	44 (4.2)	2 (1.2)		24 (3.4)	52 (4.5)	25 (3.7)
Cyprus		59 (3.9)	36 (3.7)	5 (1.7)		59 (3.6)	32 (3.2)	9 (2.0)
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)	49 (4.5)	9 (2.3)		17 (3.4)	60 (4.8)	24 (4.1)
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		52 (4.3)	37 (4.3)	11 (2.6)		41 (4.0)	45 (4.3)	14 (2.5)
Latvia		43 (4.1)	45 (4.5)	13 (2.8)		36 (3.9)	56 (4.0)	9 (2.4)
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	31 (4.6)	29 (4.5)	40 (5.1)	s	12 (3.1)	18 (4.2)	70 (5.0)
Netherlands		42 (4.7)	42 (4.7)	16 (3.2)		25 (4.4)	44 (4.7)	32 (4.4)
New Zealand		65 (3.5)	30 (3.1)	5 (1.5)		57 (3.6)	31 (3.4)	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		42 (4.6)	49 (4.7)	9 (2.2)		35 (4.2)	52 (4.2)	13 (2.8)
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		62 (2.6)	29 (2.3)	9 (1.7)		59 (2.7)	29 (2.7)	11 (1.7)
International Avg.		53 (0.8)	37 (0.8)	10 (0.5)		46 (0.8)	37 (0.8)	17 (0.6)
Benchmarking Participants								
Indiana State, US		59 (5.2)	33 (4.9)	8 (2.9)		48 (4.8)	38 (4.6)	15 (3.0)
Ontario Province, Can.		46 (4.8)	46 (4.7)	9 (2.7)		47 (5.2)	33 (4.7)	20 (3.7)
Quebec Province, Can.		52 (5.0)	34 (4.4)	14 (3.2)		46 (4.5)	33 (4.3)	22 (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 6.8: Types of Interactions Among Mathematics Teachers

MATHEMATICS Grade 4

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 19 (3.6)	69 (3.7)	11 (2.2)	r 8 (2.1)	65 (3.8)	27 (3.4)
Australia	9 (2.3)	23 (4.0)	68 (4.3)	18 (3.6)	22 (3.5)	60 (4.3)
Belgium (Flemish)	1 (0.5)	5 (1.4)	94 (1.5)	5 (1.6)	12 (2.5)	83 (2.9)
Chinese Taipei	6 (1.9)	57 (4.4)	37 (4.0)	7 (1.8)	26 (3.8)	67 (4.0)
Cyprus	7 (2.1)	33 (3.4)	60 (3.5)	30 (3.8)	42 (3.9)	27 (3.2)
England	r 2 (1.5)	31 (4.2)	66 (4.4)	r 3 (1.6)	39 (4.9)	58 (4.8)
Hong Kong, SAR	3 (1.6)	35 (4.8)	62 (5.0)	3 (1.6)	15 (3.3)	81 (3.6)
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 (1.4)	45 (3.9)	51 (3.7)	10 (2.5)	21 (3.4)	69 (3.8)
Latvia	4 (1.5)	90 (2.3)	6 (1.9)	9 (1.9)	75 (3.1)	16 (2.6)
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 (2.8)	12 (3.9)	83 (4.7)	s 5 (3.0)	12 (4.3)	83 (4.8)
Netherlands	1 (0.9)	8 (2.8)	92 (3.0)	1 (0.9)	11 (3.2)	88 (3.3)
New Zealand	4 (1.5)	31 (3.1)	65 (3.1)	11 (2.1)	38 (2.7)	51 (2.9)
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 (0.0)	8 (1.8)	92 (1.8)	1 (0.0)	15 (2.8)	84 (2.7)
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	4 (1.1)	16 (1.7)	80 (2.1)	4 (1.1)	17 (1.9)	78 (2.2)
International Avg.	7 (0.4)	34 (0.7)	59 (0.7)	9 (0.5)	31 (0.7)	60 (0.7)
Benchmarking Participants						
Indiana State, US	3 (1.6)	8 (2.4)	90 (2.5)	6 (1.9)	7 (2.1)	87 (3.0)
Ontario Province, Can.	6 (2.4)	12 (2.9)	82 (3.8)	8 (2.6)	14 (3.4)	78 (4.2)
Quebec Province, Can.	3 (1.5)	9 (2.9)	88 (3.2)	5 (2.1)	13 (3.1)	82 (3.3)

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.

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.

More than 80 percent of the students were taught mathematics by teachers having a least some professional development training in these areas.

Exhibit 6.7 presents teachers' reports about their professional development participation in six different aspects of mathematics teaching. The results were relatively consistent across the six topics – content, pedagogy, curriculum, technology, problem solving, and assessment. At the eighth grade, from 43 to 57 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 percentages, 57 percent in both cases, were for the areas of content and pedagogy. At the fourth grade, on average, the percentages were somewhat lower, ranging from 33 to 47 percent. The highest percentages were for content (46%), pedagogy (47%), and problem solving (46%). The lowest percentage was for integrating information technology into mathematics (33%).

Because opportunities for professional development do not necessarily have to be structured by the school, teachers also were asked 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 6.8, 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 (65% never).

How Ready Do Teachers Think They Are to Teach Mathematics?

TIMSS 2003 asked teachers how ready they felt to teach the mathematics topics included in the TIMSS 2003 mathematics framework. Across the five major content areas (number, algebra, measurement,

geometry, and data), the eighth-grade teachers were asked about 18 topics (sub-areas). Exhibit 6.9 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 84 to 98 percent, with the results above 90 percent for all but three of the data topics (sources of error, data collection methods, and simple probability). At the fourth grade, the results were very similar. Teachers were asked about 16 topics, with the results ranging from 83 to 100 percent, on average, internationally. The results dipped below 90 percent for only two geometry topics, relationships between two- and three-dimensional shapes (88%) and translation, reflection, and rotation (83%).

At the eighth grade, essentially all students in all countries were taught the number topics by teachers who felt ready to teach the topics. Teachers' reports for the algebra topics were similar, falling substantially below 90 percent of the students only in Tunisia (71 to 74%). In the measurement area, percentages ranged between 55 to 89 percent for at least one topic in a number of countries, including Belgium (Flemish), Botswana, Ghana, Iran, Japan, Moldova, the Philippines, Saudi Arabia, South Africa, and Tunisia. For geometry, readiness reports were uniformly above 90 percent with only few exceptions for particular topics in Chile, Hungary, Moldova, Saudi Arabia, Serbia, and Tunisia. Across the topics, the least amount of readiness was reported for the data topics. For almost all of the countries, for one or more of the data topics, fewer than 90 percent of the students were taught by teachers who felt ready to teach the topic.

At the fourth grade, in general, almost all the students (at least 90%) in all the participating entities (except Tunisia) were taught by teachers who felt ready to teach the topics in number, algebra, measurement, and data. Teachers in several countries felt less ready to teach one more of the geometry topics, including Belgium (Flemish), Hungary, Iran, Japan, the Netherlands, Norway, the Philippines, Singapore, Slovenia, and Tunisia.

Exhibit 6.9: Readiness to Teach Mathematics

Countries	Percentage of Students Whose Teachers Report Feeling They Are Ready to Teach Mathematics Topics					
	Number		Algebra			
	Representing Decimals and Fractions Using Words, Numbers, and Number Lines	Integers, Including Words, Numbers, and Number Lines; Ordering Integers; and Operations (+, –, X, ÷) with Integers	Numeric, Algebraic, and Geometric Patterns or Sequences	Simple Linear Equations and Inequalities, and Simultaneous (Two Variable) Equations	Equivalent Representations of Functions as Ordered Pairs, Tables, Graphs, Words, or Equations	Attributes of a Graph, Such as Intercepts on Axes, and Intervals
Armenia	99 (0.8)	99 (0.7)	r 99 (0.7)	r 100 (0.3)	100 (0.3)	98 (1.1)
Australia	100 (0.0)	100 (0.0)	100 (0.0)	99 (0.7)	99 (0.7)	98 (1.3)
Bahrain	99 (0.5)	99 (0.5)	94 (2.1)	98 (1.3)	97 (1.3)	94 (2.1)
Belgium (Flemish)	100 (0.4)	99 (0.8)	92 (1.8)	93 (2.3)	95 (1.6)	93 (2.0)
Botswana	r 97 (1.5)	r 98 (1.5)	r 98 (1.2)	r 98 (1.3)	r 95 (2.0)	r 90 (2.8)
Bulgaria	100 (0.0)	100 (0.0)	99 (0.7)	100 (0.0)	100 (0.0)	100 (0.0)
Chile	100 (0.0)	99 (0.8)	95 (1.4)	94 (1.5)	96 (1.5)	90 (2.1)
Chinese Taipei	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	99 (0.6)
Cyprus	98 (0.0)	98 (0.0)	r 98 (0.6)	100 (0.0)	98 (0.0)	97 (0.7)
Egypt	99 (0.8)	100 (0.0)	96 (1.9)	100 (0.0)	100 (0.0)	100 (0.0)
Estonia	100 (0.4)	100 (0.4)	100 (0.0)	100 (0.4)	100 (0.4)	100 (0.4)
Ghana	98 (1.1)	99 (0.9)	97 (1.6)	100 (0.0)	100 (0.5)	94 (2.2)
Hong Kong, SAR	100 (0.0)	100 (0.0)	99 (0.8)	100 (0.0)	99 (0.8)	98 (1.3)
Hungary	100 (0.4)	100 (0.4)	99 (0.5)	100 (0.4)	100 (0.4)	100 (0.4)
Indonesia	s 99 (1.1)	s 100 (0.0)	s 98 (1.5)	s 100 (0.0)	s 100 (0.0)	s 93 (2.9)
Iran, Islamic Rep. of	99 (0.8)	98 (1.0)	90 (2.5)	98 (1.2)	94 (2.2)	87 (2.7)
Israel	99 (0.7)	99 (0.7)	99 (0.9)	99 (0.8)	98 (0.9)	98 (0.9)
Italy	100 (0.0)	100 (0.0)	92 (1.9)	99 (0.7)	98 (0.9)	95 (1.4)
Japan	95 (1.6)	99 (0.7)	93 (2.3)	99 (0.7)	95 (2.0)	97 (1.6)
Jordan	99 (0.7)	98 (1.2)	99 (0.6)	99 (0.8)	97 (1.4)	96 (1.8)
Korea, Rep. of	s 99 (0.5)	s 98 (1.0)	s 93 (2.0)	s 99 (0.4)	s 99 (0.7)	s 98 (1.0)
Latvia	s 100 (0.0)	s 100 (0.0)	s 100 (0.0)	s 100 (0.0)	s 97 (1.5)	s 99 (1.0)
Lebanon	98 (1.4)	100 (0.0)	93 (2.6)	96 (1.8)	95 (2.0)	95 (1.6)
Lithuania	100 (0.0)	100 (0.0)	98 (1.4)	100 (0.0)	100 (0.0)	100 (0.0)
Macedonia, Rep. of	99 (0.7)	99 (1.0)	100 (0.5)	99 (0.7)	99 (1.0)	98 (1.3)
Malaysia	100 (0.0)	100 (0.0)	100 (0.0)	99 (0.7)	97 (1.3)	90 (2.6)
Moldova, Rep. of	r 91 (2.8)	r 91 (2.6)	r 94 (2.1)	r 91 (2.5)	r 89 (3.1)	r 92 (2.6)
Morocco	x x	x x	x x	x x	x x	x x
Netherlands	99 (0.6)	100 (0.0)	96 (1.6)	99 (0.8)	99 (0.6)	100 (0.0)
New Zealand	100 (0.2)	98 (2.2)	100 (0.2)	98 (1.2)	99 (0.6)	100 (0.2)
Norway	100 (0.0)	100 (0.0)	97 (1.8)	97 (1.7)	98 (1.4)	98 (1.5)
Palestinian Nat'l Auth.	100 (0.0)	100 (0.0)	99 (0.8)	100 (0.0)	100 (0.0)	99 (0.9)
Philippines	100 (0.0)	100 (0.0)	97 (1.5)	100 (0.0)	100 (0.0)	99 (1.0)
Romania	100 (0.0)	100 (0.0)	97 (1.4)	100 (0.0)	100 (0.0)	100 (0.0)
Russian Federation	– –	– –	– –	– –	– –	– –
Saudi Arabia	r 96 (1.8)	r 100 (0.0)	r 86 (5.9)	r 95 (2.4)	r 94 (5.3)	r 80 (6.1)
Scotland	100 (0.0)	100 (0.0)	100 (0.0)	95 (2.2)	98 (1.1)	96 (1.8)
Serbia	91 (2.8)	90 (2.9)	93 (2.4)	90 (2.5)	90 (2.5)	90 (2.5)
Singapore	r 99 (0.4)	r 100 (0.4)	r 95 (1.3)	r 99 (0.6)	r 98 (0.8)	r 97 (1.0)
Slovak Republic	100 (0.0)	100 (0.3)	100 (0.0)	100 (0.0)	99 (0.9)	98 (1.2)
Slovenia	100 (0.0)	100 (0.0)	99 (0.8)	100 (0.0)	100 (0.0)	100 (0.0)
South Africa	r 99 (0.9)	r 100 (0.0)	r 99 (0.7)	r 98 (1.0)	r 95 (1.8)	r 91 (2.3)
Sweden	100 (0.2)	100 (0.2)	98 (1.1)	99 (0.8)	98 (0.9)	96 (1.2)
Tunisia	r 99 (1.1)	r 98 (1.3)	r 87 (2.9)	r 71 (4.5)	r 74 (3.9)	r 71 (4.1)
United States	100 (0.0)	100 (0.0)	99 (0.6)	100 (0.2)	99 (0.4)	98 (0.9)
‡ England	– –	– –	– –	– –	– –	– –
International Avg.	99 (0.1)	99 (0.1)	97 (0.3)	98 (0.2)	97 (0.2)	95 (0.3)
Benchmarking Participants						
Basque Country, Spain	99 (0.8)	99 (0.8)	98 (1.6)	99 (0.8)	99 (0.6)	96 (1.2)
Indiana State, US	r 100 (0.0)	r 100 (0.0)	r 100 (0.0)	r 100 (0.0)	r 100 (0.0)	r 100 (0.0)
Ontario Province, Can.	100 (0.0)	98 (1.3)	98 (1.5)	97 (1.7)	99 (0.8)	96 (2.0)
Quebec Province, Can.	100 (0.0)	100 (0.0)	99 (0.9)	90 (3.2)	99 (0.9)	93 (2.6)

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 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 6.9: Readiness to Teach Mathematics *(Continued...)*

Countries	Percentage of Students Whose Teachers Report Feeling They Are Ready to Teach Mathematics Topics							
	Measurement				Geometry			
	Estimations of Length, Circumference, Area, Volume, Weight, Time, Angle, and Speed	Computations with Measurements in Problem Situations	Measurements of Irregular or Compound Areas	Precision of Measurements	Pythagorean Theorem (Not Proof) to Find Length of a Side	Congruent Figures (Triangles, Quadrilaterals) and Their Corresponding Measures	Cartesian Plane (Ordered Pairs, Equations, Intercepts, Intersections, and Gradient	Translation, Reflection, Rotation, and Enlargement
Armenia	r 99 (0.7)	r 100 (0.0)	r 98 (1.3)	r 99 (0.1)	100 (0.3)	r 99 (0.5)	r 99 (0.8)	r 98 (1.0)
Australia	100 (0.0)	99 (1.2)	97 (0.7)	97 (1.5)	100 (0.0)	100 (0.0)	99 (0.8)	98 (1.1)
Bahrain	96 (2.0)	95 (1.3)	94 (2.3)	93 (1.9)	99 (0.5)	98 (0.5)	x x	96 (1.7)
Belgium (Flemish)	94 (1.6)	98 (1.0)	83 (2.8)	91 (2.4)	98 (0.8)	98 (1.0)	90 (2.2)	98 (0.9)
Botswana	r 99 (1.0)	r 98 (1.3)	r 89 (3.1)	r 84 (3.7)	r 97 (1.9)	r 97 (1.7)	r 95 (2.2)	r 96 (2.1)
Bulgaria	99 (0.6)	99 (0.6)	98 (0.9)	97 (1.4)	98 (1.1)	100 (0.0)	100 (0.0)	100 (0.0)
Chile	99 (0.9)	98 (1.1)	91 (2.6)	93 (2.1)	98 (1.1)	100 (0.0)	96 (1.6)	76 (3.0)
Chinese Taipei	98 (1.1)	99 (0.9)	99 (0.6)	100 (0.0)	100 (0.0)	100 (0.0)	98 (0.9)	96 (1.6)
Cyprus	100 (0.0)	98 (0.0)	95 (1.4)	96 (1.1)	100 (0.0)	100 (0.0)	100 (0.0)	90 (1.7)
Egypt	97 (1.5)	94 (2.4)	93 (2.1)	94 (2.2)	100 (0.0)	100 (0.0)	x x	r 99 (0.9)
Estonia	100 (0.4)	100 (0.4)	100 (0.4)	99 (0.8)	99 (0.6)	100 (0.4)	100 (0.4)	99 (0.7)
Ghana	97 (1.3)	89 (3.4)	79 (4.3)	r 94 (2.3)	96 (2.1)	97 (1.6)	r 94 (2.6)	94 (2.4)
Hong Kong, SAR	100 (0.1)	100 (0.0)	99 (0.9)	99 (1.1)	100 (0.0)	100 (0.0)	100 (0.0)	96 (1.8)
Hungary	99 (0.5)	100 (0.4)	99 (0.8)	100 (0.4)	100 (0.4)	100 (0.4)	86 (3.1)	100 (0.4)
Indonesia	s 99 (0.9)	s 99 (1.0)	s 96 (1.9)	s 96 (1.9)	s 95 (1.8)	s 97 (1.9)	s 100 (0.0)	s 87 (3.7)
Iran, Islamic Rep. of	97 (1.4)	93 (2.2)	87 (3.1)	82 (3.4)	99 (0.8)	99 (0.7)	98 (0.4)	98 (1.3)
Israel	98 (1.6)	99 (0.8)	95 (2.1)	93 (2.3)	99 (0.8)	99 (0.8)	98 (1.0)	94 (1.7)
Italy	99 (0.6)	100 (0.0)	96 (1.5)	92 (2.1)	99 (0.6)	100 (0.5)	98 (0.9)	91 (2.0)
Japan	94 (2.0)	82 (3.1)	81 (3.4)	74 (3.7)	87 (2.7)	100 (0.0)	97 (1.5)	95 (1.7)
Jordan	99 (0.6)	97 (1.6)	94 (2.1)	97 (1.5)	99 (0.7)	98 (1.3)	96 (1.6)	90 (2.7)
Korea, Rep. of	s 95 (1.2)	s 96 (1.4)	s 91 (2.5)	s 96 (1.5)	s 96 (1.7)	s 98 (1.1)	s 99 (0.8)	s 96 (1.2)
Latvia	s 96 (2.0)	s 99 (0.7)	s 95 (2.2)	s 93 (2.8)	s 100 (0.0)	s 100 (0.0)	s 91 (3.6)	s 92 (2.7)
Lebanon	98 (1.3)	94 (2.7)	r 92 (2.3)	r 98 (1.4)	98 (1.3)	99 (1.2)	98 (1.3)	96 (1.8)
Lithuania	100 (0.4)	100 (0.0)	99 (1.0)	99 (0.9)	100 (0.0)	100 (0.0)	100 (0.0)	98 (1.2)
Macedonia, Rep. of	98 (1.1)	98 (1.1)	95 (1.9)	96 (1.7)	99 (0.7)	99 (0.7)	100 (0.0)	98 (1.3)
Malaysia	100 (0.0)	95 (1.7)	91 (2.4)	93 (2.1)	100 (0.0)	99 (0.6)	98 (1.2)	98 (1.2)
Moldova, Rep. of	r 91 (2.8)	r 92 (2.5)	r 89 (2.9)	r 85 (3.2)	r 87 (3.2)	r 89 (3.0)	r 91 (2.6)	r 91 (2.7)
Morocco	x x	x x	x x	x x	x x	x x	x x	x x
Netherlands	99 (0.7)	99 (0.7)	98 (1.1)	99 (0.6)	100 (0.0)	100 (0.0)	95 (2.0)	99 (1.0)
New Zealand	100 (0.2)	97 (2.3)	96 (2.4)	99 (0.6)	97 (1.3)	99 (0.6)	99 (0.6)	97 (2.3)
Norway	99 (1.4)	100 (0.0)	98 (1.5)	97 (1.7)	98 (1.6)	98 (1.4)	100 (0.0)	99 (1.4)
Palestinian Nat'l Auth.	99 (0.7)	98 (1.2)	96 (1.9)	99 (0.7)	100 (0.0)	100 (0.0)	99 (0.9)	92 (2.6)
Philippines	93 (1.9)	92 (2.3)	79 (3.4)	90 (2.8)	93 (2.3)	93 (2.4)	96 (1.6)	76 (3.7)
Romania	99 (0.9)	99 (1.0)	97 (1.4)	99 (0.8)	100 (0.0)	100 (0.0)	100 (0.0)	95 (1.9)
Russian Federation	— —	— —	— —	— —	— —	— —	— —	— —
Saudi Arabia	r 85 (5.8)	r 69 (6.4)	r 73 (6.0)	r 79 (6.3)	r 76 (6.6)	r 99 (1.0)	r 88 (5.6)	r 92 (2.7)
Scotland	100 (0.0)	100 (0.0)	100 (0.0)	99 (1.0)	99 (1.0)	99 (1.1)	94 (2.4)	96 (2.1)
Serbia	90 (2.9)	91 (2.7)	91 (2.7)	92 (2.4)	89 (2.7)	90 (2.5)	90 (2.9)	91 (2.8)
Singapore	r 100 (0.4)	r 99 (0.6)	r 93 (1.6)	r 97 (1.2)	r 100 (0.4)	r 97 (1.0)	r 98 (0.9)	r 97 (1.1)
Slovak Republic	100 (0.3)	99 (1.2)	99 (0.4)	97 (1.3)	100 (0.0)	100 (0.3)	98 (1.1)	98 (1.0)
Slovenia	99 (0.8)	99 (0.8)	95 (2.0)	97 (1.5)	100 (0.0)	100 (0.0)	99 (0.7)	99 (0.9)
South Africa	r 93 (1.8)	r 88 (2.7)	r 79 (3.1)	r 88 (2.8)	r 95 (1.7)	r 98 (0.9)	r 92 (1.9)	r 81 (3.1)
Sweden	100 (0.2)	100 (0.2)	99 (0.5)	98 (0.9)	98 (0.9)	98 (0.9)	98 (0.8)	93 (1.7)
Tunisia	r 84 (3.5)	r 68 (4.3)	r 66 (4.4)	r 55 (5.0)	r 47 (5.1)	r 91 (2.4)	r 61 (4.8)	r 40 (4.5)
United States	99 (0.6)	100 (0.0)	97 (0.9)	97 (1.1)	98 (0.8)	99 (0.7)	98 (1.0)	97 (1.1)
‡ England	— —	— —	— —	— —	— —	— —	— —	— —
International Avg.	97 (0.2)	96 (0.3)	92 (0.4)	93 (0.3)	96 (0.3)	98 (0.2)	96 (0.3)	93 (0.3)
Benchmarking Participants								
Basque Country, Spain	99 (0.8)	99 (0.8)	96 (2.0)	93 (2.5)	99 (0.8)	99 (0.8)	97 (1.9)	90 (3.2)
Indiana State, US	r 98 (0.2)	r 100 (0.0)	r 97 (2.3)	r 95 (2.3)	r 99 (0.0)	r 100 (0.0)	r 99 (0.6)	r 99 (0.6)
Ontario Province, Can.	100 (0.0)	100 (0.1)	93 (2.7)	95 (2.0)	100 (0.1)	100 (0.1)	91 (2.9)	98 (1.2)
Quebec Province, Can.	99 (0.9)	99 (0.5)	99 (0.9)	91 (2.9)	94 (2.8)	98 (1.2)	96 (2.1)	100 (0.4)

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.

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

Exhibit 6.9: Readiness to Teach Mathematics *(...Continued)*

Countries	Percentage of Students Whose Teachers Report Feeling They Are Ready to Teach Mathematics Topics			
	Data			
	Sources of Error in Collecting and Organizing Data	Data Collection Methods (e.g., Survey, Experiment, Questionnaire)	Characteristics of Data (Mean, Median, Range, and Shape of Distribution)	Simple Probability
Armenia	s 92 (2.8)	r 96 (1.8)	r 90 (2.8)	r 86 (3.2)
Australia	95 (1.4)	99 (0.8)	99 (0.6)	98 (0.9)
Bahrain	76 (2.8)	83 (2.9)	90 (2.5)	83 (2.8)
Belgium (Flemish)	73 (3.7)	68 (3.5)	90 (2.2)	69 (3.5)
Botswana	r 84 (3.5)	r 90 (3.0)	r 100 (0.5)	r 87 (3.3)
Bulgaria	73 (4.1)	80 (3.5)	73 (3.8)	80 (3.9)
Chile	80 (3.2)	96 (1.6)	97 (1.3)	85 (2.9)
Chinese Taipei	97 (1.3)	100 (0.0)	100 (0.0)	100 (0.4)
Cyprus	88 (1.9)	92 (1.1)	96 (1.1)	94 (1.1)
Egypt	62 (4.2)	65 (4.1)	95 (2.2)	94 (1.7)
Estonia	97 (1.5)	r 100 (0.5)	98 (1.1)	100 (0.5)
Ghana	90 (3.2)	93 (2.8)	98 (1.3)	93 (3.1)
Hong Kong, SAR	96 (1.8)	98 (1.2)	98 (1.4)	96 (1.8)
Hungary	77 (3.3)	76 (3.2)	85 (2.5)	91 (2.5)
Indonesia	s 86 (3.7)	s 93 (2.6)	s 100 (0.0)	s 96 (1.7)
Iran, Islamic Rep. of	80 (3.7)	83 (3.2)	87 (2.9)	80 (3.5)
Israel	91 (2.3)	96 (1.7)	99 (0.9)	98 (0.8)
Italy	72 (3.3)	97 (1.2)	96 (1.3)	95 (1.5)
Japan	74 (3.6)	76 (3.3)	82 (2.9)	91 (2.4)
Jordan	75 (3.9)	73 (3.9)	88 (3.0)	88 (3.1)
Korea, Rep. of	s 89 (1.9)	s 88 (2.3)	s 96 (1.7)	s 97 (1.4)
Latvia	s 71 (5.4)	s 83 (4.6)	s 78 (5.2)	s 89 (3.9)
Lebanon	r 83 (3.9)	r 88 (3.3)	87 (3.0)	79 (3.8)
Lithuania	95 (1.6)	98 (1.3)	97 (1.3)	96 (1.6)
Macedonia, Rep. of	95 (1.8)	96 (1.7)	97 (1.4)	94 (1.9)
Malaysia	83 (3.1)	92 (2.2)	94 (2.1)	79 (3.3)
Moldova, Rep. of	r 88 (3.0)	r 89 (3.1)	r 87 (3.0)	r 88 (3.2)
Morocco	x x	x x	x x	x x
Netherlands	81 (3.9)	90 (2.6)	100 (0.0)	97 (1.5)
New Zealand	99 (0.6)	100 (0.2)	100 (0.2)	97 (2.4)
Norway	96 (1.9)	96 (1.6)	98 (1.2)	95 (1.9)
Palestinian Nat'l Auth.	82 (3.6)	84 (3.4)	98 (1.2)	99 (0.9)
Philippines	79 (3.9)	80 (4.0)	90 (2.9)	78 (3.9)
Romania	90 (2.6)	95 (1.8)	87 (2.8)	99 (0.9)
Russian Federation	– –	– –	– –	– –
Saudi Arabia	r 54 (4.9)	r 49 (6.4)	r 68 (6.8)	r 64 (6.5)
Scotland	90 (3.0)	94 (2.3)	99 (0.6)	99 (1.0)
Serbia	r 85 (3.1)	r 86 (2.9)	r 87 (2.9)	83 (3.5)
Singapore	r 86 (1.8)	r 95 (1.2)	r 98 (0.8)	r 89 (1.5)
Slovak Republic	93 (2.0)	91 (2.6)	97 (1.3)	97 (1.4)
Slovenia	84 (3.2)	91 (2.6)	79 (3.7)	73 (4.0)
South Africa	r 83 (3.0)	r 88 (2.8)	r 92 (2.3)	r 83 (3.0)
Sweden	91 (1.9)	96 (1.2)	97 (1.1)	96 (1.4)
Tunisia	r 65 (4.2)	r 57 (5.3)	r 53 (5.0)	r 59 (3.9)
United States	96 (1.0)	99 (0.6)	100 (0.0)	100 (0.3)
‡ England	– –	– –	– –	– –
International Avg.	84 (0.5)	88 (0.4)	92 (0.4)	89 (0.4)
Benchmarking Participants				
Basque Country, Spain	86 (3.7)	91 (3.0)	91 (3.0)	88 (3.6)
Indiana State, US	r 100 (0.0)	r 99 (0.7)	r 100 (0.0)	r 99 (0.0)
Ontario Province, Can.	98 (1.3)	100 (0.0)	100 (0.1)	97 (1.8)
Quebec Province, Can.	85 (4.0)	95 (2.3)	88 (3.8)	97 (1.5)

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.

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 6.9: **Readiness to Teach Mathematics** *(Continued...)*

MATHEMATICS Grade 4

Countries	Percentage of Students Whose Teachers Report Feeling They Are Ready to Teach Mathematics Topics						
	Number				Patterns and Relationships		
	Operations (+, –, X, ÷) with Whole Numbers	Fractions as Part of Whole and Representation on Number Line	Fractions and Decimals Represented by Words, Numbers, or Models	Adding and Subtracting with Decimals	Patterns of Numbers and Shapes	Simple Equations	Finding a Rule for a Relationship Given Some Pair of Numbers
Armenia	r 100 (0.0)	r 100 (0.0)	r 100 (0.4)	r 100 (0.0)	r 97 (1.4)	r 100 (0.0)	r 99 (0.8)
Australia	100 (0.0)	99 (0.4)	99 (0.5)	98 (1.1)	100 (0.1)	99 (1.1)	99 (0.4)
Belgium (Flemish)	100 (0.0)	100 (0.0)	100 (0.2)	100 (0.0)	98 (1.0)	98 (0.9)	97 (1.2)
Chinese Taipei	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	99 (1.0)	99 (1.3)
Cyprus	100 (0.0)	100 (0.0)	100 (0.5)	100 (0.3)	100 (0.5)	100 (0.0)	99 (0.5)
England	– –	– –	– –	– –	– –	– –	– –
Hong Kong, SAR	100 (0.0)	100 (0.0)	98 (1.2)	100 (0.5)	98 (1.1)	98 (1.1)	97 (1.4)
Hungary	99 (1.1)	99 (1.1)	95 (2.0)	87 (3.1)	99 (1.1)	98 (1.3)	98 (1.3)
Iran, Islamic Rep. of	98 (1.1)	98 (1.4)	96 (1.8)	96 (1.7)	92 (2.8)	96 (1.8)	87 (2.8)
Italy	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	96 (1.4)	90 (2.2)	95 (1.5)
Japan	99 (1.0)	94 (1.9)	88 (2.5)	98 (1.3)	89 (2.3)	99 (1.0)	84 (2.9)
Latvia	r 99 (1.0)	r 99 (1.0)	r 89 (3.5)	s 88 (3.5)	r 95 (2.0)	r 99 (1.0)	r 96 (1.6)
Lithuania	100 (0.0)	99 (0.8)	95 (1.3)	94 (2.0)	93 (1.7)	100 (0.0)	97 (0.9)
Moldova, Rep. of	99 (0.9)	99 (0.6)	98 (1.3)	98 (1.2)	97 (1.6)	99 (0.9)	97 (1.5)
Morocco	x x	x x	x x	x x	x x	x x	x x
Netherlands	100 (0.0)	100 (0.0)	97 (1.7)	98 (1.4)	97 (1.8)	97 (1.6)	93 (2.6)
New Zealand	100 (0.0)	99 (0.8)	98 (0.7)	95 (1.5)	100 (0.1)	100 (0.0)	98 (0.7)
Norway	100 (0.0)	100 (0.4)	97 (1.6)	100 (0.4)	98 (1.0)	96 (1.9)	89 (2.6)
Philippines	100 (0.0)	99 (0.9)	99 (0.9)	99 (0.8)	95 (2.0)	95 (2.0)	96 (1.9)
Russian Federation	– –	– –	– –	– –	– –	– –	– –
Scotland	r 100 (0.0)	r 100 (0.0)	r 100 (0.0)	r 95 (2.4)	r 100 (0.2)	r 98 (1.3)	r 100 (0.2)
Singapore	100 (0.2)	100 (0.2)	100 (0.0)	100 (0.0)	99 (0.8)	98 (1.1)	97 (1.4)
Slovenia	100 (0.0)	99 (0.8)	96 (1.7)	90 (2.3)	99 (0.8)	100 (0.0)	91 (2.6)
Tunisia	99 (1.0)	s 44 (4.6)	s 42 (4.7)	r 51 (4.3)	r 92 (2.4)	r 96 (1.7)	r 92 (2.3)
United States	100 (0.0)	99 (0.4)	99 (0.5)	99 (0.5)	100 (0.4)	99 (0.4)	99 (0.6)
International Avg.	100 (0.1)	97 (0.3)	95 (0.4)	95 (0.4)	97 (0.3)	98 (0.3)	95 (0.4)
Benchmarking Participants							
Indiana State, US	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
Ontario Province, Can.	100 (0.0)	99 (0.8)	99 (0.7)	100 (0.1)	100 (0.2)	100 (0.0)	99 (0.2)
Quebec Province, Can.	100 (0.0)	97 (1.7)	97 (1.7)	95 (1.8)	100 (0.0)	100 (0.0)	99 (0.7)

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 6.9: **Readiness to Teach Mathematics** *(...Continued)*

Countries	Percentage of Students Whose Teachers Report Feeling They Are Ready to Teach Mathematics Topics					
	Measurement		Geometry			
	Recognizing and Selecting Appropriate Units to Measure Length, Weight, Time, and Temperature	Estimating and Measuring Length, Area, Volume, Weight, and Time	Familiar 2D and 3D Shapes and Their Properties	Congruent Triangles	Relationship Between 2D and 3D Shapes	Translation, Reflection, and Rotation
Armenia	r 100 (0.0)	r 100 (0.4)	r 99 (0.9)	r 100 (0.0)	r 97 (1.5)	r 96 (1.7)
Australia	100 (0.0)	100 (0.3)	100 (0.1)	100 (0.1)	100 (0.1)	95 (1.7)
Belgium (Flemish)	100 (0.0)	99 (0.8)	93 (1.9)	89 (3.0)	82 (2.5)	81 (3.4)
Chinese Taipei	100 (0.0)	100 (0.0)	99 (0.6)	99 (0.6)	99 (0.8)	94 (2.0)
Cyprus	100 (0.0)	100 (0.0)	100 (0.5)	99 (0.7)	99 (0.5)	– –
‡ England	– –	– –	– –	– –	– –	– –
Hong Kong, SAR	100 (0.3)	96 (2.1)	98 (1.4)	97 (1.6)	98 (1.2)	87 (3.3)
Hungary	99 (1.1)	99 (1.1)	92 (2.4)	93 (2.3)	86 (3.0)	90 (2.7)
Iran, Islamic Rep. of	97 (1.5)	97 (1.4)	86 (3.7)	97 (1.5)	78 (3.8)	81 (3.3)
Italy	100 (0.0)	100 (0.0)	96 (1.5)	98 (0.9)	92 (1.9)	96 (1.4)
Japan	97 (1.4)	91 (2.3)	76 (3.6)	86 (2.3)	62 (3.6)	70 (3.4)
Latvia	r 99 (0.9)	r 99 (0.9)	r 96 (1.7)	r 91 (3.5)	s 81 (4.3)	s 68 (4.9)
Lithuania	100 (0.0)	99 (0.6)	96 (1.6)	100 (0.0)	89 (2.3)	73 (2.7)
Moldova, Rep. of	99 (0.7)	99 (0.7)	90 (2.2)	88 (3.0)	89 (2.7)	77 (3.5)
Morocco	x x	x x	x x	x x	x x	x x
Netherlands	97 (1.8)	95 (2.2)	83 (3.8)	85 (3.5)	79 (3.7)	77 (3.8)
New Zealand	99 (0.3)	99 (0.8)	99 (0.4)	97 (0.9)	98 (0.6)	99 (0.8)
Norway	100 (0.4)	99 (0.6)	96 (1.5)	95 (1.4)	90 (2.3)	87 (2.8)
Philippines	95 (1.9)	92 (2.5)	91 (2.9)	96 (2.2)	88 (3.3)	79 (4.1)
Russian Federation	– –	– –	– –	– –	– –	– –
Scotland	r 100 (0.0)	r 100 (0.0)	r 100 (0.0)	r 99 (0.8)	r 99 (0.7)	r 94 (2.3)
Singapore	100 (0.2)	100 (0.2)	98 (0.8)	95 (1.7)	94 (1.9)	87 (2.9)
Slovenia	100 (0.0)	99 (0.8)	97 (1.7)	99 (0.7)	91 (2.6)	84 (3.5)
Tunisia	98 (1.1)	r 98 (1.1)	r 76 (4.2)	r 51 (4.7)	r 56 (4.5)	r 39 (4.9)
United States	99 (0.4)	100 (0.2)	99 (0.5)	100 (0.3)	98 (0.7)	97 (0.9)
International Avg.	99 (0.2)	98 (0.2)	94 (0.5)	93 (0.4)	88 (0.5)	83 (0.7)
Benchmarking Participants						
Indiana State, US	100 (0.0)	99 (1.0)	99 (0.9)	99 (1.0)	99 (0.9)	96 (2.0)
Ontario Province, Can.	99 (0.6)	99 (0.9)	100 (0.0)	98 (1.6)	98 (1.6)	97 (2.0)
Quebec Province, Can.	100 (0.0)	100 (0.2)	100 (0.1)	95 (2.0)	95 (1.9)	97 (1.5)

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.

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 6.9: Readiness to Teach Mathematics

Countries	Percentage of Students Whose Teachers Report Feeling They Are Ready to Teach Mathematics Topics		
	Data		
	Recognizing What Numbers, Symbols, and Points Mean in a Display	Displaying Data Using Tables, Pictographs, and Bar Graphs	Drawing Conclusions from Data
Armenia	r 98 (1.2)	r 98 (1.1)	r 97 (1.4)
Australia	96 (0.7)	100 (0.1)	100 (0.1)
Belgium (Flemish)	97 (1.0)	98 (0.9)	98 (0.9)
Chinese Taipei	99 (0.6)	99 (0.6)	99 (1.0)
Cyprus	100 (0.0)	100 (0.4)	100 (0.0)
England	– –	– –	– –
Hong Kong, SAR	99 (0.8)	100 (0.0)	100 (0.0)
Hungary	91 (2.7)	89 (3.0)	94 (2.1)
Iran, Islamic Rep. of	93 (2.3)	98 (1.2)	95 (1.8)
Italy	100 (0.0)	100 (0.0)	100 (0.0)
Japan	91 (2.5)	95 (1.8)	88 (2.8)
Latvia	r 93 (2.5)	r 98 (1.0)	r 97 (1.5)
Lithuania	96 (1.4)	97 (1.1)	99 (0.7)
Moldova, Rep. of	97 (1.6)	98 (1.1)	97 (1.4)
Morocco	x x	x x	x x
Netherlands	93 (2.7)	100 (0.0)	97 (1.5)
New Zealand	99 (0.7)	100 (0.0)	100 (0.0)
Norway	92 (2.0)	89 (2.2)	90 (2.2)
Philippines	92 (2.6)	92 (2.8)	90 (2.8)
Russian Federation	– –	– –	– –
Scotland	r 97 (1.8)	r 100 (0.0)	r 100 (0.0)
Singapore	99 (0.8)	100 (0.0)	99 (0.8)
Slovenia	99 (0.8)	98 (1.4)	98 (1.4)
Tunisia	r 82 (3.6)	r 85 (3.2)	r 89 (2.8)
United States	98 (0.5)	100 (0.3)	99 (0.5)
International Avg.	96 (0.4)	97 (0.3)	97 (0.3)
Benchmarking Participants			
Indiana State, US	99 (1.0)	100 (0.0)	100 (0.0)
Ontario Province, Can.	98 (1.6)	100 (0.0)	100 (0.0)
Quebec Province, Can.	99 (0.3)	100 (0.1)	96 (1.6)

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.

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.


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 mathematics classrooms and the instruction that takes place, Chapter 7 presents teachers' reports from the second part of the teacher questionnaire about their mathematics classrooms and instructional practices, as well as students' reports about the classroom activities they do in learning mathematics. Data are presented about class size, various limitations on instruction, instructional time, instructional emphases given different mathematics topics, and classroom activities. Information also is presented about the use of calculators and computers in mathematics lessons, the role of homework, and the reliance on different types of assessment approaches.

Teachers and the instructional approaches they use ultimately determine the mathematics students learn. Teachers structure the content and pace of lessons, introducing new material, selecting various instructional activities, and monitoring students' developing understanding of the mathematics concepts being studied. Teachers may help students use technology and tools to investigate mathematical ideas, analyze students' work for misconceptions, and promote positive

attitudes toward mathematics. They may also assign homework and conduct informal as well as formal assessments to evaluate achievement outcomes.

How Do the Characteristics of Mathematics 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 mathematics classes reveal that across countries the average class size was 30 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 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 mathematics achievement at both the eighth and fourth grades.

At the eighth grade, mathematics 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 mathematics 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, 20 percent of the students were in such classrooms.

Exhibit 7.1: Class Size for Mathematics Instruction

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	r	27 (0.9)	39 (4.4)	474 (5.6)	43 (4.3)	485 (5.0)	7 (1.8)	460 (9.9)	11 (2.8)	462 (8.4)
Australia		26 (0.5)	31 (4.2)	482 (9.4)	65 (4.7)	518 (5.9)	4 (2.2)	492 (14.2)	0 (0.4)	~ ~
Bahrain		32 (0.1)	6 (0.7)	451 (5.8)	52 (2.7)	402 (2.1)	40 (2.6)	395 (3.5)	3 (0.0)	412 (3.8)
Belgium (Flemish)		20 (0.3)	90 (2.3)	538 (3.3)	10 (2.3)	553 (10.5)	0 (0.0)	~ ~	0 (0.0)	~ ~
Botswana		37 (0.4)	1 (0.7)	~ ~	14 (2.6)	392 (9.1)	60 (4.3)	360 (3.7)	25 (4.1)	362 (4.1)
Bulgaria		22 (0.5)	64 (4.2)	468 (4.9)	32 (3.9)	503 (8.0)	3 (2.4)	423 (5.0)	1 (0.0)	~ ~
Chile		35 (0.4)	9 (1.5)	385 (17.0)	22 (2.6)	384 (8.1)	47 (3.6)	390 (5.7)	23 (3.0)	389 (6.9)
Chinese Taipei		37 (0.4)	4 (1.5)	598 (28.9)	14 (2.8)	567 (11.5)	65 (4.0)	575 (4.7)	17 (3.2)	636 (8.7)
Cyprus		26 (0.1)	21 (1.9)	463 (3.2)	79 (1.9)	460 (2.0)	0 (0.0)	~ ~	0 (0.0)	~ ~
Egypt		38 (0.6)	3 (1.2)	422 (13.8)	9 (2.1)	428 (11.3)	61 (4.1)	403 (4.3)	27 (3.7)	407 (7.5)
Estonia		27 (0.5)	32 (3.4)	523 (5.1)	41 (4.2)	530 (4.3)	27 (3.8)	550 (5.4)	0 (0.0)	~ ~
Ghana	r	37 (1.0)	16 (2.7)	232 (7.4)	18 (3.1)	249 (8.9)	29 (4.0)	292 (9.0)	37 (4.7)	289 (9.1)
Hong Kong, SAR		39 (0.3)	3 (1.1)	504 (28.1)	6 (1.6)	513 (21.3)	49 (4.1)	575 (5.7)	43 (4.1)	612 (4.7)
Hungary		22 (0.4)	64 (3.9)	522 (4.2)	35 (4.0)	540 (6.5)	2 (0.9)	~ ~	0 (0.0)	~ ~
Indonesia		40 (0.5)	3 (1.7)	413 (8.6)	10 (2.8)	366 (20.0)	38 (4.1)	413 (8.3)	48 (4.3)	421 (6.7)
Iran, Islamic Rep. of		29 (0.4)	23 (2.9)	397 (5.7)	50 (4.0)	413 (4.5)	25 (3.3)	420 (6.0)	3 (1.4)	431 (13.7)
Israel	r	34 (0.4)	9 (2.2)	512 (18.3)	23 (3.7)	500 (9.2)	64 (4.5)	490 (4.9)	4 (1.7)	531 (4.5)
Italy		22 (0.3)	78 (3.1)	483 (3.4)	22 (3.1)	488 (8.3)	0 (0.0)	~ ~	0 (0.0)	~ ~
Japan		35 (0.2)	3 (1.2)	561 (6.1)	18 (2.6)	557 (4.5)	78 (2.6)	571 (2.7)	1 (1.0)	~ ~
Jordan		35 (0.7)	14 (2.8)	430 (9.4)	26 (3.6)	424 (13.3)	32 (4.4)	417 (5.9)	28 (3.8)	428 (7.4)
Korea, Rep. of	s	37 (0.4)	1 (0.9)	~ ~	20 (3.0)	569 (4.6)	57 (4.6)	594 (2.9)	22 (3.5)	600 (7.0)
Latvia		24 (0.7)	52 (3.5)	497 (4.4)	42 (3.4)	519 (5.5)	3 (1.0)	527 (20.3)	3 (1.7)	506 (12.6)
Lebanon		29 (0.9)	32 (3.9)	429 (6.0)	44 (4.8)	429 (5.1)	16 (3.1)	443 (10.4)	8 (3.1)	464 (8.7)
Lithuania		25 (0.3)	39 (3.2)	486 (4.2)	61 (3.2)	510 (3.0)	0 (0.0)	~ ~	0 (0.0)	~ ~
Macedonia, Rep. of		28 (0.4)	24 (3.5)	439 (9.2)	58 (4.3)	435 (5.9)	17 (3.6)	429 (13.7)	1 (1.0)	~ ~
Malaysia		37 (0.4)	1 (0.7)	~ ~	18 (3.3)	514 (11.0)	56 (4.4)	503 (5.1)	25 (3.5)	515 (8.8)
Moldova, Rep. of	r	24 (0.5)	56 (4.5)	449 (6.0)	38 (4.6)	460 (7.0)	5 (2.5)	485 (25.2)	1 (0.6)	~ ~
Morocco		x x	x x	x x	x x	x x	x x	x x	x x	x x
Netherlands		26 (0.3)	33 (3.9)	514 (9.4)	66 (4.1)	546 (5.8)	1 (1.0)	~ ~	0 (0.0)	~ ~
New Zealand		27 (0.4)	22 (3.0)	469 (8.9)	72 (4.1)	500 (5.7)	6 (3.2)	538 (17.8)	0 (0.0)	~ ~
Norway		25 (0.3)	34 (3.8)	467 (4.3)	65 (3.6)	460 (3.5)	1 (0.7)	~ ~	1 (0.7)	~ ~
Palestinian Nat'l Auth.		39 (0.6)	6 (2.0)	398 (20.0)	17 (2.8)	393 (7.4)	27 (3.9)	394 (8.9)	50 (3.7)	385 (4.2)
Philippines		54 (0.7)	1 (0.6)	~ ~	1 (0.7)	~ ~	7 (2.0)	448 (23.4)	91 (2.1)	372 (5.4)
Romania		24 (0.5)	51 (4.5)	469 (6.7)	46 (4.5)	480 (7.4)	3 (1.4)	534 (34.7)	1 (0.0)	~ ~
Russian Federation		24 (0.6)	47 (4.2)	500 (5.1)	47 (3.6)	515 (5.0)	6 (3.4)	533 (11.0)	0 (0.0)	~ ~
Saudi Arabia		28 (0.9)	36 (5.3)	333 (7.5)	26 (4.8)	340 (8.1)	29 (5.8)	330 (5.6)	8 (3.0)	325 (4.1)
Scotland	r	27 (0.5)	33 (3.9)	457 (7.2)	56 (4.4)	520 (6.2)	11 (3.4)	548 (10.1)	1 (0.7)	~ ~
Serbia		26 (0.4)	38 (3.7)	464 (4.4)	51 (4.0)	483 (3.8)	11 (2.9)	489 (8.2)	0 (0.0)	~ ~
Singapore		38 (0.2)	2 (0.6)	~ ~	8 (1.6)	613 (18.0)	63 (2.7)	606 (5.0)	26 (2.5)	607 (5.7)
Slovak Republic		25 (0.4)	42 (4.6)	498 (4.7)	53 (4.7)	512 (5.4)	5 (1.8)	543 (19.7)	0 (0.0)	~ ~
Slovenia		22 (0.3)	70 (4.1)	491 (3.0)	30 (4.1)	500 (4.1)	0 (0.0)	~ ~	0 (0.0)	~ ~
South Africa	s	45 (1.3)	4 (1.2)	309 (35.8)	14 (3.0)	290 (23.8)	30 (3.7)	265 (11.7)	52 (4.1)	249 (8.7)
Sweden		21 (0.4)	71 (3.6)	491 (3.3)	27 (3.7)	522 (5.5)	1 (1.0)	~ ~	0 (0.5)	~ ~
Tunisia		34 (0.3)	1 (1.0)	~ ~	26 (3.3)	404 (3.6)	71 (3.5)	412 (3.2)	2 (1.1)	~ ~
United States	r	24 (0.4)	56 (2.9)	504 (3.9)	39 (2.7)	510 (5.1)	4 (1.2)	531 (16.4)	1 (0.7)	~ ~
‡ England	s	27 (0.5)	33 (5.1)	479 (11.6)	57 (5.8)	511 (8.7)	10 (3.6)	552 (16.5)	0 (0.0)	~ ~
International Avg.		30 (0.1)	29 (0.5)	461 (1.9)	35 (0.5)	473 (1.4)	24 (0.5)	470 (2.1)	13 (0.3)	448 (1.7)
Benchmarking Participants										
Basque Country, Spain		24 (0.4)	49 (3.6)	483 (4.2)	47 (4.2)	492 (4.3)	4 (2.5)	504 (2.6)	0 (0.0)	~ ~
Indiana State, US		24 (1.0)	65 (6.5)	505 (6.3)	31 (5.8)	512 (8.0)	0 (0.0)	~ ~	4 (2.5)	517 (36.6)
Ontario Province, Can.		26 (0.4)	31 (4.0)	515 (5.2)	66 (4.1)	523 (3.7)	3 (2.0)	514 (7.3)	0 (0.0)	~ ~
Quebec Province, Can.		29 (0.3)	14 (2.8)	530 (5.6)	69 (3.9)	539 (4.2)	18 (3.0)	573 (7.9)	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 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 7.1: Class Size for Mathematics Instruction

MATHEMATICS Grade 4

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	s	29 (1.5)	22 (4.1)	467 (8.6)	33 (4.2)	462 (7.6)	19 (4.3)	456 (9.6)	26 (4.8)	457 (8.2)
Australia		26 (0.6)	16 (3.0)	495 (9.6)	29 (3.8)	503 (6.7)	53 (4.3)	504 (5.6)	2 (1.5)	~ ~
Belgium (Flemish)		20 (0.4)	43 (3.4)	550 (3.6)	50 (3.6)	551 (2.3)	6 (2.0)	549 (4.9)	1 (0.0)	~ ~
Chinese Taipei		32 (0.3)	2 (0.7)	~ ~	7 (2.0)	546 (14.2)	37 (4.0)	565 (3.2)	54 (3.7)	567 (2.0)
Cyprus		23 (0.3)	18 (2.2)	502 (4.0)	56 (4.0)	513 (3.9)	25 (4.2)	508 (4.7)	0 (0.0)	~ ~
England	r	28 (0.8)	11 (2.7)	514 (16.4)	29 (4.7)	528 (7.5)	40 (4.1)	534 (6.3)	20 (4.4)	539 (13.1)
Hong Kong, SAR		34 (0.4)	2 (0.9)	~ ~	4 (1.7)	544 (14.8)	30 (4.0)	566 (4.5)	64 (4.3)	584 (4.3)
Hungary		24 (0.4)	19 (3.0)	508 (6.3)	54 (4.1)	523 (4.5)	26 (4.0)	550 (7.4)	1 (0.9)	~ ~
Iran, Islamic Rep. of		27 (0.6)	16 (2.7)	368 (9.8)	28 (3.6)	390 (6.4)	26 (4.1)	383 (10.4)	30 (4.0)	404 (6.7)
Italy		20 (0.3)	45 (3.4)	508 (4.8)	53 (3.4)	499 (5.2)	1 (0.7)	~ ~	0 (0.0)	~ ~
Japan		32 (0.3)	4 (0.9)	572 (7.2)	13 (2.3)	560 (4.6)	28 (3.0)	566 (3.0)	55 (2.9)	564 (2.4)
Latvia		23 (0.4)	31 (3.1)	521 (6.2)	38 (3.8)	529 (5.2)	27 (2.9)	561 (4.5)	5 (1.9)	561 (10.2)
Lithuania		21 (0.4)	30 (3.0)	506 (6.6)	59 (3.5)	544 (3.3)	11 (2.5)	548 (7.6)	0 (0.3)	~ ~
Moldova, Rep. of	r	25 (0.5)	16 (3.1)	491 (9.6)	49 (4.7)	503 (8.0)	30 (3.8)	520 (8.9)	5 (1.8)	506 (25.6)
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)	544 (3.5)	41 (4.6)	540 (4.3)	33 (4.2)	542 (3.6)	2 (1.5)	~ ~
New Zealand		27 (0.3)	10 (1.6)	474 (8.9)	24 (2.7)	487 (5.4)	56 (3.0)	501 (3.2)	9 (2.2)	492 (9.6)
Norway		21 (0.4)	38 (3.2)	446 (4.8)	47 (3.5)	451 (3.3)	13 (3.2)	464 (4.8)	2 (1.3)	~ ~
Philippines		40 (1.0)	3 (1.0)	336 (28.7)	7 (2.4)	350 (20.2)	16 (3.8)	388 (34.2)	75 (4.2)	353 (6.9)
Russian Federation		21 (0.3)	33 (3.2)	524 (6.5)	45 (3.6)	539 (7.7)	20 (2.5)	523 (8.2)	1 (0.9)	~ ~
Scotland	s	26 (0.5)	18 (3.5)	482 (8.3)	27 (4.5)	489 (6.2)	48 (4.5)	498 (4.4)	7 (2.5)	505 (13.9)
Singapore		38 (0.2)	0 (0.1)	~ ~	2 (0.8)	~ ~	3 (1.0)	506 (39.2)	96 (1.2)	598 (5.4)
Slovenia		20 (0.4)	45 (4.1)	477 (4.7)	49 (4.4)	480 (4.0)	6 (2.2)	477 (7.8)	0 (0.0)	~ ~
Tunisia	r	31 (0.4)	5 (1.5)	319 (25.3)	15 (2.9)	331 (14.6)	41 (4.2)	341 (7.7)	38 (4.3)	344 (9.0)
United States		23 (0.3)	23 (2.5)	519 (5.7)	56 (3.0)	523 (3.2)	18 (2.3)	509 (6.1)	3 (1.1)	513 (13.7)
International Avg.		26 (0.1)	20 (0.6)	482 (2.5)	34 (0.7)	495 (1.8)	26 (0.7)	503 (2.6)	21 (0.5)	499 (3.0)
Benchmarking Participants										
Indiana State, US		22 (0.5)	23 (5.3)	533 (7.8)	71 (5.8)	535 (3.6)	4 (2.0)	534 (9.0)	3 (2.2)	522 (19.7)
Ontario Province, Can.		25 (0.5)	11 (2.8)	503 (8.2)	48 (5.5)	520 (6.0)	37 (5.2)	503 (5.5)	3 (1.5)	497 (7.7)
Quebec Province, Can.		26 (0.3)	5 (1.6)	518 (9.5)	48 (4.6)	503 (3.7)	46 (4.6)	509 (3.8)	0 (0.0)	~ ~

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 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 7.2: Index of Teachers' Reports on Teaching Mathematics Classes with Few or No Limitations on Instruction Due to Student Factors (MCFL)

MATHEMATICS Grade 8

Index of Teachers' Reports on Teaching Mathematics Classes with Few or No Limitations on Instruction Due to Student Factors

Index based on teachers' responses to six statements about student factors limiting mathematics 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 MCFL		Medium MCFL		Low MCFL	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Netherlands	81 (3.7)	549 (4.6)	16 (3.3)	482 (11.2)	3 (1.9)	477 (18.4)
Egypt	80 (3.0)	410 (4.2)	19 (2.9)	392 (6.8)	1 (0.0)	~ ~
Belgium (Flemish)	73 (2.8)	556 (3.6)	20 (2.5)	506 (7.3)	7 (1.7)	454 (18.3)
Lithuania	71 (3.6)	508 (3.3)	29 (3.6)	484 (5.4)	0 (0.0)	~ ~
Bahrain	68 (3.6)	400 (2.2)	31 (3.6)	403 (3.7)	1 (0.7)	~ ~
Scotland	65 (4.3)	519 (5.2)	29 (3.8)	475 (6.5)	6 (2.0)	439 (10.9)
Japan	63 (4.1)	574 (3.1)	33 (3.7)	565 (3.0)	5 (1.7)	547 (12.4)
Sweden	62 (3.2)	512 (3.6)	30 (3.2)	485 (4.3)	8 (1.7)	456 (7.7)
Hungary	54 (3.7)	544 (4.0)	43 (3.7)	513 (5.6)	2 (1.3)	~ ~
Estonia	54 (4.3)	543 (3.4)	36 (4.2)	522 (4.6)	10 (2.5)	497 (7.7)
Malaysia	53 (3.8)	529 (6.3)	39 (3.9)	487 (5.8)	8 (2.1)	472 (14.4)
Iran, Islamic Rep. of	53 (4.0)	413 (3.7)	45 (4.0)	410 (4.2)	3 (1.2)	411 (10.4)
United States	51 (2.9)	530 (3.9)	30 (2.8)	492 (5.3)	19 (2.1)	474 (7.7)
Latvia	50 (4.1)	515 (5.0)	40 (4.6)	505 (3.9)	10 (2.9)	480 (7.8)
Australia	42 (4.1)	538 (6.0)	42 (4.4)	497 (7.5)	16 (3.2)	448 (13.4)
New Zealand	40 (4.6)	510 (8.4)	39 (4.9)	491 (7.2)	21 (3.6)	482 (11.5)
Israel	40 (3.5)	519 (6.1)	36 (3.9)	490 (5.9)	24 (3.4)	468 (9.3)
Lebanon	39 (4.6)	437 (6.0)	47 (4.6)	433 (5.3)	13 (2.7)	435 (9.7)
Russian Federation	37 (2.8)	516 (6.2)	41 (3.1)	502 (5.6)	23 (3.0)	506 (8.3)
Slovenia	36 (4.0)	494 (4.5)	42 (3.8)	491 (3.4)	22 (3.6)	497 (4.1)
Moldova, Rep. of r	36 (4.5)	463 (8.3)	43 (5.0)	457 (7.4)	22 (3.8)	454 (9.6)
Singapore	35 (2.5)	633 (5.4)	41 (2.9)	607 (6.0)	24 (2.8)	566 (6.8)
Indonesia	35 (4.0)	437 (8.8)	40 (4.7)	399 (8.5)	25 (4.2)	392 (9.4)
Macedonia, Rep. of	34 (4.2)	442 (7.6)	49 (4.2)	424 (6.1)	18 (3.1)	452 (10.1)
Serbia	34 (3.9)	478 (4.1)	45 (4.3)	474 (4.3)	21 (3.3)	479 (6.8)
Romania	32 (3.7)	490 (8.7)	43 (4.2)	470 (7.1)	25 (3.4)	463 (7.7)
Hong Kong, SAR	32 (4.3)	612 (7.0)	35 (3.9)	577 (5.7)	33 (4.2)	569 (8.4)
Philippines	31 (4.3)	380 (11.2)	47 (4.6)	381 (9.2)	21 (3.8)	368 (11.0)
Korea, Rep. of s	31 (3.0)	598 (5.0)	54 (3.3)	587 (3.3)	15 (2.7)	585 (5.9)
Bulgaria	29 (3.7)	492 (7.4)	45 (4.1)	468 (7.2)	25 (3.7)	466 (7.1)
Armenia r	29 (4.0)	476 (5.7)	45 (3.9)	478 (5.2)	26 (3.4)	479 (5.9)
South Africa r	29 (3.8)	269 (13.6)	44 (4.4)	265 (8.7)	27 (3.4)	249 (8.7)
Chile	28 (3.3)	407 (6.8)	36 (3.4)	389 (5.8)	36 (3.6)	370 (5.2)
Norway	27 (3.8)	473 (4.3)	58 (4.2)	459 (3.5)	15 (3.2)	453 (5.6)
Ghana	26 (4.0)	289 (9.6)	45 (4.4)	271 (7.1)	29 (4.1)	262 (7.6)
Slovak Republic	26 (3.2)	529 (7.7)	51 (4.7)	502 (4.8)	23 (3.8)	496 (5.6)
Saudi Arabia	25 (5.1)	341 (8.6)	46 (5.3)	330 (5.3)	29 (5.3)	334 (7.1)
Italy	24 (3.4)	500 (8.2)	52 (4.0)	481 (4.2)	24 (3.0)	472 (6.1)
Tunisia	23 (3.4)	408 (5.7)	44 (3.9)	411 (2.7)	32 (3.7)	410 (4.5)
Palestinian Nat'l Auth.	21 (3.2)	388 (7.1)	46 (4.1)	388 (5.7)	33 (4.3)	394 (6.5)
Jordan	20 (3.6)	450 (8.5)	53 (4.6)	422 (6.2)	27 (3.7)	411 (6.8)
Cyprus	20 (2.7)	476 (3.8)	36 (2.7)	461 (2.7)	44 (2.4)	452 (2.7)
Chinese Taipei	19 (3.1)	623 (8.8)	44 (3.8)	590 (6.5)	37 (3.9)	559 (7.1)
Botswana	19 (3.4)	374 (6.5)	41 (4.6)	366 (5.5)	41 (4.6)	362 (3.7)
Morocco s	5 (3.1)	383 (17.9)	51 (7.1)	384 (5.1)	44 (7.6)	394 (5.9)
‡ England r	52 (5.8)	540 (8.4)	42 (5.7)	479 (9.7)	6 (2.2)	417 (11.9)
International Avg.	40 (0.6)	480 (1.1)	41 (0.6)	460 (0.9)	20 (0.5)	449 (1.4)
Benchmarking Participants						
Basque Country, Spain	20 (4.4)	496 (5.5)	42 (5.1)	490 (4.3)	37 (4.6)	480 (5.4)
Indiana State, US	42 (5.5)	539 (9.5)	45 (5.3)	489 (6.4)	13 (3.8)	479 (15.8)
Ontario Province, Can.	55 (5.2)	530 (3.8)	33 (4.7)	517 (4.2)	11 (3.2)	488 (7.1)
Quebec Province, Can.	64 (4.1)	556 (4.3)	30 (4.2)	526 (4.4)	6 (2.1)	497 (7.6)

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 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

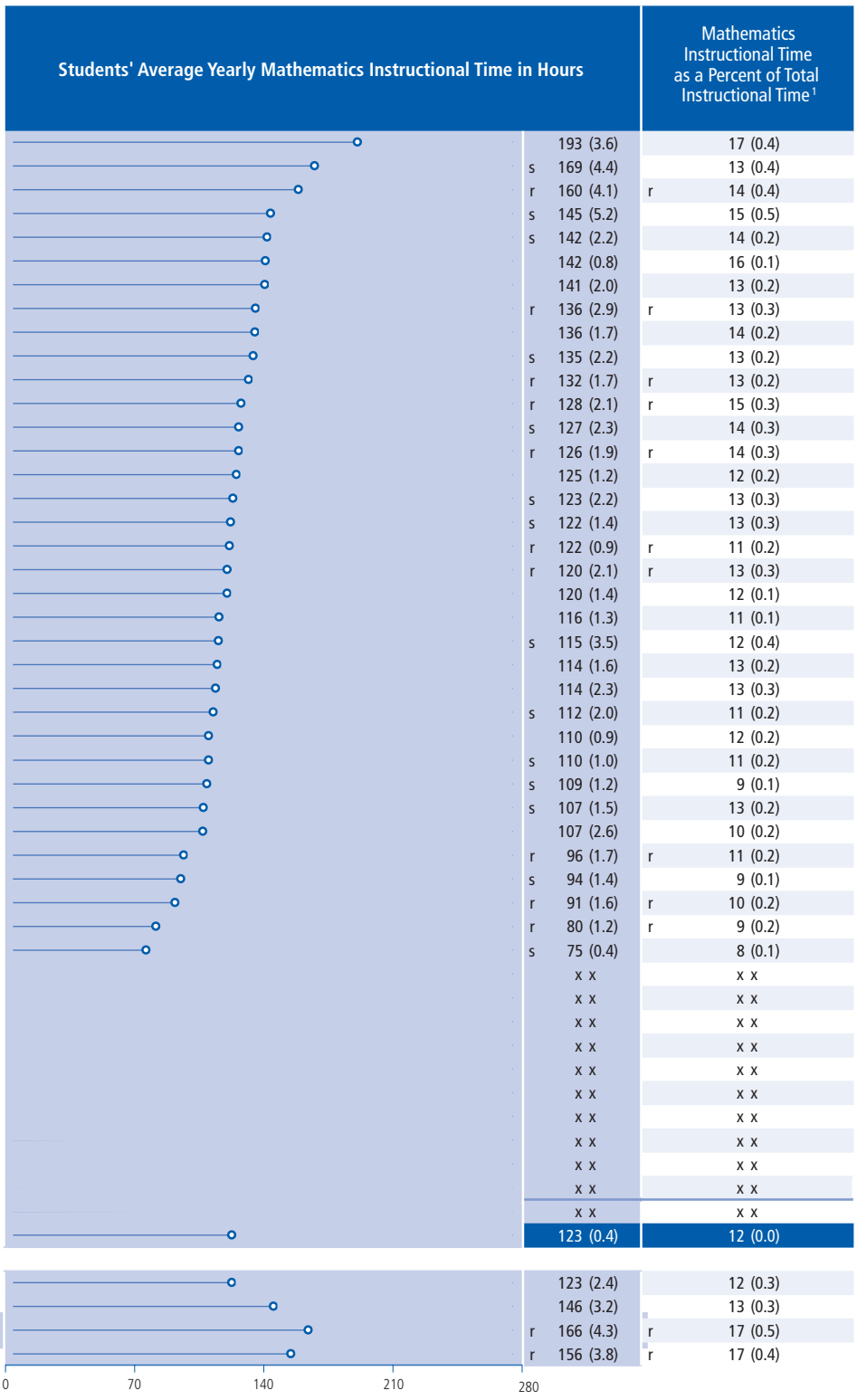
How Much School Time Is Devoted to Mathematics Instruction?

Exhibit 7.3 presents information about the amount of mathematics 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 mathematics instruction over the school year as reported by mathematics teachers. At the eighth grade, countries providing 150 or more hours per year were the Philippines, Indonesia, and Chile. Countries providing fewer than 100 hours were Bulgaria, the Netherlands, Sweden, Macedonia, and Cyprus. The percentage of instructional time at the eighth grade that was devoted to mathematics ranged from 17 percent in the Philippines to 8 percent in Cyprus.

At the fourth grade, even with fewer participating countries than at the eighth grade, a substantial number of countries provided 150 or more hours of mathematics instruction, including Italy, Belgium (Flemish), Scotland, the Netherlands, Australia, Singapore, and the Philippines. Even though Chinese Taipei was at 99 hours, the rest of the countries provided at least 110 hours of mathematics instruction per year. The percentage of instructional time at the fourth grade that was devoted to mathematics ranged from 21 percent in Italy to 12 percent in Chinese Taipei.

Exhibit 7.4 provides teachers' reports about how mathematics instructional time is allocated across the five major content areas assessed by TIMSS 2003. At the eighth grade, on average, internationally, the two areas receiving about one-fourth of the instructional time each were algebra with 27 percent and geometry with 26 percent. Number was next with 21 percent. Measurement and data each were given 10 percent and other topics 6 percent. At the fourth grade, the profile was much different. As would be anticipated, number received the largest amount of mathematics instructional time – 38 percent, on average, internationally. Patterns and relationships (beginning algebra), measurement, and geometry each were given 15 to 16 percent, data 9 percent, and other 6 percent.

Exhibit 7.3: Mathematics Instructional Time



Countries	Students' Average Yearly Mathematics Instructional Time in Hours	Mathematics Instructional Time as a Percent of Total Instructional Time[1]
Philippines	193 (3.6)	17 (0.4)
Indonesia	s 169 (4.4)	13 (0.4)
Chile	r 160 (4.1)	r 14 (0.4)
Hong Kong, SAR	s 145 (5.2)	15 (0.5)
Scotland	s 142 (2.2)	14 (0.2)
Bahrain	142 (0.8)	16 (0.1)
Chinese Taipei	141 (2.0)	13 (0.2)
Australia	r 136 (2.9)	r 13 (0.3)
New Zealand	136 (1.7)	14 (0.2)
United States	s 135 (2.2)	13 (0.2)
Italy	r 132 (1.7)	r 13 (0.2)
Russian Federation	r 128 (2.1)	r 15 (0.3)
Palestinian Nat'l Auth.	s 127 (2.3)	14 (0.3)
Slovak Republic	r 126 (1.9)	r 14 (0.3)
Estonia	125 (1.2)	12 (0.2)
Belgium (Flemish)	s 123 (2.2)	13 (0.3)
Latvia	s 122 (1.4)	13 (0.3)
Lithuania	r 122 (0.9)	r 11 (0.2)
Romania	r 120 (2.1)	r 13 (0.3)
Malaysia	120 (1.4)	12 (0.1)
Slovenia	116 (1.3)	11 (0.1)
Iran, Islamic Rep. of	s 115 (3.5)	12 (0.4)
Singapore	114 (1.6)	13 (0.2)
Norway	114 (2.3)	13 (0.3)
Hungary	s 112 (2.0)	11 (0.2)
Jordan	110 (0.9)	12 (0.2)
Saudi Arabia	s 110 (1.0)	11 (0.2)
Korea, Rep. of	s 109 (1.2)	9 (0.1)
Serbia	s 107 (1.5)	13 (0.2)
Japan	107 (2.6)	10 (0.2)
Bulgaria	r 96 (1.7)	r 11 (0.2)
Netherlands	s 94 (1.4)	9 (0.1)
Sweden	r 91 (1.6)	r 10 (0.2)
Macedonia, Rep. of	r 80 (1.2)	r 9 (0.2)
Cyprus	s 75 (0.4)	8 (0.1)
Armenia	x x	x x
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
Morocco	x x	x x
South Africa	x x	x x
Tunisia	x x	x x
‡ England	x x	x x
International Avg.	123 (0.4)	12 (0.0)
Benchmarking Participants		
Basque Country, Spain	123 (2.4)	12 (0.3)
Indiana State, US	146 (3.2)	13 (0.3)
Ontario Province, Can.	r 166 (4.3)	r 17 (0.5)
Quebec Province, Can.	r 156 (3.8)	r 17 (0.4)

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

Mathematics instructional time provided by teachers, and total instructional time provided by schools.

1 Computed as the ratio of mathematics instructional time to the total instructional time averaged across students (1 hour = 60 minutes).

‡ 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: Mathematics Instructional Time

MATHEMATICS Grade 4

Countries	Students' Average Yearly Mathematics Instructional Time in Hours	Mathematics Instructional Time as a Percent of Total Instructional Time[1]
Italy	r 199 (4.4)	r 21 (0.5)
Belgium (Flemish)	190 (2.0)	20 (0.2)
Scotland	s 189 (4.0)	s 20 (0.4)
Netherlands	s 178 (5.2)	s 18 (0.5)
Australia	r 172 (4.2)	r 18 (0.4)
Singapore	172 (1.0)	19 (0.2)
Philippines	167 (5.5)	15 (0.5)
United States	s 147 (3.2)	s 14 (0.4)
Cyprus	s 145 (1.8)	s 17 (0.2)
Slovenia	r 144 (1.2)	r 18 (0.2)
New Zealand	143 (2.7)	15 (0.3)
Lithuania	r 139 (1.6)	r 16 (0.2)
Hong Kong, SAR	s 137 (3.7)	s 15 (0.4)
Japan	137 (1.5)	13 (0.2)
Hungary	s 122 (1.7)	s 14 (0.2)
Russian Federation	s 117 (1.7)	s 16 (0.3)
Latvia	r 115 (1.1)	r 15 (0.2)
Norway	110 (1.8)	13 (0.2)
Chinese Taipei	99 (1.7)	12 (0.2)
Armenia	x x	x x
England	x x	x x
Iran, Islamic Rep. of	x x	x x
Moldova, Rep. of	x x	x x
Morocco	x x	x x
Tunisia	x x	x x
International Avg.	149 (0.7)	16 (0.1)
Benchmarking Participants		
Indiana State, US	140 (5.6)	14 (0.6)
Ontario Province, Can.	r 160 (3.4)	r 16 (0.3)
Quebec Province, Can.	r 198 (5.7)	r 22 (0.7)

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

Mathematics instructional time provided by teachers, and total instructional time provided by schools.

1 Computed as the ratio of mathematics 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 Mathematics Class Devoted to TIMSS Content Areas During the School Year

Countries	Number	Algebra	Measurement	Geometry	Data	Other
Armenia	s 32 (1.7)	s 21 (1.1)	s 9 (0.5)	s 20 (1.0)	s 11 (0.6)	s 7 (0.8)
Australia	25 (0.8)	23 (0.6)	16 (0.5)	18 (0.8)	14 (0.6)	4 (0.7)
Bahrain	23 (0.5)	26 (0.6)	9 (0.4)	27 (0.4)	11 (0.3)	5 (0.4)
Belgium (Flemish)	30 (1.1)	20 (0.8)	6 (0.4)	36 (0.6)	5 (0.3)	2 (0.5)
Botswana	29 (1.4)	20 (0.7)	r 16 (0.9)	16 (0.8)	12 (0.8)	r 9 (0.9)
Bulgaria	10 (0.8)	38 (1.2)	6 (0.6)	37 (1.1)	4 (0.5)	5 (1.0)
Chile	39 (1.1)	15 (0.6)	10 (0.6)	24 (0.7)	9 (0.6)	4 (0.7)
Chinese Taipei	16 (1.0)	35 (1.0)	7 (0.5)	38 (1.4)	3 (0.4)	1 (0.5)
Cyprus	27 (0.6)	27 (0.5)	11 (0.4)	22 (0.5)	5 (0.4)	r 8 (0.7)
Egypt	20 (0.6)	21 (0.6)	13 (0.4)	22 (0.5)	13 (0.4)	10 (0.7)
Estonia	15 (0.9)	39 (1.1)	9 (0.4)	26 (0.7)	7 (0.4)	5 (0.8)
Ghana	21 (0.8)	19 (0.6)	14 (0.5)	20 (0.7)	19 (0.7)	7 (0.6)
Hong Kong, SAR	16 (0.7)	32 (0.8)	12 (0.7)	28 (0.8)	10 (0.6)	2 (0.6)
Hungary	22 (0.7)	26 (0.7)	9 (0.3)	28 (0.5)	10 (0.4)	5 (0.5)
Indonesia	19 (0.6)	23 (0.7)	13 (0.4)	24 (0.6)	15 (0.4)	6 (0.7)
Iran, Islamic Rep. of	20 (0.7)	22 (0.8)	11 (0.4)	27 (0.5)	11 (0.5)	9 (0.8)
Israel	15 (0.9)	34 (1.1)	9 (0.7)	28 (0.9)	10 (0.5)	r 5 (0.8)
Italy	14 (0.5)	33 (0.6)	10 (0.5)	28 (0.7)	11 (0.4)	4 (0.9)
Japan	17 (1.0)	31 (1.0)	4 (0.5)	34 (0.6)	12 (0.9)	2 (0.5)
Jordan	24 (0.9)	23 (0.6)	13 (0.5)	21 (0.8)	14 (0.5)	5 (0.7)
Korea, Rep. of	s 18 (0.6)	s 27 (0.6)	s 12 (0.5)	s 26 (0.6)	s 15 (0.4)	s 2 (0.3)
Latvia	14 (0.8)	39 (1.3)	s 6 (0.6)	30 (0.7)	6 (0.5)	5 (1.1)
Lebanon	s 21 (1.1)	s 21 (0.9)	s 9 (0.8)	s 35 (1.2)	s 11 (0.8)	s 3 (0.6)
Lithuania	18 (0.7)	34 (0.9)	9 (0.3)	23 (0.6)	11 (0.4)	4 (0.5)
Macedonia, Rep. of	13 (0.9)	26 (1.1)	8 (1.1)	38 (1.8)	7 (0.5)	8 (1.5)
Malaysia	25 (0.9)	22 (0.6)	14 (0.5)	20 (0.6)	14 (0.5)	6 (0.9)
Moldova, Rep. of	s 17 (0.9)	s 29 (0.8)	s 10 (0.7)	s 30 (0.9)	s 9 (0.6)	s 6 (0.9)
Morocco	x x	x x	x x	x x	x x	x x
Netherlands	16 (0.7)	29 (1.2)	13 (0.7)	22 (0.8)	14 (0.6)	5 (0.8)
New Zealand	25 (0.6)	23 (0.8)	17 (0.6)	19 (0.4)	14 (0.7)	3 (0.6)
Norway	27 (0.7)	17 (0.7)	12 (0.4)	24 (0.6)	13 (0.5)	8 (0.8)
Palestinian Nat'l Auth.	19 (0.7)	21 (0.7)	10 (0.5)	24 (0.7)	17 (0.6)	11 (0.9)
Philippines	21 (1.1)	42 (1.9)	12 (0.6)	12 (0.7)	10 (0.6)	3 (0.7)
Romania	18 (0.7)	27 (0.7)	9 (0.5)	33 (0.9)	8 (0.4)	4 (0.7)
Russian Federation	10 (0.8)	49 (0.9)	– –	35 (0.6)	3 (0.4)	2 (0.5)
Saudi Arabia	29 (0.9)	21 (0.6)	8 (0.8)	29 (1.0)	8 (0.6)	6 (0.8)
Scotland	– –	– –	– –	– –	– –	– –
Serbia	17 (1.0)	25 (1.0)	6 (0.6)	r 28 (1.8)	6 (0.6)	r 19 (2.3)
Singapore	13 (0.4)	34 (0.7)	13 (0.4)	21 (0.4)	11 (0.3)	8 (0.5)
Slovak Republic	16 (0.8)	37 (1.1)	7 (0.6)	25 (1.0)	7 (0.4)	8 (1.1)
Slovenia	38 (1.3)	19 (0.8)	11 (0.6)	17 (0.9)	8 (0.5)	7 (1.2)
South Africa	r 23 (0.7)	r 23 (0.8)	r 13 (0.6)	r 23 (0.7)	r 14 (0.5)	r 4 (0.4)
Sweden	34 (0.8)	20 (0.7)	12 (0.5)	21 (0.4)	10 (0.5)	4 (0.6)
Tunisia	34 (0.9)	13 (0.6)	7 (0.4)	33 (0.7)	7 (0.5)	r 6 (0.7)
United States	22 (0.7)	41 (1.3)	10 (0.4)	15 (0.6)	12 (0.5)	r 2 (0.3)
‡ England	– –	– –	– –	– –	– –	– –
International Avg.	21 (0.1)	27 (0.1)	10 (0.1)	26 (0.1)	10 (0.1)	6 (0.1)
Benchmarking Participants						
Basque Country, Spain	34 (1.1)	29 (1.0)	10 (0.7)	17 (0.7)	8 (0.6)	2 (0.5)
Indiana State, US	27 (1.3)	38 (1.6)	10 (0.4)	13 (1.2)	10 (0.6)	1 (0.3)
Ontario Province, Can.	27 (0.7)	20 (0.4)	18 (0.4)	18 (0.4)	16 (0.4)	1 (0.4)
Quebec Province, Can.	23 (0.7)	29 (0.7)	12 (0.5)	28 (0.8)	8 (0.5)	r 2 (0.5)

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.

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 7.4: Percentage of Time in Mathematics Class Devoted to TIMSS Content Areas During the School Year

MATHEMATICS Grade 4

Countries	Number	Patterns and Relationships	Measurement	Geometry	Data	Other
Armenia	r 35 (1.3)	r 21 (0.8)	r 13 (0.5)	r 13 (0.5)	r 10 (0.5)	r 8 (0.8)
Australia	40 (1.9)	18 (0.9)	17 (0.6)	12 (0.6)	11 (0.4)	3 (0.5)
Belgium (Flemish)	44 (1.1)	14 (0.6)	16 (0.3)	14 (0.4)	11 (0.5)	2 (0.4)
Chinese Taipei	39 (1.2)	15 (0.6)	17 (0.4)	16 (0.4)	11 (0.4)	3 (0.4)
Cyprus	35 (1.0)	18 (0.5)	14 (0.4)	14 (0.4)	14 (0.4)	6 (0.8)
England	– –	– –	– –	– –	– –	– –
Hong Kong, SAR	53 (1.7)	13 (0.8)	11 (0.5)	12 (0.6)	11 (0.5)	1 (0.4)
Hungary	42 (1.1)	20 (0.6)	15 (0.4)	11 (0.4)	7 (0.3)	6 (0.9)
Iran, Islamic Rep. of	22 (1.0)	17 (0.6)	16 (0.7)	18 (0.8)	16 (0.6)	12 (1.0)
Italy	33 (0.8)	13 (0.4)	19 (0.4)	18 (0.4)	11 (0.4)	6 (0.6)
Japan	40 (0.9)	18 (0.8)	13 (0.5)	17 (0.5)	12 (0.5)	1 (0.3)
Latvia	s 38 (1.6)	s 19 (1.1)	s 13 (0.6)	s 12 (0.6)	s 10 (0.6)	s 9 (1.0)
Lithuania	38 (1.3)	16 (0.6)	16 (0.5)	12 (0.5)	12 (0.5)	6 (0.8)
Moldova, Rep. of	r 30 (1.3)	r 18 (0.6)	r 14 (0.5)	r 14 (0.5)	r 13 (0.6)	r 11 (1.0)
Morocco	x x	x x	x x	x x	x x	x x
Netherlands	52 (1.6)	13 (0.8)	14 (0.6)	7 (0.4)	11 (0.6)	3 (0.5)
New Zealand	49 (1.1)	13 (0.4)	13 (0.4)	12 (0.4)	11 (0.3)	3 (0.5)
Norway	57 (1.3)	10 (0.4)	14 (0.6)	9 (0.4)	7 (0.4)	3 (0.5)
Philippines	29 (1.3)	20 (0.6)	16 (0.5)	15 (0.6)	15 (0.7)	6 (0.7)
Russian Federation	– –	– –	– –	– –	– –	– –
Scotland	– –	– –	– –	– –	– –	– –
Singapore	49 (1.3)	14 (0.7)	13 (0.5)	11 (0.5)	9 (0.3)	5 (0.7)
Slovenia	21 (1.2)	18 (1.1)	22 (0.9)	10 (0.5)	11 (0.5)	18 (1.5)
Tunisia	r 25 (1.3)	r 19 (0.8)	r 20 (0.6)	r 18 (0.6)	r 13 (0.6)	r 5 (0.7)
United States	38 (0.9)	19 (0.4)	13 (0.3)	13 (0.3)	15 (0.4)	4 (0.5)
International Avg.	38 (0.3)	16 (0.2)	15 (0.1)	13 (0.1)	11 (0.1)	6 (0.2)
Benchmarking Participants						
Indiana State, US	44 (2.2)	18 (1.3)	12 (0.7)	11 (0.6)	11 (0.7)	3 (0.8)
Ontario Province, Can.	34 (1.0)	16 (0.4)	17 (0.4)	16 (0.4)	15 (0.4)	2 (0.5)
Quebec Province, Can.	40 (1.4)	16 (0.8)	15 (0.4)	16 (0.5)	9 (0.5)	4 (0.7)

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.

What Activities Do Students Do in Their Mathematics Lessons?

Exhibits 7.5 and 7.6 present information about the frequency of students doing particular content related activities, as reported by the students themselves and by their mathematics teachers, respectively. The data presented are for doing the activities in half of their lessons or more. At the eighth grade, the activities were: 1) practicing numerical operations without a calculator, 2) working on fractions and decimals, 3) interpreting data in tables, charts, or graphs, and 4) writing equations and functions to represent relationships. According to the eighth-grade students, internationally, on average, considerable effort was devoted to working on the two activities most likely related to the number content area. Fifty-seven percent of the students reported being asked to practice numerical operations in at least half of their lessons and another 51 percent reported working on fractions and decimals at least this frequently. Fifty-five percent reported writing equations and functions in half their lessons. The smallest percentage of students spent time on data interpretation tasks in at least half their lessons (41%). Teachers' reports agreed with that of their students when it came to the emphasis on number activities. For doing the activities in at least half of the lessons, teachers reported the largest percentages of students for practicing operations (62%) and working on fractions and decimals (43%). In contrast to students' views, teachers reported less emphasis on writing equations (30%) and far less on data interpretation (17%).

At the fourth grade, the activities were: 1) practicing operations, 2) working on fractions and decimals, 3) measuring things, 4) making tables charts or graphs, and 5) learning about shapes such as circles, triangles, rectangles, and cubes. Similar to the eighth-grade reports, students reported a much more balanced approach. The international averages were two-thirds of the students practicing operations in at least half the lessons and more than half (54%) working on fractions and decimals and learning about shapes. According to the students, 39 percent, on average, were making graphs in more than half their

lessons, and one-fourth were measuring things. In contrast, teachers reported an overwhelming emphasis on having students practice numerical operations. The teachers said they asked 82 percent of the students, on average, internationally, to practice adding, subtracting, multiplying, or dividing in half of the lessons or more. They reported asking 29 percent, on average, internationally, to work on fractions and decimals this frequently. According to teachers, measuring things, making graphs, and learning about shapes were relatively infrequent activities for more than 80 percent of the fourth-grade students.

Exhibit 7.5: Students' Reports on Mathematics Content Related Emphasis in Classroom Activities

Countries	Percentage of Students Who Reported Doing the Activity About Half of the Lessons or More			
	Practice Adding, Subtracting, Multiplying, and Dividing Without Using Calculator	Work on Fractions and Decimals	Interpret Data in Tables, Charts, or Graphs	Write Equations and Functions to Represent Relationships
Armenia	55 (1.0)	56 (1.1)	45 (1.0)	60 (1.3)
Australia	49 (1.5)	43 (1.5)	36 (1.4)	47 (1.4)
Bahrain	64 (0.9)	54 (1.0)	50 (0.7)	62 (0.8)
Belgium (Flemish)	65 (1.3)	61 (1.4)	19 (1.1)	43 (1.4)
Botswana	63 (1.1)	40 (1.0)	34 (1.0)	39 (0.9)
Bulgaria	60 (1.1)	51 (1.4)	46 (1.6)	71 (1.2)
Chile	68 (1.0)	71 (1.1)	51 (1.3)	64 (1.1)
Chinese Taipei	55 (1.0)	32 (1.0)	36 (0.9)	47 (1.0)
Cyprus	60 (0.8)	35 (0.8)	41 (0.9)	49 (0.9)
Egypt	61 (1.1)	63 (0.8)	55 (1.1)	67 (0.6)
Estonia	50 (1.3)	53 (1.3)	29 (1.2)	59 (1.3)
Ghana	63 (1.3)	55 (1.2)	50 (1.0)	54 (1.0)
Hong Kong, SAR	43 (0.8)	32 (0.9)	21 (0.9)	41 (0.9)
Hungary	67 (1.2)	64 (1.3)	56 (1.6)	67 (1.3)
Indonesia	49 (0.9)	38 (1.2)	42 (1.1)	44 (1.0)
Iran, Islamic Rep. of	58 (1.2)	44 (1.1)	49 (1.2)	48 (1.2)
Israel	61 (1.2)	55 (1.5)	51 (1.4)	65 (1.2)
Italy	43 (1.5)	46 (1.2)	39 (1.8)	68 (1.5)
Japan	86 (0.6)	42 (1.0)	51 (0.8)	66 (0.9)
Jordan	60 (0.9)	57 (0.8)	64 (1.1)	71 (1.0)
Korea, Rep. of	81 (0.7)	40 (0.8)	13 (0.6)	39 (0.9)
Latvia	78 (0.9)	73 (1.0)	30 (1.0)	65 (1.2)
Lebanon	58 (1.5)	58 (1.4)	44 (1.5)	66 (1.1)
Lithuania	46 (1.5)	56 (1.4)	39 (1.2)	62 (1.3)
Macedonia, Rep. of	55 (1.1)	44 (1.3)	37 (1.1)	64 (1.0)
Malaysia	72 (1.1)	65 (1.0)	46 (1.0)	48 (0.9)
Moldova, Rep. of	56 (1.3)	51 (1.5)	35 (1.2)	57 (1.5)
Morocco	61 (1.4)	64 (1.3)	51 (1.5)	58 (1.1)
Netherlands	12 (1.1)	30 (1.1)	42 (1.4)	38 (1.5)
New Zealand	46 (1.3)	45 (1.5)	40 (1.3)	45 (1.3)
Norway	21 (0.9)	28 (1.3)	29 (1.4)	23 (0.8)
Palestinian Nat'l Auth.	58 (1.0)	49 (1.2)	61 (1.1)	56 (1.0)
Philippines	74 (0.7)	68 (1.0)	54 (1.2)	68 (1.0)
Romania	63 (1.5)	63 (1.4)	44 (1.6)	70 (1.2)
Russian Federation	69 (1.0)	58 (1.3)	40 (1.2)	62 (1.3)
Saudi Arabia	57 (1.3)	54 (1.0)	51 (0.9)	64 (1.1)
Scotland	56 (1.4)	41 (1.5)	28 (1.2)	38 (1.3)
Serbia	56 (1.2)	52 (1.0)	35 (1.0)	55 (0.9)
Singapore	55 (0.7)	52 (0.8)	34 (0.8)	60 (0.9)
Slovak Republic	55 (1.2)	47 (1.1)	18 (1.0)	65 (1.1)
Slovenia	57 (1.3)	61 (1.5)	40 (1.6)	46 (1.2)
South Africa	70 (0.7)	66 (1.0)	54 (1.1)	62 (1.0)
Sweden	37 (1.3)	37 (1.3)	25 (1.3)	30 (1.3)
Tunisia	54 (0.9)	66 (0.8)	42 (0.9)	45 (0.9)
United States	63 (0.9)	66 (0.9)	55 (1.2)	73 (1.0)
‡ England	43 (1.1)	31 (1.3)	33 (1.5)	38 (1.7)
International Avg.	57 (0.2)	51 (0.2)	41 (0.2)	55 (0.2)
Benchmarking Participants				
Basque Country, Spain	79 (1.4)	76 (1.1)	53 (2.0)	77 (1.4)
Indiana State, US	67 (1.8)	72 (1.5)	54 (2.1)	74 (1.9)
Ontario Province, Can.	51 (1.7)	50 (1.4)	41 (1.7)	53 (1.3)
Quebec Province, Can.	33 (1.5)	51 (1.6)	32 (1.3)	57 (1.2)

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.

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

Exhibit 7.5: Students' Reports on Mathematics Content Related Emphasis in Classroom Activities

MATHEMATICS Grade 4

Countries	Percentage of Students Who Reported Doing the Activity About Half of the Lessons or More											
	Practice Adding, Subtracting, Multiplying, and Dividing Without Using Calculator		Work on Fractions and Decimals		Measure Things in the Classroom and Around the School		Make Tables, Charts, or Graphs		Learn about Shapes such as Circles, Triangles, Rectangles, and Cubes	
Armenia	r	68 (1.1)	r	76 (1.2)	s	20 (1.0)	s	34 (1.2)	s	64 (1.4)
Australia		75 (1.1)		58 (1.7)		29 (1.2)		42 (1.4)		52 (1.6)
Belgium (Flemish)		74 (1.2)		60 (1.3)		14 (0.7)		23 (1.4)		51 (1.6)
Chinese Taipei		50 (1.1)		45 (1.1)		29 (1.0)		37 (1.1)		52 (1.2)
Cyprus		69 (0.9)		69 (1.0)		45 (1.2)		58 (1.0)		69 (1.0)
England		63 (1.1)		42 (1.6)		12 (0.9)		36 (1.5)		33 (1.3)
Hong Kong, SAR		53 (1.6)		53 (1.1)		16 (1.0)		25 (1.0)		46 (1.1)
Hungary		72 (1.0)		32 (1.6)		12 (0.7)		16 (1.0)		53 (1.7)
Iran, Islamic Rep. of		58 (2.8)		64 (2.8)		51 (2.3)		58 (2.6)		72 (2.4)
Italy		61 (1.3)		60 (1.4)		21 (1.1)		49 (1.6)		72 (1.5)
Japan		80 (0.9)		74 (1.4)		27 (0.9)		50 (1.4)		57 (1.3)
Latvia		73 (1.1)		46 (1.7)		19 (1.0)		33 (1.4)		62 (1.3)
Lithuania		76 (1.0)		60 (1.4)		11 (0.7)		37 (1.4)		57 (1.1)
Moldova, Rep. of		65 (2.1)		42 (2.1)		15 (1.1)		36 (2.0)		49 (2.3)
Morocco	r	75 (2.1)	r	61 (2.8)	r	49 (2.3)	r	56 (2.6)	r	64 (2.5)
Netherlands		74 (1.4)		36 (1.8)		9 (0.9)		29 (1.5)		15 (0.9)
New Zealand		74 (0.8)		58 (1.3)		31 (1.2)		48 (1.2)		52 (1.1)
Norway		56 (1.1)		36 (1.6)		13 (0.7)		21 (1.2)		41 (1.0)
Philippines		66 (1.8)		73 (1.4)		45 (1.5)		49 (1.5)		74 (1.6)
Russian Federation		– –		– –		– –		– –		– –
Scotland		73 (1.0)		38 (1.7)		25 (1.3)		42 (1.5)		43 (1.5)
Singapore		77 (0.9)		73 (1.0)		14 (0.6)		29 (0.9)		47 (1.2)
Slovenia		59 (1.3)		40 (1.8)		18 (1.1)		26 (1.2)		50 (1.9)
Tunisia	r	53 (2.0)	r	25 (1.8)	r	46 (2.2)	r	50 (2.6)	r	62 (2.3)
United States		74 (0.7)		64 (1.1)		28 (0.8)		51 (1.0)		56 (1.0)
International Avg.		67 (0.3)		54 (0.3)		25 (0.3)		39 (0.3)		54 (0.3)
Benchmarking Participants										
Indiana State, US		76 (1.2)		66 (2.5)		22 (1.4)		43 (1.9)		50 (1.8)
Ontario Province, Can.		72 (1.0)		58 (2.3)		30 (1.3)		53 (1.3)		53 (1.6)
Quebec Province, Can.		76 (0.9)		57 (1.8)		31 (1.4)		45 (1.5)		63 (1.4)

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 Mathematics Content Related Emphasis in Students' Classroom Activities

Countries	Percentage of Students Whose Teachers Reported Students Doing the Activity About Half of the Lessons or More							
	Practice Adding, Subtracting, Multiplying, and Dividing Without Using Calculator		Work on Fractions and Decimals		Interepret Data in Tables, Charts, or Graphs		Write Equations and Functions to Represent Relationships	
Armenia	66 (3.9)	r	51 (4.3)	r	13 (2.9)	r	27 (3.8)	
Australia	38 (4.3)		26 (3.9)		8 (2.2)		17 (3.5)	
Bahrain	66 (3.1)		32 (3.4)		14 (3.3)		23 (3.4)	
Belgium (Flemish)	67 (3.5)		45 (3.4)		1 (0.5)		3 (1.1)	
Botswana	80 (3.6)		36 (4.5)		9 (2.6)		18 (3.7)	
Bulgaria	85 (3.3)		71 (4.1)		5 (1.6)		28 (3.9)	
Chile	73 (3.4)		50 (3.9)		16 (2.5)		26 (3.5)	
Chinese Taipei	70 (3.8)		16 (3.0)		9 (2.4)		30 (3.9)	
Cyprus	69 (2.2)		40 (2.1)		7 (1.6)		40 (2.5)	
Egypt	44 (3.7)		40 (4.1)		25 (3.9)		33 (3.7)	
Estonia	63 (4.3)		61 (4.4)		12 (2.7)		32 (3.6)	
Ghana	73 (4.2)		37 (4.2)		22 (3.9)		30 (4.5)	
Hong Kong, SAR	10 (2.8)		6 (2.2)		6 (2.2)		32 (4.2)	
Hungary	75 (3.2)		80 (3.4)		5 (1.3)		50 (4.4)	
Indonesia	48 (4.2)		31 (3.7)		30 (4.2)		48 (4.8)	
Iran, Islamic Rep. of	77 (3.0)		50 (3.8)		41 (3.8)		33 (3.9)	
Israel	53 (3.8)		44 (3.8)		27 (3.1)		34 (3.9)	
Italy	53 (3.5)		62 (3.5)		20 (3.0)		22 (2.8)	
Japan	53 (4.3)		11 (2.6)		36 (3.7)		62 (3.7)	
Jordan	76 (3.3)		41 (4.3)		27 (3.9)		40 (4.3)	
Korea, Rep. of	56 (3.8)	s	32 (3.9)	s	18 (2.4)	s	41 (3.3)	s
Latvia	86 (2.6)		80 (3.3)		9 (2.1)		35 (4.0)	
Lebanon	51 (4.5)		37 (4.4)		29 (3.6)		37 (4.4)	
Lithuania	66 (3.7)		62 (3.8)		21 (3.0)		16 (2.8)	
Macedonia, Rep. of	67 (4.0)		57 (4.5)		21 (3.5)		49 (4.0)	
Malaysia	82 (3.2)		46 (4.2)		24 (4.0)		31 (3.6)	
Moldova, Rep. of	79 (3.8)	r	61 (4.6)	r	29 (4.3)	r	38 (4.8)	r
Morocco	77 (5.7)	s	82 (5.5)	s	18 (5.0)	s	21 (5.8)	s
Netherlands	15 (3.5)		8 (3.0)		34 (4.8)		28 (4.1)	
New Zealand	40 (4.2)		24 (4.3)		12 (3.6)		15 (4.4)	
Norway	5 (2.0)		5 (2.1)		2 (1.1)		4 (1.5)	
Palestinian Nat'l Auth.	71 (3.8)		33 (4.1)		28 (4.0)		24 (4.1)	
Philippines	73 (4.3)		52 (4.9)		26 (3.8)		46 (4.3)	
Romania	85 (3.2)		67 (4.4)		13 (2.8)		32 (3.8)	
Russian Federation	85 (2.4)		70 (3.6)		20 (3.1)		51 (3.7)	
Saudi Arabia	85 (3.5)		32 (4.2)		25 (4.6)		21 (4.2)	
Scotland	63 (4.5)		25 (4.0)		8 (2.7)		5 (2.4)	
Serbia	74 (3.6)		59 (3.9)		15 (3.0)		45 (3.6)	
Singapore	38 (2.5)		26 (2.3)		10 (1.6)		37 (2.8)	
Slovak Republic	57 (4.0)		56 (4.5)		5 (1.7)		35 (4.5)	
Slovenia	71 (3.9)		66 (4.0)		6 (1.9)		12 (2.3)	
South Africa	63 (3.4)		26 (3.6)		23 (3.0)		25 (3.5)	
Sweden	43 (3.7)		25 (3.3)		6 (1.8)		6 (1.8)	
Tunisia	75 (3.4)		50 (4.7)		11 (2.5)		16 (3.1)	
United States	46 (2.6)		45 (3.1)		25 (2.5)		47 (2.9)	
‡ England	50 (5.7)	s	19 (4.4)	s	9 (3.2)	s	14 (3.7)	s
International Avg.	62 (0.5)		43 (0.6)		17 (0.5)		30 (0.5)	
Benchmarking Participants								
Basque Country, Spain	75 (4.1)		60 (5.2)		15 (3.0)		39 (5.3)	
Indiana State, US	64 (4.8)		64 (5.1)		14 (4.7)		48 (5.2)	
Ontario Province, Can.	37 (4.5)		34 (4.3)		12 (3.0)		26 (4.3)	
Quebec Province, Can.	19 (3.9)		47 (5.0)		11 (2.9)		35 (4.6)	

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.

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 Mathematics Content Related Emphasis in Students' Classroom Activities

MATHEMATICS Grade 4

Countries	Percentage of Students Whose Teachers Reported Students Doing the Activity About Half of the Lessons or More									
	Practice Adding, Subtracting, Multiplying, and Dividing Without Using Calculator		Work on Fractions and Decimals		Measure Things in the Classroom and Around the School		Make Tables, Charts, or Graphs		Learn about Shapes such as Circles, Triangles, Rectangles, and Cubes	
Armenia	r	91 (2.3)	r	73 (3.9)	r	8 (2.2)	r	11 (2.5)	r	22 (3.7)
Australia		71 (4.6)		18 (2.9)		6 (1.9)		7 (2.0)		8 (2.1)
Belgium (Flemish)		89 (2.1)		42 (3.0)		5 (1.6)		9 (1.9)		6 (1.8)
Chinese Taipei		75 (3.7)		22 (3.1)		9 (2.5)		8 (2.1)		8 (2.2)
Cyprus		80 (3.1)		43 (4.4)		16 (3.0)		19 (3.5)		18 (3.2)
England	r	82 (3.7)	r	21 (4.1)	r	5 (2.7)	r	6 (2.8)	r	4 (2.4)
Hong Kong, SAR		52 (4.6)		23 (3.9)		3 (1.6)		3 (1.4)		4 (1.6)
Hungary		97 (1.4)		8 (2.0)		5 (1.5)		2 (1.1)		5 (1.9)
Iran, Islamic Rep. of		56 (4.6)		41 (4.6)		48 (4.5)		39 (4.4)		61 (4.5)
Italy		76 (2.7)		42 (3.4)		7 (1.7)		18 (2.4)		21 (3.0)
Japan		90 (2.3)		53 (4.1)		18 (3.2)		35 (4.0)		37 (4.4)
Latvia		97 (1.2)		15 (3.1)		4 (1.5)		18 (3.3)		35 (4.1)
Lithuania		98 (1.0)		24 (2.6)		9 (2.0)		20 (2.8)		22 (2.5)
Moldova, Rep. of	r	93 (2.4)	r	25 (4.4)	r	5 (1.8)	r	25 (3.7)	r	29 (4.2)
Morocco		x x		x x		x x		x x		x x
Netherlands		90 (2.8)		33 (4.4)		3 (1.6)		5 (2.1)		0 (0.0)
New Zealand		88 (2.0)		20 (2.8)		3 (0.9)		7 (1.5)		4 (1.1)
Norway		70 (3.6)		2 (1.1)		3 (1.7)		0 (0.5)		4 (2.3)
Philippines		84 (3.4)		54 (4.8)		36 (4.4)		34 (4.4)		43 (4.3)
Russian Federation		– –		– –		– –		– –		– –
Scotland	r	84 (3.7)	r	12 (3.3)	r	2 (1.1)	r	2 (1.1)	r	6 (2.1)
Singapore		87 (2.4)		58 (4.4)		4 (1.5)		6 (1.5)		7 (1.8)
Slovenia		81 (3.5)		7 (2.2)		5 (1.9)		11 (2.9)		6 (2.2)
Tunisia		59 (4.6)	s	10 (3.3)	r	34 (4.6)	r	35 (4.2)	r	25 (4.1)
United States		87 (1.7)		23 (2.7)		8 (1.4)		17 (2.3)		11 (1.8)
International Avg.		82 (0.7)		29 (0.7)		11 (0.5)		15 (0.6)		17 (0.6)
Benchmarking Participants										
Indiana State, US		91 (3.2)		30 (5.5)		1 (0.0)		5 (2.2)		9 (3.7)
Ontario Province, Can.		73 (3.6)		15 (3.9)		4 (2.1)		21 (3.8)		11 (2.7)
Quebec Province, Can.		84 (3.0)		21 (3.9)		3 (1.5)		7 (1.7)		10 (2.4)

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."

Educators, parents, employers, and most of the public support the goal of improving students' capacity for mathematics problem-solving. To examine the emphasis placed on that goal, TIMSS asked eighth-grade students and teachers about how often students were asked to do the following three activities – relate what was being learned in mathematics to their daily lives, explain their answers, and decide procedures for solving complex problems.

Exhibits 7.7 and 7.8 present students' and teachers' reports, respectively. In most of the countries, students reported a moderate emphasis on doing these types of problems in mathematics class. About two-thirds (67 percent), on average, internationally, said they were asked to explain answers in at least half their lessons, and more than half (53%) reported deciding problem-solving procedures this frequently. Students reported the least attention to relating mathematics to their daily lives (44%). On average, internationally, teachers reported more emphasis on explanations than did the students. They reported asking about three-fourths of the students (78%) to explain answers in at least half the lessons. Perhaps as a matter for some concern, the teachers reported somewhat less emphasis on problem-solving procedures (45%) than did the students. Teachers reported half the students were asked to relate mathematics to their daily lives in at least half the lessons.

Exhibit 7.7: Students' Reports on Problem Solving Related Emphasis in Classroom Activities

MATHEMATICS Grade 8

Countries	Percentage of Students Who Reported Doing the Activity About Half of the Lessons or More		
	Relate What is Being Learned in Mathematics to Their Daily Lives	Explain Answers	Decide Procedures for Solving Complex Problems
Armenia	51 (1.1)	72 (0.8)	71 (0.9)
Australia	37 (1.1)	69 (1.1)	45 (1.1)
Bahrain	59 (0.9)	73 (0.8)	63 (0.8)
Belgium (Flemish)	22 (1.0)	71 (1.1)	38 (1.0)
Botswana	64 (0.6)	78 (0.7)	52 (0.8)
Bulgaria	32 (1.6)	66 (1.2)	49 (1.6)
Chile	63 (1.0)	68 (1.0)	55 (1.1)
Chinese Taipei	28 (0.8)	31 (0.9)	41 (0.9)
Cyprus	50 (0.8)	81 (0.6)	46 (0.7)
Egypt	68 (0.9)	73 (0.7)	63 (0.8)
Estonia	31 (1.2)	65 (1.3)	82 (0.8)
Ghana	71 (1.2)	75 (1.2)	56 (1.0)
Hong Kong, SAR	41 (0.8)	57 (0.9)	52 (0.7)
Hungary	38 (1.4)	72 (1.1)	50 (1.1)
Indonesia	34 (1.1)	47 (1.0)	– –
Iran, Islamic Rep. of	61 (1.2)	75 (0.9)	73 (0.9)
Israel	50 (1.3)	82 (0.9)	73 (1.1)
Italy	37 (1.1)	57 (1.3)	55 (1.1)
Japan	24 (0.8)	32 (1.5)	45 (0.9)
Jordan	63 (1.0)	83 (0.9)	80 (0.9)
Korea, Rep. of	17 (0.6)	29 (0.8)	43 (0.8)
Latvia	28 (1.1)	67 (1.2)	35 (1.2)
Lebanon	56 (1.4)	79 (1.0)	63 (1.4)
Lithuania	25 (1.0)	60 (1.2)	37 (1.1)
Macedonia, Rep. of	53 (1.4)	65 (1.3)	50 (1.2)
Malaysia	65 (0.9)	62 (1.0)	47 (1.0)
Moldova, Rep. of	39 (1.6)	72 (1.2)	49 (1.5)
Morocco r	61 (1.3)	76 (1.0)	66 (1.1)
Netherlands	22 (1.2)	67 (1.8)	28 (1.2)
New Zealand	40 (1.2)	68 (1.7)	49 (1.3)
Norway	35 (1.1)	51 (1.3)	40 (1.1)
Palestinian Nat'l Auth.	63 (0.9)	80 (0.8)	74 (0.9)
Philippines	71 (0.8)	64 (1.0)	59 (1.0)
Romania	32 (1.3)	71 (1.3)	53 (1.6)
Russian Federation	30 (1.4)	84 (0.7)	57 (1.2)
Saudi Arabia	53 (1.3)	70 (1.5)	61 (1.7)
Scotland	36 (1.1)	75 (1.2)	45 (1.1)
Serbia	42 (1.3)	56 (1.2)	52 (0.9)
Singapore	41 (0.9)	60 (0.7)	51 (0.8)
Slovak Republic	51 (1.3)	63 (1.1)	48 (1.4)
Slovenia	42 (1.3)	57 (1.1)	42 (1.1)
South Africa	74 (1.0)	78 (0.8)	64 (0.8)
Sweden	25 (1.1)	57 (1.2)	50 (1.1)
Tunisia	50 (1.0)	75 (0.9)	53 (1.0)
United States	45 (1.0)	79 (0.8)	53 (0.9)
‡ England	27 (1.2)	69 (1.6)	42 (1.1)
International Avg.	44 (0.2)	67 (0.2)	53 (0.2)
Benchmarking Participants			
Basque Country, Spain	49 (1.6)	73 (1.4)	67 (1.5)
Indiana State, US	45 (2.0)	76 (1.2)	48 (1.7)
Ontario Province, Can.	44 (1.3)	86 (1.0)	56 (1.5)
Quebec Province, Can.	38 (1.3)	74 (1.0)	71 (1.1)

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 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 7.8: Teachers' Reports on Problem Solving Related Emphasis in Classroom Activities

Countries	Percentage of Students Whose Teachers Reported Students Doing the Activity About Half of the Lessons or More					
	Relate What is Being Learned in Mathematics to Students' Daily Lives		Explain Answers		Decide Procedures for Solving Complex Problems	
Armenia	r	45 (4.2)	r	82 (2.9)	r	40 (3.6)
Australia		39 (4.3)		64 (4.2)		23 (3.7)
Bahrain		56 (3.2)		92 (1.3)		47 (3.9)
Belgium (Flemish)		32 (3.3)		78 (3.0)		22 (2.7)
Botswana		71 (4.3)		78 (4.0)		46 (5.3)
Bulgaria		26 (3.6)		88 (3.2)		28 (3.9)
Chile		87 (2.2)		84 (2.7)		75 (3.1)
Chinese Taipei		27 (3.6)		58 (3.9)		24 (3.2)
Cyprus		50 (2.5)		86 (1.3)		68 (2.2)
Egypt		63 (4.4)		85 (3.3)		41 (3.8)
Estonia		62 (3.9)		91 (2.5)		80 (3.2)
Ghana		63 (4.3)		75 (4.0)		36 (4.9)
Hong Kong, SAR		26 (4.0)		60 (4.7)		40 (4.6)
Hungary		63 (3.7)		98 (1.2)		68 (4.2)
Indonesia		50 (4.4)		61 (4.5)		25 (3.7)
Iran, Islamic Rep. of		69 (4.1)		92 (2.4)		64 (4.0)
Israel		44 (3.6)		82 (2.7)		71 (3.5)
Italy		31 (3.4)		89 (2.1)		57 (3.4)
Japan		14 (3.0)		44 (3.9)		21 (3.5)
Jordan		72 (3.9)		88 (2.4)		42 (4.0)
Korea, Rep. of	s	50 (3.6)	s	75 (3.1)	s	52 (3.5)
Latvia		43 (3.7)		80 (3.2)		54 (4.0)
Lebanon		43 (4.1)		89 (2.8)		56 (4.5)
Lithuania		52 (3.3)		92 (2.0)		58 (4.0)
Macedonia, Rep. of		57 (4.1)		76 (3.5)		58 (3.8)
Malaysia		64 (4.3)		78 (3.5)		40 (4.3)
Moldova, Rep. of	r	63 (4.2)	r	85 (3.5)	r	44 (4.7)
Morocco	s	45 (6.7)	s	81 (4.3)		x x
Netherlands		26 (4.2)		62 (4.7)		19 (4.0)
New Zealand		57 (4.7)		75 (4.3)		35 (4.4)
Norway		46 (4.4)		60 (4.0)		32 (3.9)
Palestinian Nat'l Auth.		72 (3.6)		92 (2.5)		43 (4.3)
Philippines		63 (4.4)		78 (4.1)		56 (4.8)
Romania		57 (3.5)		90 (2.4)		74 (3.6)
Russian Federation		24 (2.7)		93 (1.6)		14 (2.7)
Saudi Arabia		48 (4.7)		75 (5.7)		21 (4.4)
Scotland		41 (4.2)		69 (4.5)		25 (4.5)
Serbia		57 (3.8)		85 (3.0)		58 (4.0)
Singapore		32 (2.5)		48 (2.7)		27 (2.5)
Slovak Republic		66 (4.7)		84 (3.1)		66 (4.5)
Slovenia		58 (4.6)		74 (3.6)		46 (4.2)
South Africa		59 (4.0)		67 (3.4)		36 (3.9)
Sweden		40 (3.5)		60 (4.0)		54 (3.5)
Tunisia		38 (3.8)		80 (3.3)		35 (4.1)
United States		66 (2.8)		80 (2.4)		62 (2.9)
‡ England	s	46 (6.9)	s	75 (5.5)	s	45 (7.1)
International Avg.		50 (0.6)		78 (0.5)		45 (0.6)
Benchmarking Participants						
Basque Country, Spain		64 (4.5)		93 (2.6)		48 (4.3)
Indiana State, US		63 (5.3)		66 (5.8)		51 (6.5)
Ontario Province, Can.		60 (4.5)		81 (3.9)		49 (4.5)
Quebec Province, Can.		58 (5.1)		74 (4.5)		48 (5.1)

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.

What Instructional Strategies Are Used in Mathematics Classes?

As shown in Exhibit 7.9, the textbook is often the foundation of mathematics instruction at both the eighth and fourth grades. On average, internationally, nearly two-thirds of the eighth- and fourth-grade students (65-66%) had teachers who reported using a textbook as the primary basis of their lessons. For another 32 percent of the eighth-grade students and 29 percent of the fourth-grade students, teachers reported using textbooks as a supplementary resource.

Exhibit 7.10 presents a profile of the activities most commonly encountered in mathematics classes around the world, as reported by mathematics teachers. At the eighth grade, the three most predominant activities, accounting for 59 percent of class time, on average, internationally, were teacher lecture (19 % of class time), teacher-guided student practice (22 %), and students working on problems on their own (18%). At the fourth grade, these activities accounted for approximately about the same percentage of time as at the eighth grade (61%). The distribution was slightly different, though, since problem-solving activities with teacher guidance (22%) and on students' own (23%) accounted for nearly half the time. Teachers reported that 16 percent of the time, on average, was devoted to teacher lecture.

Exhibit 7.9: Textbook Use in Teaching Mathematics

Countries		Percentage of Students Taught by Teachers Reporting Textbook Use		
		Do Not Use Textbook to Teach Mathematics	Use Textbook to Teach Mathematics	
			As Primary Basis for Lessons	As Supplementary Resource
Armenia	r	7 (2.0)	72 (3.9)	21 (3.5)
Australia		5 (1.8)	52 (4.5)	43 (4.2)
Bahrain		0 (0.0)	76 (3.1)	24 (3.1)
Belgium (Flemish)		10 (2.3)	64 (3.5)	26 (2.8)
Botswana		3 (1.6)	44 (4.2)	53 (4.2)
Bulgaria		2 (1.1)	77 (3.7)	21 (3.5)
Chile		15 (2.6)	4 (1.2)	81 (2.8)
Chinese Taipei		6 (1.9)	81 (3.5)	13 (3.1)
Cyprus		3 (0.8)	63 (2.6)	34 (2.6)
Egypt		0 (0.0)	48 (4.2)	52 (4.2)
Estonia		0 (0.0)	93 (1.6)	7 (1.6)
Ghana		4 (1.5)	42 (4.6)	54 (4.5)
Hong Kong, SAR		0 (0.3)	83 (3.6)	17 (3.5)
Hungary		1 (0.4)	60 (3.6)	40 (3.6)
Indonesia		0 (0.0)	63 (3.7)	37 (3.7)
Iran, Islamic Rep. of		15 (3.0)	75 (3.2)	10 (2.2)
Israel		2 (0.9)	56 (3.7)	42 (3.7)
Italy		4 (1.2)	34 (3.8)	62 (3.9)
Japan		2 (1.2)	76 (3.7)	22 (3.8)
Jordan		0 (0.0)	84 (3.2)	16 (3.2)
Korea, Rep. of	s	4 (1.4)	89 (2.1)	8 (1.6)
Latvia		0 (0.0)	66 (4.1)	34 (4.1)
Lebanon		11 (2.8)	52 (5.0)	37 (4.6)
Lithuania		0 (0.0)	100 (0.0)	0 (0.0)
Macedonia, Rep. of		4 (1.9)	64 (4.0)	32 (4.2)
Malaysia		11 (2.5)	64 (4.2)	26 (4.0)
Moldova, Rep. of	r	1 (0.9)	85 (4.0)	14 (3.9)
Morocco	s	2 (1.1)	42 (6.4)	56 (6.4)
Netherlands		0 (0.0)	99 (1.2)	1 (1.2)
New Zealand		4 (2.4)	44 (5.6)	52 (5.5)
Norway		0 (0.0)	92 (2.4)	8 (2.4)
Palestinian Nat'l Auth.		2 (1.3)	80 (3.9)	18 (3.8)
Philippines		6 (1.9)	60 (4.5)	34 (4.3)
Romania		2 (1.4)	58 (4.3)	39 (4.2)
Russian Federation		0 (0.4)	86 (2.5)	14 (2.5)
Saudi Arabia		1 (0.0)	67 (5.8)	33 (5.8)
Scotland		4 (1.8)	80 (3.7)	16 (3.2)
Serbia		1 (0.0)	47 (4.2)	52 (4.3)
Singapore		0 (0.0)	74 (2.3)	26 (2.3)
Slovak Republic		1 (0.4)	74 (4.1)	26 (4.0)
Slovenia		0 (0.2)	55 (4.5)	45 (4.5)
South Africa		6 (1.9)	34 (4.0)	60 (3.9)
Sweden		0 (0.2)	90 (2.2)	9 (2.2)
Tunisia		1 (0.0)	23 (3.6)	76 (3.7)
United States		3 (0.9)	64 (3.0)	33 (3.0)
‡ England	r	14 (4.0)	46 (6.6)	40 (7.0)
International Avg.		3 (0.2)	65 (0.6)	32 (0.6)
Benchmarking Participants				
Basque Country, Spain		10 (3.3)	56 (5.4)	33 (5.0)
Indiana State, US		2 (1.2)	74 (4.2)	24 (4.3)
Ontario Province, Can.		2 (1.3)	55 (5.0)	43 (5.0)
Quebec Province, Can.		3 (1.6)	46 (4.4)	50 (4.4)

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.

Exhibit 7.9: Textbook Use in Teaching Mathematics

MATHEMATICS Grade 4

Countries		Percentage of Students Taught by Teachers Reporting Textbook Use		
		Do Not Use Textbook to Teach Mathematics	Use Textbook to Teach Mathematics	
			As Primary Basis for Lessons	As Supplementary Resource
Armenia	r	13 (3.3)	69 (4.7)	19 (3.7)
Australia		29 (3.9)	16 (3.1)	56 (4.1)
Belgium (Flemish)		4 (1.4)	85 (2.8)	11 (2.6)
Chinese Taipei		2 (1.1)	92 (2.3)	6 (2.1)
Cyprus		0 (0.0)	71 (3.7)	29 (3.7)
England	r	11 (2.9)	26 (3.9)	62 (4.5)
Hong Kong, SAR		0 (0.0)	81 (3.5)	19 (3.5)
Hungary		0 (0.0)	77 (3.8)	23 (3.8)
Iran, Islamic Rep. of		5 (1.7)	68 (4.5)	27 (4.5)
Italy		11 (2.0)	11 (2.0)	78 (2.5)
Japan		1 (0.0)	86 (3.0)	14 (2.9)
Latvia		0 (0.4)	88 (2.6)	11 (2.5)
Lithuania		0 (0.0)	100 (0.0)	0 (0.0)
Moldova, Rep. of	r	8 (2.7)	85 (3.6)	7 (2.5)
Morocco		x x	x x	x x
Netherlands		2 (1.4)	98 (1.4)	0 (0.4)
New Zealand		11 (2.2)	16 (2.8)	72 (3.0)
Norway		1 (0.6)	87 (3.1)	13 (3.0)
Philippines		6 (2.3)	57 (5.2)	37 (5.0)
Russian Federation		0 (0.0)	92 (1.9)	8 (1.9)
Scotland	s	0 (0.0)	82 (4.2)	18 (4.2)
Singapore		0 (0.0)	66 (4.0)	34 (4.0)
Slovenia		9 (2.5)	44 (4.5)	47 (4.8)
Tunisia	r	3 (1.4)	33 (4.1)	65 (4.2)
United States		11 (2.1)	60 (3.1)	29 (2.8)
International Avg.		5 (0.4)	66 (0.7)	29 (0.7)
Benchmarking Participants				
Indiana State, US		6 (2.6)	73 (4.8)	21 (3.6)
Ontario Province, Can.		6 (2.4)	39 (4.7)	54 (4.6)
Quebec Province, Can.		5 (1.6)	55 (4.5)	40 (4.4)

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 7.10: Percentage of Time in Mathematics Lessons Students Spend on Various Activities in a Typical Week

Countries	Reviewing Homework	Listening to Lecture-Style Presentations	Working Problems with Teacher's Guidance	Working Problems on Their Own Without Teacher's Guidance
Armenia	r 10 (0.5)	r 14 (0.8)	r 26 (1.1)	r 19 (0.9)
Australia	8 (0.5)	15 (0.8)	23 (1.2)	28 (1.2)
Bahrain	13 (0.5)	24 (0.9)	17 (0.5)	12 (0.5)
Belgium (Flemish)	7 (0.4)	14 (1.0)	26 (1.0)	20 (0.9)
Botswana	r 13 (0.9)	r 16 (1.1)	r 19 (1.1)	r 21 (1.2)
Bulgaria	10 (0.6)	18 (1.3)	26 (1.0)	16 (0.8)
Chile	10 (0.4)	18 (0.8)	21 (0.9)	18 (0.8)
Chinese Taipei	12 (0.5)	42 (1.3)	13 (0.6)	7 (0.5)
Cyprus	r 22 (0.4)	r 16 (0.5)	r 20 (0.5)	r 14 (0.4)
Egypt	11 (0.4)	18 (1.0)	17 (0.8)	15 (0.7)
Estonia	10 (0.4)	12 (0.6)	25 (1.0)	25 (0.8)
Ghana	r 11 (0.4)	r 16 (0.9)	r 20 (0.8)	r 18 (0.7)
Hong Kong, SAR	8 (0.4)	36 (1.5)	18 (0.7)	16 (0.8)
Hungary	12 (0.4)	13 (0.7)	25 (0.9)	25 (1.0)
Indonesia	r 12 (0.5)	r 25 (1.1)	r 20 (0.9)	r 14 (0.9)
Iran, Islamic Rep. of	12 (0.6)	17 (0.8)	18 (0.7)	14 (0.7)
Israel	r 14 (0.6)	r 15 (0.8)	r 22 (0.7)	r 21 (0.8)
Italy	15 (0.6)	22 (0.6)	19 (0.6)	13 (0.6)
Japan	7 (0.6)	29 (1.3)	28 (1.1)	11 (1.0)
Jordan	15 (0.7)	23 (1.0)	17 (0.8)	13 (0.8)
Korea, Rep. of	s 6 (0.3)	s 30 (1.2)	s 19 (0.6)	s 20 (0.7)
Latvia	r 8 (0.6)	r 12 (0.7)	r 25 (1.1)	r 22 (0.9)
Lebanon	s 24 (1.6)	s 17 (0.9)	s 23 (1.1)	s 8 (0.8)
Lithuania	9 (0.5)	7 (0.6)	30 (1.2)	26 (0.9)
Macedonia, Rep. of	7 (0.3)	37 (1.1)	19 (0.7)	15 (0.7)
Malaysia	13 (0.7)	21 (1.0)	21 (0.9)	16 (0.8)
Moldova, Rep. of	s 9 (0.6)	s 15 (1.0)	s 23 (1.0)	s 18 (0.9)
Morocco	x x	x x	x x	x x
Netherlands	15 (1.1)	13 (0.7)	21 (2.0)	28 (2.5)
New Zealand	7 (0.4)	17 (0.8)	24 (1.1)	23 (1.3)
Norway	8 (0.4)	19 (0.6)	26 (1.2)	25 (1.5)
Palestinian Nat'l Auth.	r 13 (0.6)	r 23 (1.0)	r 18 (0.8)	r 16 (0.9)
Philippines	r 9 (0.4)	r 20 (0.9)	r 16 (0.8)	r 15 (1.0)
Romania	9 (0.4)	24 (0.8)	29 (1.0)	15 (0.7)
Russian Federation	11 (0.2)	20 (0.7)	20 (0.7)	18 (0.7)
Saudi Arabia	r 15 (1.0)	r 16 (1.6)	r 13 (1.0)	r 8 (0.7)
Scotland	r 8 (0.3)	r 22 (0.7)	r 26 (1.3)	r 22 (1.5)
Serbia	7 (0.4)	25 (1.4)	23 (1.2)	20 (1.2)
Singapore	11 (0.4)	27 (0.7)	19 (0.6)	15 (0.5)
Slovak Republic	8 (0.3)	17 (0.7)	27 (0.9)	17 (0.7)
Slovenia	11 (0.4)	21 (0.8)	24 (0.7)	22 (0.9)
South Africa	s 15 (0.9)	s 13 (0.7)	s 19 (0.9)	s 18 (0.9)
Sweden	4 (0.4)	11 (0.6)	37 (1.8)	28 (1.8)
Tunisia	r 18 (0.9)	r 14 (1.0)	r 17 (0.9)	r 18 (0.9)
United States	13 (0.5)	18 (0.7)	21 (0.6)	18 (0.6)
‡ England	s 8 (0.4)	s 15 (1.2)	s 32 (2.3)	s 20 (1.7)
International Avg.	11 (0.1)	19 (0.1)	22 (0.2)	18 (0.2)
Benchmarking Participants				
Basque Country, Spain	22 (1.2)	16 (1.0)	20 (1.1)	15 (0.9)
Indiana State, US	16 (1.0)	17 (0.9)	19 (1.1)	18 (1.3)
Ontario Province, Can.	16 (0.7)	16 (0.8)	18 (0.9)	22 (1.3)
Quebec Province, Can.	12 (0.7)	25 (0.9)	17 (0.9)	21 (1.0)

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. 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 7.10: Percentage of Time in Mathematics Lessons Students Spend on Various Activities in a Typical Week

MATHEMATICS 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	r	13 (0.6)	r	11 (0.6)	r	4 (0.3)	r	4 (0.3)
Australia		9 (0.4)		7 (0.4)		7 (0.6)		3 (0.4)
Bahrain		12 (0.3)		13 (0.5)		6 (0.5)		6 (0.3)
Belgium (Flemish)		16 (0.8)		11 (0.4)		4 (0.3)		2 (0.2)
Botswana	r	11 (0.8)	r	10 (0.7)	r	6 (0.5)	r	5 (0.4)
Bulgaria		17 (0.9)		8 (0.5)		3 (0.4)		2 (0.3)
Chile		14 (0.7)		11 (0.5)		6 (0.4)		3 (0.3)
Chinese Taipei		9 (0.4)		10 (0.4)		4 (0.3)		3 (0.3)
Cyprus	r	12 (0.4)	r	10 (0.5)	r	5 (0.2)	r	2 (0.2)
Egypt		15 (0.8)		11 (0.4)		6 (0.3)		7 (0.4)
Estonia		11 (0.5)		13 (0.6)		3 (0.3)		2 (0.3)
Ghana	r	12 (0.7)	r	12 (0.4)	r	7 (0.4)	r	6 (0.3)
Hong Kong, SAR		9 (0.7)		6 (0.3)		4 (0.5)		4 (0.4)
Hungary		10 (0.4)		10 (0.4)		3 (0.3)		3 (0.3)
Indonesia	r	12 (0.5)	r	12 (0.7)	r	3 (0.4)	r	3 (0.5)
Iran, Islamic Rep. of		15 (0.7)		11 (0.5)		6 (0.3)		6 (0.6)
Israel	r	11 (0.4)	r	10 (0.5)	r	5 (0.5)	r	3 (0.3)
Italy		13 (0.4)		11 (0.5)		4 (0.3)		2 (0.3)
Japan		15 (0.9)		6 (0.4)		2 (0.2)		2 (0.4)
Jordan		11 (0.5)		9 (0.4)		6 (0.4)		6 (0.5)
Korea, Rep. of	s	9 (0.4)	s	8 (0.4)	s	5 (0.3)	s	3 (0.5)
Latvia	r	11 (0.6)	r	15 (0.7)	r	2 (0.2)	r	4 (0.4)
Lebanon	s	10 (0.6)	s	11 (0.6)	s	4 (0.4)	s	4 (0.4)
Lithuania		11 (0.7)		14 (0.6)		1 (0.2)		2 (0.2)
Macedonia, Rep. of		6 (0.4)		8 (0.4)		3 (0.3)		4 (0.3)
Malaysia		9 (0.5)		8 (0.4)		6 (0.4)		6 (0.4)
Moldova, Rep. of	s	11 (0.8)	s	14 (0.8)	s	4 (0.7)	s	5 (0.6)
Morocco		x x		x x		x x		x x
Netherlands		7 (0.5)		8 (0.5)		5 (0.5)		4 (0.4)
New Zealand		9 (0.4)		8 (0.4)		7 (0.5)		4 (0.5)
Norway		10 (0.4)		6 (0.3)		4 (0.3)		3 (0.4)
Palestinian Nat'l Auth.	r	11 (0.5)	r	9 (0.3)	r	6 (0.3)	r	6 (0.4)
Philippines	r	11 (0.5)	r	16 (0.7)	r	7 (0.3)	r	6 (0.4)
Romania		10 (0.4)		9 (0.5)		3 (0.3)		2 (0.2)
Russian Federation		8 (0.4)		18 (0.5)		1 (0.2)		3 (0.3)
Saudi Arabia	r	23 (2.2)	r	12 (1.0)	r	6 (0.4)	r	7 (0.8)
Scotland	r	8 (0.5)	r	4 (0.3)	r	6 (0.5)	r	3 (0.5)
Serbia		9 (0.5)		7 (0.4)		3 (0.3)		5 (0.5)
Singapore		9 (0.3)		8 (0.3)		6 (0.4)		4 (0.4)
Slovak Republic		13 (0.5)		12 (0.4)		3 (0.3)		3 (0.3)
Slovenia		10 (0.6)		6 (0.3)		2 (0.2)		4 (0.4)
South Africa	s	11 (0.6)	s	12 (0.6)	s	7 (0.4)	s	5 (0.4)
Sweden		9 (0.3)		6 (0.3)		3 (0.3)		3 (0.4)
Tunisia	r	14 (0.8)	r	13 (0.7)	r	4 (0.4)	r	4 (0.5)
United States		11 (0.3)		11 (0.4)		5 (0.3)		4 (0.4)
‡ England	s	11 (0.6)	s	4 (0.4)	s	7 (0.6)	s	4 (0.8)
International Avg.		11 (0.1)		10 (0.1)		5 (0.1)		4 (0.1)
Benchmarking Participants								
Basque Country, Spain		10 (0.7)		9 (0.6)		4 (0.4)		3 (0.5)
Indiana State, US		10 (0.6)		10 (0.7)		6 (0.6)		4 (0.7)
Ontario Province, Can.		10 (0.5)		11 (0.6)		5 (0.4)		3 (0.4)
Quebec Province, Can.		9 (0.4)		9 (0.5)		5 (0.4)		3 (0.4)

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 7.10: Percentage of Time in Mathematics Lessons Students Spend on Various Activities in a Typical Week

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 (0.5)	s	12 (0.7)	s	24 (1.1)	s	20 (0.8)
Australia		6 (0.4)		12 (0.8)		27 (1.1)		25 (1.0)
Belgium (Flemish)		6 (0.4)		18 (0.6)		19 (0.6)		32 (1.1)
Chinese Taipei		10 (0.4)		33 (1.3)		16 (0.6)		11 (0.7)
Cyprus		14 (0.5)		12 (0.5)		22 (0.6)		21 (0.7)
England	r	6 (0.4)	r	18 (1.2)	r	24 (1.2)	r	27 (1.1)
Hong Kong, SAR		7 (0.4)		37 (1.3)		17 (0.7)		15 (0.8)
Hungary	r	8 (0.4)	r	12 (0.8)	r	27 (0.8)	r	27 (0.8)
Iran, Islamic Rep. of		13 (0.6)		13 (0.6)		17 (0.7)		14 (0.7)
Italy		11 (0.4)		24 (0.6)		13 (0.4)		14 (0.4)
Japan		5 (0.3)		19 (0.9)		32 (1.1)		16 (1.0)
Latvia		7 (0.5)		10 (0.7)		22 (0.8)		27 (0.9)
Lithuania		8 (0.3)		6 (0.4)		24 (0.8)		33 (1.0)
Moldova, Rep. of	r	10 (0.5)	r	12 (0.6)	r	20 (1.0)	r	18 (0.8)
Morocco		x x		x x		x x		x x
Netherlands	r	3 (0.3)	r	14 (0.9)	r	20 (1.2)	r	37 (1.4)
New Zealand		4 (0.3)		10 (0.5)		28 (1.1)		27 (0.9)
Norway		7 (0.4)		15 (0.5)		23 (1.3)		35 (1.6)
Philippines		9 (0.4)		18 (0.8)		17 (0.7)		17 (0.8)
Russian Federation		9 (0.3)		14 (0.6)		21 (0.7)		23 (0.6)
Scotland	s	6 (0.4)	s	21 (0.9)	s	20 (1.4)	s	31 (1.8)
Singapore		14 (0.6)		21 (1.0)		17 (0.8)		17 (0.7)
Slovenia	r	9 (0.4)	r	14 (0.8)	r	23 (1.0)	r	29 (1.2)
Tunisia	r	14 (1.0)	r	9 (1.0)	r	25 (1.6)	s	18 (1.1)
United States		10 (0.4)		16 (0.4)		23 (0.7)		22 (0.7)
International Avg.		8 (0.1)		16 (0.2)		22 (0.2)		23 (0.2)
Benchmarking Participants								
Indiana State, US		10 (0.8)		18 (1.2)		25 (1.4)		21 (1.6)
Ontario Province, Can.		13 (0.7)		16 (0.8)		21 (1.1)		21 (1.1)
Quebec Province, Can.		7 (0.3)		20 (0.9)		21 (1.0)		20 (0.9)

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.

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 7.10: Percentage of Time in Mathematics Lessons Students Spend on Various Activities in a Typical Week

MATHEMATICS Grade 4

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 13 (0.7)	s 12 (0.6)	s 5 (0.4)	s 5 (0.5)
Australia	13 (0.6)	7 (0.4)	5 (0.5)	r 5 (0.6)
Belgium (Flemish)	11 (0.6)	8 (0.3)	3 (0.2)	3 (0.3)
Chinese Taipei	12 (0.4)	9 (0.4)	4 (0.2)	4 (0.3)
Cyprus	13 (0.5)	10 (0.4)	5 (0.3)	6 (0.6)
England	r 12 (0.6)	s 5 (0.4)	s 4 (0.3)	s 5 (0.7)
Hong Kong, SAR	9 (0.5)	6 (0.3)	4 (0.3)	6 (0.4)
Hungary	r 12 (0.6)	r 8 (0.6)	r 3 (0.3)	r 5 (0.6)
Iran, Islamic Rep. of	15 (0.8)	12 (0.6)	8 (0.4)	9 (0.6)
Italy	14 (0.4)	14 (0.5)	6 (0.3)	5 (0.4)
Japan	15 (0.7)	10 (0.4)	1 (0.2)	2 (0.6)
Latvia	11 (0.5)	15 (0.6)	2 (0.2)	r 6 (0.7)
Lithuania	11 (0.6)	13 (0.6)	3 (0.3)	2 (0.3)
Moldova, Rep. of	r 12 (0.6)	r 16 (0.7)	r 6 (0.5)	r 7 (0.5)
Morocco	x x	x x	x x	x x
Netherlands	r 12 (0.7)	r 7 (0.8)	r 3 (0.3)	r 4 (0.6)
New Zealand	14 (0.7)	7 (0.3)	4 (0.2)	6 (0.6)
Norway	10 (0.4)	5 (0.3)	3 (0.2)	3 (0.3)
Philippines	12 (0.7)	15 (0.8)	8 (0.5)	6 (0.3)
Russian Federation	9 (0.4)	18 (0.6)	1 (0.2)	5 (0.5)
Scotland	s 9 (0.5)	s 5 (0.3)	s 4 (0.3)	s 4 (0.5)
Singapore	11 (0.4)	8 (0.4)	6 (0.3)	5 (0.5)
Slovenia	r 10 (0.4)	r 9 (0.6)	r 3 (0.3)	r 4 (0.4)
Tunisia	r 14 (1.0)	s 12 (0.6)	r 5 (0.4)	s 6 (0.7)
United States	11 (0.3)	9 (0.3)	5 (0.3)	5 (0.4)
International Avg.	12 (0.1)	10 (0.1)	4 (0.1)	5 (0.1)
Benchmarking Participants				
Indiana State, US	11 (0.6)	9 (0.5)	4 (0.6)	4 (0.6)
Ontario Province, Can.	12 (0.5)	8 (0.6)	6 (0.5)	4 (0.5)
Quebec Province, Can.	12 (0.8)	7 (0.4)	7 (0.5)	7 (1.1)

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.

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.

How Are Calculators and Computers Used?

Exhibit 7.11 shows the number of countries with national policies on calculator use, the percentages of students not permitted to use calculators in mathematics class, and the percentages of students using calculators for various activities in about half of the lessons or more. At the eighth grade, 29 countries and all four benchmarking participants reported that their official curriculum contained statements about using calculators. According to their teachers, the percentages of students not permitted to use calculators varied dramatically from country to country. More than half the eighth-grade students were not permitted to use calculators in Bahrain, Cyprus, Ghana, Iran, Jordan, Romania, and Saudi Arabia. The countries permitting calculator use for essentially all eighth-grade students (98% or more) included Egypt, Hong Kong SAR, Lithuania, Morocco, the Netherlands, Norway, the Palestinian National Authority, Scotland, Sweden, and England. The percentages of eighth-grade students asked to use calculators in at least half of their lessons for each of four different activities reveal that, on average, internationally, teachers asked the most students to use calculators for checking answers (27%), performing routine computations (29%), and solving complex problems (31%). Only 14 percent, on average, were asked to explore number concepts.

At the fourth grade, 14 participants reported that their national or regional mathematics curriculum contained statements about using calculators. Compared to eighth grade, teachers in the TIMSS countries reported that greater percentages of fourth-grade students were not permitted to use calculators – 57 percent, on average. The countries permitting widespread calculator usage (90% of the students or more) at the fourth grade included Australia, Cyprus, England, New Zealand, and Scotland. However, even in those countries, teachers reported asking relatively small percentages of students to do any calculator activities in half the lessons or more.

Countries' reports on computer use in mathematics class are presented in Exhibit 7.12. Across countries, 26 participants at the eighth grade and 12 at the fourth grade reported that their mathematics curriculum contained statements about computer use, nearly as many as reported statements about calculator use. Yet, access to computers remains a challenge in many countries. Teachers reported that, on average, internationally, computers were not available for 68 percent of the eighth-grade students and 58 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.

Exhibit 7.11: Emphasis on Calculators in Mathematics Class

Countries	National Curriculum Contains Policies / Statements About the Use of Calculators	Percentage of Students Whose Teachers Reported That Calculators Are Not Permitted	Percentage of Students Whose Teachers Reported on Calculator Use About Half of the Lessons or More			
			Checking Answers	Doing Routine Computations	Solving Complex Problems	Exploring Number Concepts
Armenia	○	r 8 (2.5)	r 23 (3.2)	r 35 (3.9)	r 32 (3.9)	r 18 (3.5)
Australia	●	4 (2.2)	62 (4.5)	74 (4.1)	56 (4.7)	25 (3.6)
Bahrain	○	69 (2.6)	10 (1.1)	4 (1.0)	11 (2.2)	6 (1.2)
Belgium (Flemish)	●	3 (1.4)	32 (3.6)	27 (3.1)	61 (3.8)	18 (2.8)
Botswana	●	37 (4.5)	7 (2.1)	8 (2.5)	9 (2.4)	5 (1.9)
Bulgaria	○	29 (4.1)	9 (2.7)	11 (2.6)	10 (2.2)	2 (1.5)
Chile	●	14 (2.5)	38 (3.4)	22 (3.0)	33 (3.6)	23 (3.4)
Chinese Taipei	●	34 (4.0)	2 (1.3)	4 (1.6)	8 (2.4)	6 (2.0)
Cyprus	○	65 (2.8)	7 (1.8)	8 (1.4)	6 (1.7)	2 (1.2)
Egypt	●	0 (0.0)	46 (4.0)	64 (4.1)	52 (4.1)	36 (3.9)
Estonia	●	5 (1.7)	59 (3.9)	65 (4.1)	51 (4.2)	18 (3.4)
Ghana	●	r 61 (5.0)	5 (2.0)	4 (1.7)	7 (2.4)	4 (2.0)
Hong Kong, SAR	○	2 (1.1)	49 (4.4)	66 (4.4)	50 (4.6)	13 (3.1)
Hungary	●	19 (3.1)	29 (3.7)	23 (3.4)	33 (3.9)	9 (2.3)
Indonesia	○	28 (4.0)	8 (2.4)	7 (2.3)	19 (3.4)	7 (2.3)
Iran, Islamic Rep. of	○	52 (4.1)	8 (2.1)	5 (1.7)	10 (2.4)	3 (1.5)
Israel	●	8 (2.2)	50 (3.7)	53 (4.1)	47 (3.8)	28 (3.2)
Italy	●	16 (2.9)	40 (4.2)	45 (3.9)	55 (4.0)	11 (2.3)
Japan	●	37 (4.1)	0 (0.0)	2 (1.2)	1 (0.9)	3 (1.6)
Jordan	●	55 (4.4)	4 (1.7)	6 (2.1)	14 (3.5)	3 (1.4)
Korea, Rep. of	●	s 35 (3.3)	s 2 (1.3)	s 2 (1.2)	s 3 (1.0)	s 2 (0.8)
Latvia	○	47 (4.5)	10 (2.7)	8 (2.4)	7 (2.0)	5 (1.7)
Lebanon	○	6 (1.8)	46 (4.5)	39 (4.4)	34 (4.1)	26 (3.8)
Lithuania	●	1 (0.7)	59 (3.7)	60 (3.8)	68 (3.5)	17 (2.9)
Macedonia, Rep. of	○	24 (3.7)	19 (3.4)	19 (3.0)	19 (3.3)	9 (2.3)
Malaysia	○	46 (3.9)	14 (2.7)	12 (2.6)	23 (3.7)	10 (2.4)
Moldova, Rep. of	○	s 15 (3.4)	r 24 (4.2)	r 23 (3.9)	r 23 (3.5)	r 22 (3.8)
Morocco	○	s 1 (1.1)	s 15 (4.8)	s 10 (4.0)	s 13 (4.1)	s 15 (5.0)
Netherlands	●	0 (0.0)	72 (4.3)	94 (2.3)	75 (4.1)	42 (4.8)
New Zealand	●	4 (2.5)	60 (4.8)	77 (3.2)	64 (5.4)	42 (4.5)
Norway	●	0 (0.0)	72 (3.6)	77 (3.8)	68 (4.0)	21 (3.4)
Palestinian Nat'l Auth.	●	1 (0.7)	24 (4.0)	21 (3.9)	39 (4.1)	8 (2.4)
Philippines	○	28 (4.1)	10 (2.0)	6 (2.1)	16 (3.4)	13 (2.9)
Romania	●	52 (4.1)	4 (1.6)	6 (1.7)	0 (0.0)	0 (0.0)
Russian Federation	●	20 (2.4)	20 (2.6)	13 (2.3)	19 (3.2)	5 (1.5)
Saudi Arabia	○	r 59 (4.6)	10 (3.3)	4 (2.0)	9 (3.1)	2 (1.0)
Scotland	●	2 (1.4)	11 (2.3)	22 (3.8)	37 (5.2)	12 (3.2)
Serbia	●	36 (4.2)	19 (3.4)	22 (3.4)	17 (3.2)	11 (2.7)
Singapore	●	0 (0.0)	63 (2.4)	63 (2.1)	65 (2.5)	32 (2.2)
Slovak Republic	○	— —	r 36 (4.6)	r 38 (4.5)	r 22 (4.0)	r 9 (2.8)
Slovenia	●	40 (4.4)	9 (2.5)	9 (2.3)	13 (2.7)	3 (1.4)
South Africa	●	r 6 (1.8)	21 (3.3)	18 (2.5)	32 (3.4)	23 (3.1)
Sweden	●	1 (0.4)	43 (3.5)	70 (3.7)	55 (4.0)	13 (2.1)
Tunisia	○	r 44 (4.6)	6 (2.0)	8 (2.4)	5 (1.9)	8 (2.4)
United States	●	6 (1.4)	55 (3.1)	52 (2.6)	69 (2.7)	48 (3.0)
‡ England	●	r 0 (0.0)	r 42 (6.7)	r 35 (5.4)	r 51 (6.3)	r 16 (4.1)
International Avg.		23 (0.5)	27 (0.5)	29 (0.5)	31 (0.5)	14 (0.4)
Benchmarking Participants						
Basque Country, Spain	●	27 (4.3)	24 (4.3)	27 (4.6)	48 (5.2)	16 (3.3)
Indiana State, US	●	14 (3.9)	51 (5.9)	40 (4.4)	62 (5.7)	42 (6.8)
Ontario Province, Can.	●	1 (1.0)	62 (4.5)	56 (4.6)	75 (4.4)	44 (4.7)
Quebec Province, Can.	●	0 (0.0)	91 (2.2)	86 (4.0)	87 (3.7)	49 (4.5)

● 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 7.11: **Emphasis on Calculators in Mathematics Class**

MATHEMATICS Grade 4

Countries	National Curriculum Contains Policies / Statements About the Use of Calculators	Percentage of Students Whose Teachers Reported That Calculators Are Not Permitted	Percentage of Students Whose Teachers Reported on Calculator Use About Half of the Lessons or More			
			Checking Answers	Doing Routine Computations	Solving Complex Problems	Exploring Number Concepts
Armenia	○	s 74 (3.8)	r 3 (1.0)	r 4 (1.4)	r 2 (0.8)	r 5 (1.7)
Australia	●	6 (2.4)	15 (3.3)	5 (1.9)	13 (2.6)	11 (2.9)
Belgium (Flemish)	○	29 (3.8)	9 (2.1)	2 (0.7)	9 (2.2)	1 (0.5)
Chinese Taipei	○	54 (4.3)	0 (0.0)	1 (1.0)	4 (1.7)	3 (1.4)
Cyprus	●	3 (1.3)	21 (3.3)	16 (3.2)	15 (3.3)	24 (3.6)
England	●	r 1 (0.6)	r 18 (4.2)	r 7 (2.7)	r 22 (4.4)	r 14 (3.7)
Hong Kong, SAR	○	87 (3.0)	0 (0.0)	1 (0.9)	1 (0.9)	2 (1.1)
Hungary	○	87 (2.9)	1 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Iran, Islamic Rep. of	○	82 (4.0)	0 (0.1)	0 (0.1)	0 (0.1)	1 (0.0)
Italy	●	88 (2.3)	1 (0.9)	2 (0.7)	1 (0.4)	1 (0.0)
Japan	●	32 (3.7)	0 (0.0)	1 (0.0)	3 (1.4)	1 (1.0)
Latvia	○	95 (1.8)	0 (0.0)	0 (0.0)	1 (0.5)	1 (0.5)
Lithuania	●	69 (3.6)	1 (0.6)	0 (0.0)	4 (1.4)	2 (1.1)
Moldova, Rep. of	○	r 66 (4.6)	r 4 (1.6)	r 4 (1.7)	r 7 (2.5)	r 3 (1.5)
Morocco	○	x x	x x	x x	x x	x x
Netherlands	●	61 (4.8)	1 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
New Zealand	●	4 (1.3)	11 (2.0)	3 (1.1)	13 (2.2)	7 (1.6)
Norway	●	10 (2.7)	3 (1.2)	1 (0.5)	2 (1.0)	2 (0.9)
Philippines	○	96 (1.7)	1 (0.7)	1 (0.7)	0 (0.0)	0 (0.0)
Russian Federation	○	89 (2.2)	2 (1.1)	1 (0.6)	0 (0.0)	1 (0.8)
Scotland	●	s 9 (2.4)	r 2 (1.6)	r 0 (0.0)	r 5 (2.0)	r 4 (1.7)
Singapore	○	97 (1.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Slovenia	○	95 (2.0)	0 (0.0)	1 (0.0)	1 (1.0)	0 (0.0)
Tunisia	○	r 97 (1.6)	r 4 (1.9)	r 3 (1.5)	r 5 (2.0)	r 2 (1.3)
United States	●	r 31 (2.6)	7 (1.4)	2 (0.8)	9 (1.8)	6 (1.4)
International Avg.		57 (0.6)	4 (0.3)	2 (0.2)	5 (0.4)	4 (0.3)
Benchmarking Participants						
Indiana State, US	●	40 (5.9)	6 (2.5)	1 (0.8)	4 (1.6)	3 (1.6)
Ontario Province, Can.	●	20 (3.8)	5 (2.1)	3 (2.2)	15 (3.8)	7 (2.5)
Quebec Province, Can.	●	38 (4.3)	9 (2.6)	1 (0.8)	8 (2.6)	2 (1.4)

● 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.

Exhibit 7.12: Computer Use in Mathematics 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			
			Discovering Principles and Concepts	Practicing Skills and Procedures	Looking up Ideas and Information	Processing and Analyzing Data
Armenia	○	r 80 (3.4)	r 0 (0.4)	r 3 (1.8)	r 1 (0.7)	r 1 (0.9)
Australia	●	46 (4.2)	0 (0.4)	1 (0.4)	1 (0.6)	0 (0.0)
Bahrain	○	65 (3.5)	1 (0.6)	1 (0.7)	3 (1.1)	5 (1.3)
Belgium (Flemish)	●	52 (3.8)	1 (1.0)	1 (0.9)	1 (0.9)	1 (0.8)
Botswana	●	r 93 (2.6)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.5)
Bulgaria	○	91 (2.2)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.0)
Chile	○	48 (3.8)	1 (0.8)	2 (0.8)	9 (2.1)	7 (2.0)
Chinese Taipei	●	71 (3.3)	0 (0.0)	0 (0.0)	1 (1.0)	1 (1.0)
Cyprus	○	92 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Egypt	●	– –	– –	– –	– –	– –
Estonia	●	69 (3.8)	0 (0.0)	0 (0.0)	0 (0.0)	2 (1.0)
Ghana	●	85 (3.5)	0 (0.0)	1 (0.0)	1 (0.9)	2 (1.1)
Hong Kong, SAR	○	61 (4.3)	0 (0.4)	0 (0.0)	1 (0.9)	3 (1.5)
Hungary	●	73 (3.5)	1 (0.7)	1 (1.0)	1 (0.7)	1 (0.7)
Indonesia	○	89 (2.5)	1 (0.7)	2 (1.3)	1 (0.8)	1 (0.8)
Iran, Islamic Rep. of	○	98 (0.9)	1 (0.0)	1 (0.0)	1 (0.0)	1 (0.0)
Israel	●	53 (3.8)	5 (1.3)	9 (2.1)	3 (1.0)	7 (1.8)
Italy	○	68 (3.6)	0 (0.3)	1 (0.6)	0 (0.0)	1 (0.8)
Japan	●	14 (3.2)	2 (1.2)	1 (0.9)	1 (1.0)	1 (0.7)
Jordan	●	89 (2.8)	0 (0.0)	1 (1.0)	0 (0.0)	1 (0.0)
Korea, Rep. of	●	s 27 (3.4)	s 17 (2.6)	s 7 (1.7)	s 11 (2.3)	s 6 (2.0)
Latvia	○	77 (4.1)	0 (0.0)	0 (0.4)	0 (0.0)	1 (0.5)
Lebanon	○	76 (3.8)	8 (2.4)	8 (2.4)	6 (2.3)	10 (3.2)
Lithuania	○	30 (3.6)	0 (0.0)	3 (1.5)	3 (1.3)	3 (1.7)
Macedonia, Rep. of	○	96 (1.4)	0 (0.0)	1 (0.5)	0 (0.0)	0 (0.0)
Malaysia	○	95 (1.7)	1 (0.7)	0 (0.5)	0 (0.5)	0 (0.0)
Moldova, Rep. of	○	r 72 (3.7)	r 13 (3.6)	r 14 (3.2)	r 12 (2.9)	r 14 (3.1)
Morocco	○	x x	x x	x x	x x	x x
Netherlands	●	70 (4.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
New Zealand	●	29 (4.6)	1 (0.3)	0 (0.3)	1 (0.6)	1 (0.6)
Norway	●	45 (4.1)	1 (0.5)	1 (0.9)	3 (1.4)	3 (1.3)
Palestinian Nat'l Auth.	●	71 (4.1)	3 (1.4)	3 (1.3)	2 (1.2)	0 (0.0)
Philippines	○	90 (2.9)	2 (1.4)	2 (1.4)	3 (1.6)	2 (1.4)
Romania	○	88 (2.7)	0 (0.0)	1 (0.5)	1 (0.8)	0 (0.0)
Russian Federation	○	89 (2.6)	1 (0.5)	1 (0.6)	1 (0.5)	1 (0.7)
Saudi Arabia	○	81 (3.6)	1 (0.9)	3 (1.5)	5 (1.7)	3 (1.3)
Scotland	●	60 (4.8)	2 (1.0)	2 (1.0)	0 (0.0)	0 (0.0)
Serbia	●	92 (2.4)	3 (1.7)	3 (1.5)	3 (1.5)	3 (1.5)
Singapore	●	33 (2.7)	3 (1.0)	4 (1.0)	3 (0.9)	3 (0.8)
Slovak Republic	○	75 (3.5)	0 (0.0)	1 (0.6)	0 (0.0)	0 (0.0)
Slovenia	●	62 (4.1)	0 (0.1)	1 (1.0)	0 (0.1)	1 (0.2)
South Africa	○	r 85 (2.7)	3 (1.4)	3 (1.2)	3 (1.2)	2 (1.1)
Sweden	●	54 (3.6)	0 (0.0)	2 (0.9)	1 (0.7)	1 (0.5)
Tunisia	○	77 (3.5)	3 (0.8)	3 (0.8)	4 (1.3)	5 (1.3)
United States	○	54 (3.0)	2 (0.7)	4 (1.0)	3 (1.0)	2 (0.7)
‡ England	●	r 34 (6.6)	r 1 (0.8)	r 5 (2.9)	r 2 (1.4)	r 1 (1.3)
International Avg.		68 (0.5)	2 (0.2)	2 (0.2)	2 (0.2)	2 (0.2)
Benchmarking Participants						
Basque Country, Spain	●	65 (4.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Indiana State, US	●	49 (5.9)	2 (1.5)	4 (2.0)	1 (1.1)	2 (1.5)
Ontario Province, Can.	●	54 (5.2)	1 (0.0)	2 (1.2)	4 (1.5)	5 (1.9)
Quebec Province, Can.	●	89 (2.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

● 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. An "x" indicates data are available for less than 50% of the students.

Exhibit 7.12: **Computer Use in Mathematics Class**

MATHEMATICS 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		
			Discovering Principles and Concepts	Practicing Skills and Procedures	Looking up Ideas and Information
Armenia	○	r 88 (2.6)	r 0 (0.0)	r 0 (0.0)	r 1 (0.6)
Australia	●	24 (3.6)	5 (2.3)	8 (2.4)	3 (1.7)
Belgium (Flemish)	○	33 (3.4)	0 (0.3)	9 (2.2)	1 (0.2)
Chinese Taipei	●	84 (3.3)	1 (0.0)	1 (0.0)	1 (0.6)
Cyprus	○	19 (3.3)	2 (1.2)	7 (2.1)	6 (1.8)
England	●	r 19 (3.4)	r 4 (1.9)	r 5 (2.3)	r 2 (1.4)
Hong Kong, SAR	○	47 (4.4)	1 (1.0)	1 (1.1)	0 (0.0)
Hungary	○	86 (3.3)	1 (0.9)	3 (1.4)	2 (1.1)
Iran, Islamic Rep. of	○	98 (1.1)	0 (0.0)	0 (0.0)	0 (0.0)
Italy	●	75 (3.1)	0 (0.0)	0 (0.3)	0 (0.0)
Japan	●	16 (3.2)	0 (0.0)	1 (0.7)	1 (0.7)
Latvia	○	89 (2.9)	0 (0.0)	0 (0.0)	0 (0.3)
Lithuania	○	87 (2.5)	0 (0.2)	3 (1.3)	0 (0.0)
Moldova, Rep. of	○	r 94 (2.1)	r 1 (0.0)	r 2 (1.2)	r 1 (0.0)
Morocco	○	x x	x x	x x	x x
Netherlands	○	24 (3.5)	11 (3.0)	31 (4.4)	1 (0.0)
New Zealand	●	30 (3.1)	1 (0.5)	4 (1.4)	1 (0.6)
Norway	●	41 (4.5)	1 (0.6)	3 (2.2)	0 (0.0)
Philippines	○	95 (2.3)	1 (0.0)	2 (1.1)	2 (1.1)
Russian Federation	○	96 (1.2)	1 (0.4)	1 (0.4)	2 (0.7)
Scotland	●	r 19 (3.8)	r 0 (0.3)	r 2 (1.1)	r 0 (0.3)
Singapore	●	21 (3.3)	6 (1.9)	14 (3.0)	4 (1.5)
Slovenia	○	76 (3.7)	0 (0.0)	1 (0.8)	0 (0.0)
Tunisia	○	r 89 (2.9)	2 (1.2)	5 (1.9)	10 (2.7)
United States	○	40 (2.4)	3 (0.8)	7 (1.3)	3 (0.9)
International Avg.		58 (0.6)	2 (0.2)	4 (0.3)	2 (0.2)
Benchmarking Participants					
Indiana State, US	●	43 (5.3)	1 (1.1)	9 (3.4)	1 (0.8)
Ontario Province, Can.	●	43 (4.6)	1 (0.9)	3 (1.8)	2 (1.3)
Quebec Province, Can.	●	54 (4.7)	1 (0.6)	2 (1.1)	1 (1.0)

● Yes
○ No

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

Background data provided by National Research Coordinators and by teachers.

( ) 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 "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 mathematics. Exhibit 7.13 presents the index of teachers' emphasis on mathematics 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 substantial variation across countries in the emphasis placed on homework. At the eighth grade, more than 70 percent of the students in Romania and Italy were in the high category. For the majority of countries, most students were in the medium category. More than half the students were in the low category in Sweden, Belgium (Flemish), Korea, Japan, and Scotland. 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 eighth grade, there was a slight, but noticeable positive relationship between teachers assigning more homework and students having higher mathematics achievement. At the fourth grade, teachers reported giving homework much less frequently than at eighth grade. On average, internationally, only 14 percent of the fourth-grade students were in the high category. About half (49%) were in the medium category and 37 percent were in the low category. The fourth-grade students in the high category had the lowest mathematics achievement, on average, suggesting that homework often was being used for remedial purposes.

Exhibit 7.14 presents eighth-grade teachers' reports about how they usually use homework in their mathematics instruction. Internationally, the eighth-grade mathematics teachers reported always or

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.

almost always monitoring whether homework was completed (for 78 percent of the students, on average). For more than half the eighth-grade students, on average, teachers reported always or almost always correcting assignments and giving feedback to students, but for about one-third, on average, the students corrected their own homework in class. About one-fourth of the students, on average, had teachers that reported using homework as basis for class discussion (27%) and to contribute toward grades or marks (25%).

As shown in Exhibit 7.15, eighth-grade teachers reported substantial variation across countries in the frequency of testing in mathematics class. On average, internationally, nearly half the students (47%) reported having a mathematics test or examination every two weeks or more and another 40 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, Belgium (Flemish), Chinese Taipei, Lebanon, Lithuania, the Philippines, the Russian Federation, the Slovak Republic, and the Canadian province of Quebec. Even though the international average was low (14%) for infrequent testing, there were countries where teachers reported testing only a few time a year or more for half or more of the eighth-grade students, including Scotland, Slovenia, Sweden, and England.

Exhibit 7.16 presents eighth-grade teachers' reports about the types of test formats they use for mathematics tests in relation to average mathematics achievement. On average, internationally, more than half the eighth-grade students (56%) had teachers who used only or mostly constructed-response tests or examinations. These students had higher mathematics achievement, on average, than did students whose teachers used some constructed-response and multiple-choice items or only multiple-choice items. However, very few students (12%, on average) had teachers who reported using only or mostly multiple-choice testing.

Exhibit 7.13: **Index of Teachers' Emphasis on Mathematics Homework (EMH)**

MATHEMATICS Grade 8

Index of Teachers' Emphasis on Mathematics Homework

Index based on teachers' responses to two questions about how often they usually assign mathematics homework and how many minutes of mathematics 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 EMH		Medium EMH		Low EMH	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Romania	78 (3.3)	478 (5.5)	21 (3.3)	463 (10.1)	1 (0.7)	~ ~
Italy	71 (3.5)	482 (3.2)	25 (3.2)	489 (8.4)	4 (1.5)	480 (11.2)
Armenia r	65 (4.6)	481 (4.2)	31 (4.7)	474 (6.6)	4 (2.1)	467 (11.5)
Iran, Islamic Rep. of	63 (4.4)	417 (3.2)	26 (4.0)	406 (7.2)	12 (2.8)	399 (9.3)
Malaysia	60 (4.5)	508 (5.0)	34 (4.2)	515 (8.5)	5 (1.9)	466 (10.1)
Singapore	59 (2.4)	620 (4.2)	33 (2.5)	592 (6.6)	8 (1.3)	563 (13.1)
Russian Federation	56 (3.5)	514 (4.3)	43 (3.5)	499 (4.7)	1 (0.5)	~ ~
Morocco s	54 (6.2)	391 (5.9)	37 (6.4)	383 (5.2)	9 (4.1)	389 (11.1)
Bulgaria	53 (4.2)	483 (6.1)	38 (4.2)	467 (7.7)	9 (2.5)	469 (15.6)
Israel	50 (3.8)	501 (5.4)	44 (4.1)	500 (6.1)	6 (1.7)	438 (17.8)
Lebanon	49 (4.6)	433 (4.6)	45 (4.4)	436 (5.8)	6 (1.9)	401 (13.1)
Ghana	48 (5.0)	271 (7.9)	37 (5.0)	275 (7.1)	15 (3.0)	284 (10.2)
Indonesia	45 (3.9)	421 (7.4)	45 (4.4)	402 (9.4)	10 (2.6)	412 (15.3)
Botswana	44 (4.6)	364 (4.0)	49 (4.5)	368 (4.0)	7 (2.5)	379 (7.0)
Moldova, Rep. of r	43 (4.8)	451 (6.1)	52 (5.0)	463 (7.9)	5 (1.9)	468 (10.1)
Cyprus	35 (3.1)	455 (3.2)	65 (3.1)	462 (2.3)	0 (0.0)	~ ~
Serbia	34 (4.1)	474 (4.9)	45 (4.3)	481 (4.5)	22 (3.7)	470 (5.6)
Jordan	30 (3.8)	422 (5.5)	55 (4.4)	430 (6.3)	14 (2.8)	410 (8.6)
Palestinian Nat'l Auth.	30 (4.0)	389 (6.4)	58 (4.3)	391 (4.6)	12 (2.5)	388 (14.9)
Chinese Taipei	29 (3.9)	602 (8.6)	39 (3.9)	588 (6.3)	32 (3.9)	570 (7.6)
United States	27 (2.5)	531 (8.0)	62 (2.9)	504 (3.8)	11 (2.2)	471 (9.5)
South Africa r	26 (3.4)	266 (9.2)	54 (3.9)	267 (9.6)	20 (3.3)	250 (9.1)
Hong Kong, SAR	26 (3.7)	598 (6.0)	50 (4.6)	593 (6.0)	24 (4.0)	566 (10.0)
Norway	25 (3.4)	460 (6.5)	46 (4.3)	465 (3.8)	29 (4.3)	455 (5.0)
Philippines	24 (4.0)	358 (10.9)	61 (4.8)	384 (7.1)	15 (3.7)	377 (19.1)
Egypt	23 (3.3)	401 (8.6)	57 (3.8)	409 (4.8)	20 (3.2)	406 (8.1)
Macedonia, Rep. of	22 (3.3)	450 (8.1)	66 (3.9)	428 (5.2)	12 (2.6)	432 (13.8)
Sweden	17 (2.8)	503 (7.0)	25 (3.2)	506 (6.0)	59 (3.7)	494 (4.0)
Latvia	17 (2.9)	523 (8.8)	75 (3.8)	505 (3.5)	9 (2.6)	500 (11.7)
Bahrain	15 (2.5)	389 (6.1)	72 (3.7)	404 (2.3)	14 (3.1)	396 (8.7)
Saudi Arabia	14 (3.0)	331 (8.9)	69 (3.9)	332 (4.6)	17 (3.0)	346 (15.0)
Lithuania	13 (2.7)	512 (7.7)	76 (3.6)	501 (3.4)	11 (2.6)	477 (11.3)
Slovenia	13 (2.9)	490 (9.2)	85 (3.1)	495 (2.5)	3 (1.0)	473 (9.7)
Estonia	12 (2.3)	540 (9.9)	78 (3.2)	532 (3.3)	9 (2.5)	518 (14.1)
Tunisia	12 (2.5)	423 (9.1)	84 (3.0)	407 (2.2)	4 (1.6)	442 (11.3)
Australia	10 (3.0)	544 (19.7)	56 (4.1)	518 (5.9)	34 (3.8)	475 (9.5)
Chile	10 (2.2)	401 (14.9)	49 (3.6)	388 (5.1)	40 (3.3)	383 (5.5)
Belgium (Flemish)	9 (2.5)	555 (6.5)	30 (3.8)	555 (5.8)	60 (3.9)	529 (5.6)
Korea, Rep. of s	9 (2.1)	582 (10.8)	31 (3.6)	589 (4.7)	60 (3.5)	591 (3.5)
Hungary	8 (2.0)	532 (8.9)	90 (2.2)	530 (3.5)	2 (0.9)	~ ~
New Zealand	7 (2.1)	479 (15.6)	67 (4.1)	510 (6.6)	25 (4.2)	471 (5.3)
Netherlands	7 (2.4)	550 (15.3)	82 (3.7)	541 (4.9)	11 (3.1)	495 (14.1)
Japan	7 (2.2)	583 (23.4)	29 (3.8)	573 (6.9)	64 (3.9)	567 (2.5)
Slovak Republic	5 (1.5)	510 (12.4)	79 (2.9)	511 (4.0)	16 (2.7)	492 (6.3)
Scotland	3 (1.7)	549 (10.6)	45 (4.6)	527 (5.7)	51 (4.5)	477 (6.2)
‡ England r	24 (6.1)	528 (10.2)	21 (4.5)	519 (15.8)	56 (5.9)	493 (9.7)
International Avg.	30 (0.5)	473 (1.4)	51 (0.6)	469 (0.9)	19 (0.4)	453 (1.7)
Benchmarking Participants						
Basque Country, Spain	15 (4.0)	496 (7.1)	70 (5.2)	486 (3.3)	15 (3.3)	487 (8.6)
Indiana State, US	35 (4.4)	537 (9.3)	60 (4.2)	495 (5.5)	5 (2.0)	470 (14.4)
Ontario Province, Can.	30 (4.3)	511 (5.2)	63 (4.4)	526 (3.7)	7 (2.4)	505 (11.9)
Quebec Province, Can.	22 (4.0)	557 (8.5)	61 (5.1)	542 (4.1)	17 (3.9)	528 (6.8)

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 7.13: **Index of Teachers' Emphasis on Mathematics Homework (EMH)**

MATHEMATICS Grade 4

Countries		High EMH		Medium EMH		Low EMH	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Armenia	r	46 (4.4)	460 (6.3)	51 (4.4)	451 (5.7)	3 (1.4)	453 (28.4)
Singapore		35 (4.2)	593 (7.7)	49 (3.8)	596 (8.7)	16 (2.8)	598 (11.0)
Hong Kong, SAR		33 (4.7)	575 (5.3)	63 (4.7)	577 (4.1)	4 (1.7)	552 (8.9)
Italy		33 (3.4)	498 (7.0)	33 (3.7)	501 (7.1)	34 (3.5)	509 (4.6)
Iran, Islamic Rep. of		32 (5.0)	389 (8.7)	33 (4.6)	402 (7.5)	35 (4.6)	378 (6.0)
Moldova, Rep. of		30 (4.2)	516 (9.3)	70 (4.2)	502 (5.9)	0 (0.0)	~ ~
Russian Federation		25 (3.3)	536 (9.9)	73 (3.5)	529 (4.9)	1 (0.9)	~ ~
Cyprus		15 (2.9)	514 (6.1)	76 (3.5)	509 (2.8)	8 (2.2)	503 (8.8)
Tunisia		14 (3.3)	330 (15.6)	32 (3.8)	350 (8.7)	53 (4.2)	333 (7.0)
Chinese Taipei		11 (2.7)	555 (8.4)	52 (4.3)	568 (2.7)	37 (3.9)	561 (3.2)
Latvia		8 (1.9)	542 (8.6)	86 (2.8)	536 (3.3)	5 (2.0)	517 (15.5)
Philippines		8 (2.1)	322 (19.0)	71 (4.3)	360 (10.9)	21 (3.9)	367 (17.6)
United States		8 (1.3)	503 (8.8)	68 (2.8)	521 (2.8)	25 (2.8)	518 (5.6)
Hungary		7 (2.3)	499 (15.2)	88 (2.8)	529 (3.7)	4 (1.7)	547 (11.7)
Norway		7 (2.0)	448 (10.2)	46 (4.6)	451 (4.1)	47 (4.6)	452 (3.3)
England	r	5 (2.5)	483 (25.2)	13 (3.2)	553 (10.7)	82 (4.0)	531 (4.4)
Australia		4 (1.3)	520 (12.7)	26 (4.0)	504 (9.4)	70 (4.1)	498 (4.6)
Japan		3 (1.5)	563 (7.9)	40 (4.3)	567 (2.4)	57 (4.4)	563 (2.5)
Slovenia		3 (1.6)	480 (9.7)	87 (2.5)	479 (2.9)	10 (2.1)	474 (10.0)
Belgium (Flemish)		2 (1.0)	~ ~	10 (2.4)	544 (4.4)	88 (2.6)	551 (2.0)
Lithuania		2 (1.0)	~ ~	73 (2.5)	538 (3.3)	25 (2.4)	519 (5.8)
Scotland	s	1 (0.6)	~ ~	20 (4.3)	503 (6.1)	80 (4.4)	491 (4.3)
New Zealand		1 (0.4)	~ ~	11 (2.4)	500 (10.7)	88 (2.5)	494 (2.7)
Netherlands		0 (0.0)	~ ~	2 (1.4)	~ ~	98 (1.4)	542 (2.4)
Morocco		x x	x x	x x	x x	x x	x x
International Avg.		14 (0.6)	491 (2.7)	49 (0.7)	503 (1.4)	37 (0.6)	498 (2.1)
Benchmarking Participants							
Indiana State, US		10 (3.7)	523 (8.0)	75 (5.4)	537 (4.2)	15 (4.3)	521 (6.0)
Ontario Province, Can.		6 (2.5)	472 (10.2)	42 (4.5)	513 (8.0)	53 (4.8)	513 (3.4)
Quebec Province, Can.		8 (2.6)	500 (9.6)	18 (3.6)	503 (5.1)	74 (4.0)	508 (3.1)

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 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 7.14: Use of Mathematics 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	86 (2.6)	r	68 (3.8)	r	18 (2.9)	r	16 (2.7)	r	9 (2.1)
Australia		75 (3.4)		56 (3.6)		25 (3.7)		16 (3.2)		22 (3.3)
Bahrain		92 (2.4)		91 (2.3)		70 (1.8)		50 (3.9)		66 (2.4)
Belgium (Flemish)		88 (2.9)		83 (2.8)		24 (3.3)		7 (1.8)		22 (3.2)
Botswana		97 (1.8)		93 (2.4)		31 (4.3)		30 (3.8)		8 (1.6)
Bulgaria		79 (3.9)		53 (4.7)		7 (2.2)		22 (3.6)		3 (1.2)
Chile		79 (3.4)		72 (3.4)		59 (4.0)		37 (3.9)		20 (3.0)
Chinese Taipei		75 (3.6)		48 (4.5)		46 (3.9)		48 (4.5)		57 (4.1)
Cyprus		85 (1.9)		84 (1.8)		28 (2.1)		44 (2.6)		46 (2.4)
Egypt		80 (3.1)		72 (3.8)		31 (3.5)		37 (3.7)		42 (4.3)
Estonia		72 (3.6)		20 (3.3)		19 (3.2)		21 (3.5)		13 (2.2)
Ghana		87 (3.3)		83 (3.8)		45 (4.7)		43 (4.6)		52 (4.5)
Hong Kong, SAR		86 (3.2)		78 (3.8)		20 (3.5)		23 (3.7)		20 (3.5)
Hungary		97 (1.6)		38 (3.6)		73 (3.5)		13 (2.7)		7 (2.2)
Indonesia		92 (2.5)		85 (3.0)		22 (3.6)		14 (3.0)		37 (4.2)
Iran, Islamic Rep. of		76 (3.5)		43 (3.6)		56 (3.7)		41 (3.6)		38 (3.9)
Israel		71 (3.3)		39 (3.7)		29 (3.5)		38 (3.6)		47 (3.5)
Italy		82 (2.5)		41 (3.8)		59 (3.7)		48 (3.3)		9 (2.2)
Japan		51 (3.7)		15 (2.7)		41 (3.8)		9 (2.3)		24 (3.2)
Jordan		83 (3.0)		73 (3.6)		66 (3.9)		54 (3.8)		35 (4.2)
Korea, Rep. of	s	76 (3.0)	s	13 (2.9)	s	28 (3.4)	s	3 (1.3)	s	28 (3.2)
Latvia		80 (3.1)		57 (4.1)		11 (3.0)		9 (2.0)		26 (3.0)
Lebanon		77 (3.7)		66 (4.3)		62 (4.6)		44 (4.8)		15 (3.0)
Lithuania		67 (3.5)		26 (3.5)		8 (2.3)		6 (1.6)		6 (1.8)
Macedonia, Rep. of		69 (4.0)		54 (3.8)		24 (3.8)		27 (3.9)		42 (4.5)
Malaysia		89 (2.8)		86 (3.3)		14 (3.0)		31 (3.9)		5 (1.8)
Moldova, Rep. of	r	70 (5.0)	r	34 (4.7)	r	33 (4.0)	r	21 (4.1)	r	25 (4.5)
Morocco	s	60 (7.0)	s	79 (6.1)	s	59 (5.5)	s	41 (6.4)	s	8 (3.6)
Netherlands		44 (4.5)		39 (5.0)		69 (4.4)		13 (3.0)		4 (1.9)
New Zealand		68 (4.9)		34 (4.2)		41 (5.4)		13 (3.4)		12 (3.5)
Norway		21 (3.4)		4 (1.6)		12 (2.6)		10 (2.4)		20 (3.6)
Palestinian Nat'l Auth.		92 (2.5)		66 (3.8)		66 (3.5)		50 (4.1)		38 (4.2)
Philippines		85 (3.6)		83 (3.6)		43 (4.7)		41 (4.5)		55 (4.9)
Romania		86 (3.0)		49 (4.1)		15 (3.1)		35 (3.7)		9 (2.3)
Russian Federation		86 (3.3)		48 (3.1)		16 (2.3)		8 (1.7)		6 (1.7)
Saudi Arabia		95 (1.2)		84 (5.1)		65 (5.5)		42 (5.4)		68 (5.7)
Scotland		88 (3.0)		62 (4.6)		13 (3.0)		19 (3.7)		11 (3.0)
Serbia		77 (3.4)		38 (3.7)		21 (2.8)		22 (3.4)		11 (2.7)
Singapore		89 (1.8)		87 (1.8)		5 (1.2)		24 (2.1)		18 (1.6)
Slovak Republic		74 (4.0)		46 (4.2)		19 (3.1)		12 (2.6)		6 (2.1)
Slovenia		79 (3.7)		23 (3.2)		60 (3.8)		18 (3.6)		3 (1.5)
South Africa		85 (2.5)		80 (2.3)	r	38 (3.6)	r	38 (3.9)		30 (3.2)
Sweden		67 (3.3)		42 (3.5)		12 (2.6)		7 (1.9)		11 (2.4)
Tunisia		68 (4.2)		58 (3.8)		75 (3.5)		30 (4.0)		6 (2.1)
United States		90 (1.6)		45 (3.6)		55 (2.8)		50 (3.2)		77 (2.7)
‡ England	r	94 (2.0)	r	72 (5.4)	r	8 (2.9)	r	15 (4.4)	r	37 (6.4)
International Avg.		78 (0.5)		57 (0.6)		36 (0.5)		27 (0.5)		25 (0.5)
Benchmarking Participants										
Basque Country, Spain		79 (4.0)		54 (5.4)		86 (3.5)		29 (4.9)		62 (4.8)
Indiana State, US		97 (1.6)		42 (6.5)		58 (5.5)		55 (6.3)		80 (5.8)
Ontario Province, Can.		82 (3.6)		47 (4.9)		56 (4.8)		38 (4.7)		38 (5.0)
Quebec Province, Can.		64 (4.7)		66 (4.1)		53 (4.5)		24 (3.9)		19 (3.5)

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 7.15: **Frequency of Mathematics Tests**

MATHEMATICS Grade 8

Countries		Percentage of Students Whose Teachers Give a Mathematics Test or Examination		
		Every Two Weeks or More	About Once a Month	A Few Times a Year or Less
Armenia	r	38 (3.7)	53 (3.8)	9 (2.0)
Australia		19 (3.6)	64 (4.6)	16 (3.4)
Bahrain		85 (1.7)	15 (1.7)	0 (0.0)
Belgium (Flemish)		94 (1.7)	4 (1.5)	2 (0.9)
Botswana		17 (3.6)	81 (3.8)	1 (1.3)
Bulgaria		31 (4.2)	46 (4.1)	23 (3.1)
Chile		78 (3.3)	20 (3.2)	2 (0.9)
Chinese Taipei		99 (0.9)	1 (0.6)	1 (0.0)
Cyprus		9 (2.0)	79 (2.7)	11 (1.7)
Egypt		– –	– –	– –
Estonia		67 (4.1)	32 (4.1)	1 (0.8)
Ghana		75 (3.8)	25 (3.8)	1 (0.0)
Hong Kong, SAR		43 (4.8)	39 (4.8)	18 (3.6)
Hungary		68 (4.1)	30 (3.9)	2 (1.2)
Indonesia		45 (4.2)	47 (4.4)	9 (2.6)
Iran, Islamic Rep. of	r	34 (3.6)	34 (3.9)	31 (4.4)
Israel		57 (4.0)	34 (3.6)	9 (2.1)
Italy		31 (3.4)	67 (3.4)	2 (1.2)
Japan		17 (3.4)	38 (4.4)	45 (4.3)
Jordan		30 (3.6)	70 (3.6)	0 (0.0)
Korea, Rep. of	s	63 (3.4)	33 (3.1)	5 (1.5)
Latvia		71 (4.2)	28 (4.2)	1 (0.0)
Lebanon		83 (3.4)	17 (3.4)	0 (0.0)
Lithuania		80 (3.2)	19 (3.1)	0 (0.0)
Macedonia, Rep. of		23 (3.8)	49 (4.3)	27 (3.7)
Malaysia		5 (1.4)	48 (3.8)	47 (3.9)
Moldova, Rep. of	r	67 (4.5)	30 (4.7)	3 (1.6)
Morocco		x x	x x	x x
Netherlands		43 (4.8)	57 (4.8)	0 (0.0)
New Zealand		25 (4.4)	59 (4.6)	16 (4.0)
Norway		6 (2.5)	64 (4.4)	30 (4.0)
Palestinian Nat'l Auth.		61 (2.7)	38 (2.8)	1 (0.0)
Philippines		93 (2.4)	5 (1.9)	2 (1.4)
Romania		73 (3.9)	25 (3.7)	2 (1.2)
Russian Federation		88 (2.5)	11 (2.3)	1 (0.9)
Saudi Arabia		45 (5.8)	43 (5.8)	11 (2.8)
Scotland		14 (3.2)	31 (4.5)	55 (4.6)
Serbia		15 (2.8)	66 (4.1)	18 (3.2)
Singapore		31 (1.8)	57 (2.4)	12 (1.5)
Slovak Republic		81 (3.3)	17 (3.1)	2 (1.2)
Slovenia		2 (1.2)	47 (3.7)	51 (3.8)
South Africa	r	41 (3.8)	53 (4.0)	6 (1.6)
Sweden		1 (1.0)	28 (3.5)	70 (3.4)
Tunisia	s	21 (4.4)	74 (5.0)	6 (2.5)
United States		73 (2.6)	24 (2.7)	3 (1.1)
‡ England	r	9 (2.6)	38 (6.2)	53 (6.5)
International Avg.		47 (0.5)	40 (0.6)	14 (0.4)
Benchmarking Participants				
Basque Country, Spain		51 (4.7)	48 (4.5)	1 (1.4)
Indiana State, US		77 (4.8)	22 (4.8)	1 (0.1)
Ontario Province, Can.		84 (3.2)	15 (3.0)	1 (1.0)
Quebec Province, Can.		61 (4.2)	33 (4.2)	6 (2.4)

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 7.16: Item Formats Used by Teachers in Mathematics Tests or Examinations

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	76 (3.8)	477 (3.8)	17 (3.3)	490 (6.8)	7 (2.5)	454 (11.1)
Australia		69 (3.8)	504 (6.3)	22 (2.8)	497 (8.9)	9 (3.0)	537 (31.2)
Bahrain		41 (3.0)	405 (2.9)	52 (3.2)	397 (3.4)	7 (2.0)	395 (8.8)
Belgium (Flemish)		62 (3.5)	542 (4.3)	12 (2.5)	532 (15.7)	26 (3.8)	534 (9.0)
Botswana		23 (4.2)	370 (6.8)	48 (4.4)	370 (4.5)	29 (3.7)	360 (4.7)
Bulgaria		51 (4.7)	481 (6.5)	27 (3.6)	472 (6.7)	21 (4.0)	467 (9.3)
Chile		55 (3.6)	388 (5.2)	43 (3.4)	386 (5.3)	2 (1.1)	~ ~
Chinese Taipei		25 (3.5)	599 (8.9)	70 (3.7)	581 (5.2)	5 (1.8)	585 (20.5)
Cyprus		38 (2.5)	462 (3.0)	24 (2.4)	454 (4.7)	38 (2.0)	462 (2.4)
Egypt		– –	– –	– –	– –	– –	– –
Estonia		25 (3.4)	538 (6.7)	28 (3.6)	528 (6.8)	46 (3.8)	529 (4.0)
Ghana		25 (3.9)	279 (8.5)	75 (3.9)	271 (5.5)	1 (0.6)	~ ~
Hong Kong, SAR		72 (3.4)	576 (5.1)	27 (3.5)	611 (6.1)	1 (0.8)	~ ~
Hungary		86 (2.5)	531 (3.8)	12 (2.6)	513 (6.5)	2 (1.0)	~ ~
Indonesia		52 (4.3)	402 (7.2)	40 (4.4)	421 (9.5)	8 (2.0)	432 (16.0)
Iran, Islamic Rep. of	s	47 (5.3)	422 (5.2)	45 (4.9)	402 (6.1)	7 (2.6)	411 (13.6)
Israel		58 (3.6)	497 (4.3)	33 (3.6)	496 (8.1)	8 (2.1)	482 (13.6)
Italy		48 (4.2)	492 (3.8)	43 (4.1)	475 (5.8)	9 (2.0)	475 (7.9)
Japan		89 (2.2)	571 (2.3)	10 (2.2)	561 (6.0)	1 (1.0)	~ ~
Jordan		38 (4.5)	421 (6.4)	58 (4.7)	427 (6.3)	4 (1.7)	425 (6.0)
Korea, Rep. of	s	28 (3.3)	595 (3.6)	34 (4.0)	587 (5.1)	38 (3.6)	588 (3.6)
Latvia		81 (3.8)	508 (3.9)	16 (3.5)	511 (8.9)	3 (1.3)	501 (28.9)
Lebanon		24 (4.1)	427 (9.3)	45 (4.7)	435 (5.6)	31 (4.4)	437 (5.8)
Lithuania		85 (3.0)	505 (2.8)	15 (3.0)	477 (6.6)	0 (0.0)	~ ~
Macedonia, Rep. of		52 (4.2)	438 (5.9)	44 (3.9)	438 (5.9)	4 (1.8)	352 (28.8)
Malaysia		9 (2.4)	499 (11.0)	88 (2.8)	510 (4.5)	3 (1.5)	495 (22.9)
Moldova, Rep. of	r	29 (4.5)	462 (8.5)	32 (4.8)	459 (10.0)	39 (4.7)	452 (8.3)
Morocco		x x	x x	x x	x x	x x	x x
Netherlands		95 (1.8)	537 (4.3)	2 (1.1)	~ ~	3 (1.4)	536 (35.1)
New Zealand		72 (4.4)	495 (5.3)	17 (3.4)	487 (11.4)	10 (3.1)	530 (15.3)
Norway		72 (3.9)	461 (3.0)	24 (3.9)	458 (5.2)	4 (1.8)	476 (14.7)
Palestinian Nat'l Auth.		24 (3.4)	403 (7.0)	69 (3.9)	386 (4.4)	7 (2.1)	394 (12.9)
Philippines		37 (4.8)	374 (10.3)	62 (4.7)	381 (7.1)	1 (0.9)	~ ~
Romania		35 (4.0)	472 (8.0)	46 (4.0)	474 (7.1)	19 (2.9)	483 (12.3)
Russian Federation		78 (5.2)	505 (3.8)	21 (5.2)	519 (5.6)	1 (0.6)	~ ~
Saudi Arabia		7 (2.3)	318 (11.7)	79 (3.2)	337 (4.9)	13 (3.0)	323 (6.4)
Scotland		99 (1.1)	502 (4.2)	1 (1.1)	~ ~	0 (0.0)	~ ~
Serbia		88 (2.9)	477 (2.7)	11 (2.8)	480 (9.1)	2 (1.1)	~ ~
Singapore		85 (1.9)	607 (3.9)	4 (1.1)	577 (8.7)	11 (1.6)	603 (12.4)
Slovak Republic		92 (2.4)	506 (3.3)	7 (2.2)	534 (19.2)	1 (0.8)	~ ~
Slovenia		88 (2.4)	494 (2.4)	12 (2.4)	486 (9.2)	0 (0.2)	~ ~
South Africa	r	45 (3.7)	286 (9.7)	44 (3.6)	240 (8.8)	11 (2.4)	261 (14.7)
Sweden		84 (2.8)	500 (3.0)	11 (2.5)	494 (9.7)	5 (1.6)	478 (12.6)
Tunisia	s	8 (3.0)	413 (11.7)	20 (4.3)	412 (5.3)	72 (4.6)	412 (4.3)
United States		55 (3.3)	516 (4.2)	31 (3.1)	487 (5.7)	14 (2.0)	521 (11.0)
‡ England	s	97 (2.0)	509 (6.6)	3 (2.0)	392 (33.1)	0 (0.0)	~ ~
International Avg.		56 (0.5)	472 (0.9)	32 (0.5)	463 (1.4)	12 (0.4)	464 (2.8)
Benchmarking Participants							
Basque Country, Spain		33 (4.5)	487 (5.3)	17 (3.9)	482 (6.2)	50 (5.4)	490 (4.1)
Indiana State, US		71 (6.0)	513 (6.1)	22 (6.2)	497 (13.5)	7 (3.1)	510 (5.2)
Ontario Province, Can.	r	82 (4.0)	524 (3.8)	17 (3.9)	513 (8.2)	1 (0.1)	~ ~
Quebec Province, Can.		x x	x x	x x	x x	x x	x x

Background data provided by teachers.

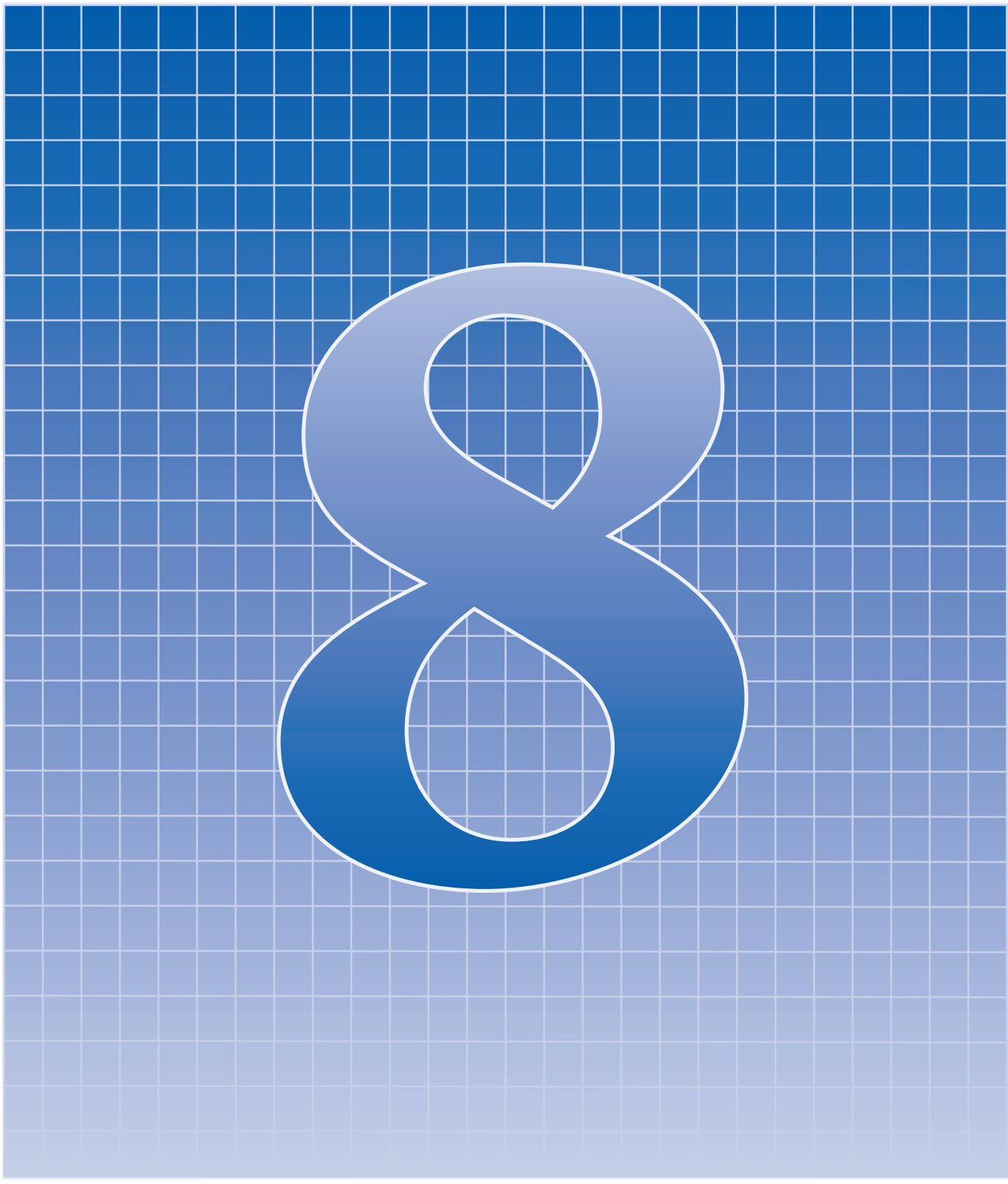
‡ Did not satisfy guidelines for sample participation rates (see Exhibit A.9).

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

A 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."

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 mathematics, 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 %) 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, mathematics achievement for students in schools with few students from economically disadvantaged homes was 57 scale-score points greater than that for students attending schools with more than half their student population from disadvantaged homes (496 vs. 439). At the fourth grade, this difference also was substantial – 47 points (515 vs. 468).

Exhibit 8.1: Principals' Reports on the Percentages of Students in Their Schools Coming from Economically Disadvantaged Homes

MATHEMATICS Grade 8

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)	462 (21.8)	21 (3.6)	480 (6.2)	29 (4.3)	484 (6.3)	47 (4.8)	476 (4.5)
Australia	32 (4.6)	521 (8.4)	35 (4.2)	518 (9.9)	23 (3.3)	487 (10.3)	9 (2.3)	473 (9.8)
Bahrain	16 (0.1)	423 (3.4)	20 (0.1)	397 (3.3)	33 (0.2)	408 (2.5)	31 (0.2)	381 (3.8)
Belgium (Flemish)	53 (3.7)	559 (4.0)	36 (3.9)	526 (5.4)	7 (2.2)	499 (21.0)	4 (1.7)	404 (24.2)
Botswana	15 (3.6)	385 (11.0)	22 (3.6)	375 (6.2)	25 (3.9)	363 (3.2)	38 (4.6)	354 (3.2)
Bulgaria	20 (3.3)	509 (12.8)	25 (4.2)	480 (12.0)	25 (3.6)	451 (6.9)	30 (3.9)	469 (6.7)
Chile	19 (2.7)	454 (9.9)	12 (2.2)	403 (9.3)	17 (3.1)	392 (8.1)	52 (3.7)	353 (4.4)
Chinese Taipei	67 (3.5)	596 (5.3)	25 (3.5)	576 (8.6)	5 (1.8)	572 (11.8)	3 (1.5)	463 (12.1)
Cyprus	38 (0.3)	469 (2.2)	35 (0.3)	456 (3.2)	15 (0.2)	449 (3.7)	11 (0.3)	448 (3.4)
Egypt	11 (2.5)	448 (11.8)	24 (3.7)	410 (8.2)	23 (3.5)	393 (6.3)	42 (3.8)	392 (5.5)
Estonia	13 (3.1)	549 (9.3)	45 (4.5)	532 (4.2)	25 (3.7)	526 (6.2)	18 (2.7)	514 (6.1)
Ghana	4 (1.6)	295 (24.1)	8 (2.5)	308 (14.9)	18 (3.5)	286 (9.0)	71 (4.3)	264 (5.9)
Hong Kong, SAR	14 (3.5)	619 (8.3)	27 (4.0)	579 (11.5)	24 (3.9)	582 (9.7)	35 (4.6)	571 (8.5)
Hungary	15 (3.0)	557 (9.0)	23 (3.3)	542 (6.6)	35 (4.3)	527 (5.5)	27 (3.9)	503 (8.3)
Indonesia	5 (1.9)	485 (34.5)	17 (3.5)	423 (10.6)	24 (3.5)	421 (10.5)	54 (4.1)	395 (7.5)
Iran, Islamic Rep. of	15 (2.6)	458 (5.9)	12 (2.2)	426 (7.4)	25 (3.5)	408 (6.2)	49 (4.1)	394 (3.3)
Israel	15 (3.1)	531 (7.5)	35 (3.8)	517 (5.9)	26 (4.1)	483 (8.6)	25 (3.3)	467 (7.6)
Italy	45 (3.4)	496 (3.4)	33 (3.8)	482 (7.0)	13 (2.4)	465 (9.9)	10 (2.2)	452 (8.3)
Japan	72 (3.6)	575 (2.6)	23 (3.3)	562 (4.0)	4 (1.7)	553 (3.8)	1 (0.0)	~ ~
Jordan	14 (3.2)	453 (16.8)	22 (4.2)	422 (7.4)	24 (3.5)	424 (6.4)	40 (4.5)	417 (6.8)
Korea, Rep. of	34 (3.7)	607 (3.8)	40 (4.1)	587 (3.2)	16 (3.0)	576 (3.7)	10 (2.5)	563 (6.1)
Latvia	22 (4.1)	523 (5.7)	44 (4.6)	510 (5.2)	18 (3.3)	494 (6.8)	16 (3.5)	492 (7.1)
Lebanon	8 (2.6)	415 (13.0)	17 (3.2)	454 (8.8)	15 (2.7)	449 (7.1)	61 (4.0)	426 (4.7)
Lithuania r	20 (4.1)	530 (6.5)	41 (4.9)	506 (3.9)	31 (4.4)	481 (4.5)	8 (2.5)	461 (13.6)
Macedonia, Rep. of	11 (2.6)	468 (16.4)	19 (3.5)	448 (13.6)	35 (4.6)	431 (6.6)	36 (4.5)	418 (7.0)
Malaysia	8 (2.3)	555 (16.2)	12 (2.8)	523 (11.7)	17 (3.3)	514 (12.3)	64 (4.0)	499 (4.6)
Moldova, Rep. of r	7 (2.4)	450 (18.4)	16 (3.7)	447 (7.4)	35 (4.4)	466 (7.0)	42 (4.8)	455 (8.7)
Morocco s	0 (0.0)	~ ~	5 (2.2)	380 (13.7)	16 (4.1)	390 (6.0)	79 (4.6)	384 (3.0)
Netherlands	60 (4.6)	563 (6.0)	26 (4.0)	505 (8.1)	10 (2.6)	490 (11.6)	5 (2.3)	465 (12.6)
New Zealand	36 (4.2)	527 (8.9)	30 (5.6)	497 (8.1)	16 (3.2)	469 (15.0)	18 (2.3)	449 (11.3)
Norway	– –	– –	– –	– –	– –	– –	– –	– –
Palestinian Nat'l Auth.	6 (2.0)	407 (20.2)	11 (2.6)	389 (9.4)	28 (3.8)	394 (5.3)	55 (3.7)	387 (5.1)
Philippines	9 (2.7)	379 (22.3)	16 (2.6)	411 (15.3)	22 (3.9)	381 (9.3)	53 (4.4)	363 (7.1)
Romania	11 (2.9)	513 (14.1)	18 (3.2)	494 (10.7)	21 (3.0)	467 (8.1)	50 (4.2)	465 (6.9)
Russian Federation	19 (2.9)	525 (7.1)	36 (3.0)	510 (4.4)	24 (2.8)	504 (7.3)	20 (2.9)	493 (6.0)
Saudi Arabia	19 (3.7)	346 (6.7)	28 (4.3)	336 (9.5)	29 (5.3)	320 (11.7)	24 (3.9)	324 (10.2)
Scotland s	28 (4.7)	525 (10.4)	44 (5.6)	512 (7.6)	23 (4.7)	477 (11.3)	6 (2.7)	452 (12.8)
Serbia	10 (2.2)	495 (11.2)	28 (4.0)	478 (5.8)	23 (4.0)	472 (6.6)	39 (4.2)	472 (3.6)
Singapore	57 (0.0)	617 (5.0)	28 (0.0)	596 (7.6)	10 (0.0)	566 (16.1)	5 (0.0)	578 (14.8)
Slovak Republic	16 (2.9)	528 (8.2)	43 (4.8)	510 (5.5)	25 (3.3)	495 (6.3)	16 (3.6)	494 (10.3)
Slovenia	23 (4.0)	499 (5.2)	43 (4.6)	494 (3.8)	23 (4.1)	488 (5.5)	11 (2.7)	483 (6.8)
South Africa	3 (1.3)	479 (44.9)	2 (1.0)	~ ~	9 (2.4)	334 (25.7)	85 (2.8)	237 (3.4)
Sweden r	47 (4.0)	515 (4.2)	32 (4.1)	491 (6.1)	19 (3.8)	487 (6.8)	2 (1.1)	~ ~
Tunisia	10 (2.6)	439 (8.9)	15 (2.7)	427 (4.4)	17 (2.9)	410 (4.4)	59 (4.2)	400 (2.4)
United States r	28 (2.9)	539 (6.8)	23 (3.1)	525 (6.4)	25 (3.1)	496 (5.1)	24 (2.8)	464 (4.5)
‡ England s	32 (5.3)	534 (13.4)	33 (6.0)	505 (10.8)	22 (6.2)	491 (16.4)	13 (4.2)	457 (12.2)
International Avg.	22 (0.5)	496 (2.1)	26 (0.5)	476 (1.3)	21 (0.5)	460 (1.5)	31 (0.5)	439 (1.3)
Benchmarking Participants								
Basque Country, Spain	65 (4.9)	492 (3.8)	20 (3.8)	483 (6.1)	9 (3.1)	467 (8.9)	7 (2.4)	476 (9.9)
Indiana State, US	9 (4.3)	541 (17.6)	38 (7.5)	538 (7.2)	36 (6.7)	485 (7.6)	17 (4.9)	479 (9.5)
Ontario Province, Can.	41 (4.7)	532 (4.0)	29 (4.5)	520 (5.4)	14 (3.5)	518 (7.2)	16 (3.3)	496 (7.9)
Quebec Province, Can.	44 (4.7)	560 (6.4)	30 (4.9)	541 (4.6)	15 (3.0)	532 (8.6)	11 (2.5)	515 (7.4)

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 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.

Exhibit 8.1: Principals' Reports on the Percentages of Students in Their Schools Coming from Economically Disadvantaged Homes

MATHEMATICS Grade 4

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)	471 (29.6)	21 (3.5)	457 (8.5)	28 (4.1)	453 (8.3)	48 (4.6)	455 (6.2)
Australia	34 (4.4)	520 (7.1)	30 (4.0)	498 (6.6)	21 (3.6)	486 (7.4)	15 (4.0)	456 (11.1)
Belgium (Flemish)	59 (4.4)	558 (1.9)	27 (4.0)	552 (3.5)	7 (2.1)	521 (5.2)	7 (2.7)	516 (16.0)
Chinese Taipei	80 (3.4)	567 (2.1)	15 (3.0)	559 (3.1)	4 (1.5)	521 (17.5)	2 (0.9)	~ ~
Cyprus	58 (4.5)	518 (3.0)	30 (4.4)	502 (5.0)	6 (2.2)	509 (8.6)	5 (1.1)	482 (13.6)
England r	38 (4.4)	559 (7.0)	25 (4.5)	528 (6.9)	11 (3.0)	529 (12.2)	25 (4.2)	484 (8.8)
Hong Kong, SAR	23 (4.4)	591 (5.8)	26 (3.5)	574 (6.1)	25 (4.9)	579 (6.4)	25 (4.4)	559 (5.6)
Hungary	15 (3.3)	555 (6.5)	24 (4.2)	533 (5.8)	31 (4.0)	530 (6.5)	30 (3.6)	505 (6.3)
Iran, Islamic Rep. of	17 (3.5)	429 (10.3)	11 (3.2)	398 (10.8)	22 (4.3)	394 (9.1)	50 (4.7)	369 (5.9)
Italy	46 (4.1)	510 (3.8)	37 (3.8)	502 (6.7)	10 (2.4)	478 (10.7)	8 (1.6)	495 (19.3)
Japan	74 (3.9)	566 (2.0)	22 (3.6)	559 (3.4)	4 (1.5)	559 (11.0)	0 (0.0)	~ ~
Latvia	23 (3.7)	554 (5.4)	42 (4.8)	543 (4.9)	22 (4.0)	520 (8.8)	14 (3.3)	507 (7.5)
Lithuania	26 (3.8)	560 (6.5)	33 (4.5)	540 (5.8)	31 (3.8)	513 (5.0)	11 (2.9)	512 (9.7)
Moldova, Rep. of r	10 (3.0)	496 (27.5)	17 (3.1)	509 (10.0)	31 (4.7)	505 (14.4)	43 (5.2)	498 (6.7)
Morocco r	3 (1.2)	352 (34.9)	4 (1.5)	338 (11.5)	18 (3.5)	337 (11.5)	75 (3.8)	352 (6.4)
Netherlands	64 (4.0)	552 (2.1)	17 (3.5)	540 (5.1)	8 (2.5)	522 (8.2)	10 (2.0)	496 (10.2)
New Zealand	44 (3.2)	526 (3.9)	22 (3.5)	491 (5.6)	12 (2.3)	474 (6.7)	22 (2.5)	444 (7.0)
Norway	– –	– –	– –	– –	– –	– –	– –	– –
Philippines	12 (2.7)	368 (24.2)	14 (3.5)	385 (23.5)	25 (3.9)	335 (10.4)	48 (4.8)	345 (8.0)
Russian Federation	18 (2.5)	548 (10.5)	33 (3.6)	531 (8.2)	26 (3.0)	536 (7.8)	23 (3.6)	512 (8.6)
Scotland r	36 (4.5)	509 (4.4)	31 (4.6)	489 (4.6)	17 (4.3)	469 (5.3)	15 (3.4)	459 (6.3)
Singapore	64 (3.7)	608 (7.0)	25 (3.2)	568 (9.5)	6 (1.7)	564 (23.7)	4 (1.6)	575 (19.4)
Slovenia	24 (4.0)	485 (5.9)	43 (4.6)	478 (4.3)	22 (4.0)	470 (6.3)	11 (2.7)	483 (9.4)
Tunisia	20 (3.1)	387 (11.4)	16 (2.9)	334 (12.1)	15 (3.0)	337 (12.1)	49 (3.6)	318 (6.7)
United States	19 (2.8)	561 (4.1)	23 (2.6)	541 (4.7)	20 (2.9)	523 (4.8)	38 (2.6)	484 (3.3)
International Avg.	34 (0.7)	515 (2.7)	25 (0.8)	498 (1.7)	18 (0.7)	486 (2.2)	24 (0.7)	468 (2.1)
Benchmarking Participants								
Indiana State, US	19 (4.5)	558 (7.1)	27 (6.2)	549 (5.5)	28 (6.6)	528 (5.7)	26 (3.9)	503 (6.3)
Ontario Province, Can.	48 (5.5)	520 (4.4)	20 (4.1)	522 (14.3)	15 (3.8)	502 (8.8)	17 (4.1)	482 (6.0)
Quebec Province, Can.	41 (4.4)	515 (4.1)	30 (3.7)	498 (3.3)	13 (3.2)	494 (5.5)	17 (3.3)	500 (7.0)

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 insufficient 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 Mathematics Learning?

Some school resources are specific to mathematics, but many are general resources that improve learning opportunities across the curriculum. All the available resources, however, can work together to support mathematics 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 mathematics 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 five questions about shortages that affect mathematics instruction in particular. Students were placed in the high category if principals reported that shortages, both general and for mathematics 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 mathematics 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 14 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. Nine 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 Mathematics Instruction (ASRMI)

MATHEMATICS Grade 8

Index of Availability of School Resources for Mathematics 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 five questions about shortages that affect mathematics instruction: computers for mathematics instruction; computer software for mathematics instruction; calculators for mathematics instruction; library materials relevant to mathematics instruction; and audio-visual resources for mathematics 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 ASRMI			Medium ASRMI		
		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		88 (0.0)	50 (4.0) ▲	55 (4.6) ▲	10 (0.0)	46 (4.1) ▼	43 (4.4) ▼
Hong Kong, SAR		63 (4.0)	22 (4.1) ▲	23 (5.4) ▲	35 (4.0)	67 (4.4) ▼	72 (5.6) ▼
Belgium (Flemish)		60 (4.9)	54 (4.6)	48 (5.3)	38 (4.7)	46 (4.6)	52 (5.3)
Japan		57 (3.8)	36 (4.3) ▲	28 (3.5) ▲	42 (3.8)	61 (4.2) ▼	68 (3.9) ▼
Australia	r	56 (3.8)	– –	42 (5.0) ▲	43 (3.9)	– –	52 (5.2)
Netherlands	r	56 (4.9)	40 (6.2) ▲	46 (7.1)	44 (4.9)	60 (6.2) ▼	53 (7.0)
Slovenia	r	55 (3.7)	– –	13 (3.2) ▲	42 (3.7)	– –	80 (4.0) ▼
United States	r	53 (3.8)	37 (3.8) ▲	18 (3.2) ▲	46 (3.8)	59 (3.6) ▼	75 (3.6) ▼
Israel		49 (4.4)	32 (4.1) ▲	– –	48 (4.5)	62 (4.3) ▼	– –
New Zealand		44 (4.8)	34 (4.3)	15 (2.9) ▲	55 (4.9)	62 (4.3)	79 (3.6) ▼
Italy		39 (3.7)	28 (3.4) ▲	– –	59 (3.8)	66 (4.0)	– –
Sweden		37 (4.2)	✧ ✧	39 (4.8)	62 (4.2)	✧ ✧	56 (4.6)
Scotland		37 (5.6)	✧ ✧	– –	62 (5.7)	✧ ✧	– –
Egypt		34 (4.1)	✧ ✧	✧ ✧	48 (4.3)	✧ ✧	✧ ✧
Hungary		32 (3.9)	35 (4.0)	19 (3.2) ▲	67 (3.8)	59 (4.1)	79 (3.3) ▼
Estonia		29 (4.1)	✧ ✧	✧ ✧	66 (4.4)	✧ ✧	✧ ✧
Korea, Rep. of		28 (4.0)	4 (1.6) ▲	4 (1.6) ▲	69 (3.9)	81 (3.5) ▼	82 (3.2) ▼
Lebanon		24 (3.3)	✧ ✧	✧ ✧	70 (3.7)	✧ ✧	✧ ✧
Chinese Taipei		24 (3.4)	6 (1.9) ▲	✧ ✧	71 (3.8)	78 (3.2)	✧ ✧
Norway	r	21 (3.9)	✧ ✧	38 (4.0) ▼	74 (4.2)	✧ ✧	61 (4.0) ▲
Chile		21 (3.0)	22 (3.1)	✧ ✧	65 (3.7)	68 (3.3)	✧ ✧
Malaysia		18 (3.3)	20 (3.6)	✧ ✧	70 (3.8)	73 (3.8)	✧ ✧
Saudi Arabia		17 (5.6)	✧ ✧	✧ ✧	70 (6.1)	✧ ✧	✧ ✧
Jordan		16 (3.4)	5 (1.9) ▲	✧ ✧	74 (3.7)	64 (4.4)	✧ ✧
Bahrain		15 (0.1)	✧ ✧	✧ ✧	74 (0.2)	✧ ✧	✧ ✧
Latvia		15 (2.9)	– –	– –	80 (3.5)	– –	– –
Tunisia		14 (3.0)	4 (1.8) ▲	✧ ✧	74 (3.6)	78 (3.9)	✧ ✧
Philippines		13 (2.6)	12 (2.7)	✧ ✧	51 (4.6)	59 (4.1)	✧ ✧
Ghana		12 (2.9)	✧ ✧	✧ ✧	75 (4.2)	✧ ✧	✧ ✧
Palestinian Nat'l Auth.		12 (2.8)	✧ ✧	✧ ✧	74 (3.7)	✧ ✧	✧ ✧
Cyprus	r	12 (0.1)	15 (0.2) ▼	31 (0.5) ▼	79 (0.2)	85 (0.2) ▼	63 (0.5) ▲
Slovak Republic		12 (2.6)	8 (2.4)	13 (2.7)	74 (4.0)	85 (2.9) ▼	84 (2.7) ▼
Morocco		9 (3.3)	– –	✧ ✧	65 (6.5)	– –	✧ ✧
Lithuania		9 (2.6)	8 (2.2)	2 (1.1) ▲	81 (3.7)	67 (3.6) ▲	79 (3.5)
Iran, Islamic Rep. of		8 (2.3)	6 (1.8)	1 (0.9) ▲	71 (3.5)	71 (4.1)	67 (4.7)
Macedonia, Rep. of		8 (2.4)	2 (1.2) ▲	✧ ✧	69 (3.9)	59 (3.7)	✧ ✧
South Africa		8 (1.6)	8 (2.0)	– –	53 (3.5)	46 (4.2)	– –
Romania		8 (2.4)	6 (2.4)	4 (1.4)	82 (3.2)	67 (3.7) ▲	73 (3.8)
Indonesia		8 (2.0)	23 (3.9) ▼	✧ ✧	88 (2.6)	66 (4.8) ▲	✧ ✧
Armenia	r	8 (2.8)	✧ ✧	✧ ✧	69 (4.6)	✧ ✧	✧ ✧
Moldova, Rep. of	r	7 (2.5)	0 (0.4) ▲	✧ ✧	71 (5.0)	33 (4.3) ▲	✧ ✧
Bulgaria		5 (1.8)	1 (1.0)	– –	86 (2.7)	62 (4.7) ▲	– –
Russian Federation		5 (1.4)	1 (0.9) ▲	1 (0.0) ▲	70 (3.9)	47 (4.0) ▲	46 (4.5) ▲
Serbia		5 (2.0)	✧ ✧	✧ ✧	74 (3.9)	✧ ✧	✧ ✧
Botswana		4 (1.7)	✧ ✧	✧ ✧	77 (3.6)	✧ ✧	✧ ✧
‡ England	s	35 (6.6)	26 (4.2)	25 (4.7)	56 (6.2)	72 (4.4) ▼	73 (4.9) ▼
International Avg.		26 (0.5)	19 (0.6) ▲	23 (0.8) ▲	64 (0.6)	64 (0.8)	67 (1.0) ▼
Benchmarking Participants							
Basque Country, Spain		60 (5.0)	✧ ✧	✧ ✧	40 (5.1)	✧ ✧	✧ ✧
Indiana State, US		50 (6.9)	36 (7.8)	✧ ✧	47 (7.0)	62 (7.7)	✧ ✧
Ontario Province, Can.		28 (4.5)	21 (3.8)	17 (3.9)	65 (4.9)	71 (4.5)	77 (3.9)
Quebec Province, Can.	r	56 (4.6)	56 (5.8)	41 (7.6)	43 (4.8)	44 (5.8)	59 (7.6)

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).

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 Mathematics Instruction (ASRMI)

MATHEMATICS Grade 8

Countries		Low ASRMI		
		2003 Percent of Students	1999 Percent of Students	1995 Percent of Students
Singapore		1 (0.0)	4 (1.4)	2 (1.2)
Hong Kong, SAR		2 (1.2)	10 (2.7) ▼	5 (2.6)
Belgium (Flemish)		2 (1.2)	0 (0.0)	0 (0.0)
Japan		0 (0.3)	3 (1.5)	4 (1.9) ▼
Australia	r	1 (0.7)	– –	6 (2.3) ▼
Netherlands	r	0 (0.0)	0 (0.0) ▼	1 (0.1) ▼
Slovenia	r	2 (1.3)	– –	8 (2.8)
United States	r	2 (0.8)	4 (1.5)	6 (1.4) ▼
Israel		3 (1.4)	6 (2.0)	– –
New Zealand		1 (0.9)	4 (1.7)	6 (2.1) ▼
Italy		2 (1.1)	6 (2.0)	– –
Sweden		0 (0.4)	✧ ✧	5 (2.3)
Scotland		1 (1.2)	✧ ✧	– –
Egypt		18 (3.7)	✧ ✧	✧ ✧
Hungary		1 (0.8)	6 (2.2) ▼	2 (1.2)
Estonia		5 (2.0)	✧ ✧	✧ ✧
Korea, Rep. of		3 (1.4)	16 (3.1) ▼	14 (2.9) ▼
Lebanon		6 (2.1)	✧ ✧	✧ ✧
Chinese Taipei		5 (1.7)	16 (2.7) ▼	✧ ✧
Norway	r	5 (1.7)	✧ ✧	1 (1.0)
Chile		14 (2.6)	10 (2.2)	✧ ✧
Malaysia		12 (2.8)	7 (1.9)	✧ ✧
Saudi Arabia		13 (3.1)	✧ ✧	✧ ✧
Jordan		10 (2.5)	31 (4.2) ▼	✧ ✧
Bahrain		10 (0.2)	✧ ✧	✧ ✧
Latvia		5 (2.3)	– –	– –
Tunisia		12 (2.5)	17 (3.5)	✧ ✧
Philippines		36 (4.1)	29 (3.6)	✧ ✧
Ghana		13 (3.2)	✧ ✧	✧ ✧
Palestinian Nat'l Auth.		14 (3.1)	✧ ✧	✧ ✧
Cyprus	r	10 (0.1)	0 (0.0) ▲	6 (0.4) ▲
Slovak Republic		15 (2.9)	7 (2.4) ▲	3 (1.4) ▲
Morocco		26 (5.8)	– –	✧ ✧
Lithuania		10 (2.6)	25 (3.5) ▼	19 (3.3) ▼
Iran, Islamic Rep. of		21 (3.2)	23 (3.7)	32 (4.7)
Macedonia, Rep. of		23 (3.7)	39 (3.8) ▼	✧ ✧
South Africa		39 (3.4)	46 (4.4)	– –
Romania		10 (2.6)	26 (3.5) ▼	23 (3.7) ▼
Indonesia		4 (1.8)	11 (3.0)	✧ ✧
Armenia	r	23 (4.2)	✧ ✧	✧ ✧
Moldova, Rep. of	r	22 (4.5)	67 (4.4) ▼	✧ ✧
Bulgaria		9 (2.1)	36 (4.6) ▼	– –
Russian Federation		25 (3.9)	52 (3.9) ▼	53 (4.6) ▼
Serbia		21 (3.4)	✧ ✧	✧ ✧
Botswana		19 (3.4)	✧ ✧	✧ ✧
‡ England	s	9 (4.0)	2 (1.5)	2 (1.5)
International Avg.		11 (0.4)	19 (0.6) ▼	10 (0.6)
Benchmarking Participants				
Basque Country, Spain		0 (0.5)	✧ ✧	✧ ✧
Indiana State, US		4 (2.6)	2 (1.8)	✧ ✧
Ontario Province, Can.		6 (2.5)	7 (2.5)	5 (2.1)
Quebec Province, Can.	r	2 (1.2)	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 Mathematics Instruction (ASRMI)

MATHEMATICS Grade 4

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	86 (2.7)	47 (4.0) ▲	14 (2.6)	53 (4.0) ▼	1 (0.5)	0 (0.0)
Scotland	62 (4.3)	– –	37 (4.2)	– –	1 (0.0)	– –
Slovenia r	58 (3.9)	11 (2.9) ▲	40 (4.0)	81 (3.9) ▼	2 (1.3)	8 (2.8)
Japan	57 (3.8)	25 (3.7) ▲	41 (3.8)	70 (3.7) ▼	1 (1.0)	5 (1.8)
Belgium (Flemish)	53 (3.9)	✧ ✧	44 (4.1)	✧ ✧	3 (1.4)	✧ ✧
Hong Kong, SAR	51 (4.9)	33 (5.4) ▲	49 (4.9)	65 (5.5) ▼	0 (0.0)	2 (1.4)
New Zealand	49 (3.6)	28 (3.9) ▲	49 (3.7)	65 (4.2) ▼	1 (0.9)	8 (2.5) ▼
Australia	46 (4.1)	27 (4.7) ▲	53 (4.1)	71 (5.0) ▼	1 (0.8)	2 (1.4)
England r	44 (4.9)	27 (4.5) ▲	56 (4.9)	66 (4.6)	0 (0.0)	7 (2.8) ▼
United States r	43 (3.3)	32 (3.9) ▲	54 (3.4)	65 (3.7) ▼	3 (1.2)	3 (1.4)
Netherlands	39 (5.0)	35 (5.2)	58 (4.8)	61 (5.1)	3 (1.5)	4 (1.7)
Hungary	38 (4.5)	20 (3.5) ▲	61 (4.6)	78 (3.6) ▼	1 (1.0)	2 (1.2)
Norway r	32 (4.6)	29 (4.8)	62 (4.7)	69 (4.8)	7 (2.3)	3 (1.6)
Italy	28 (3.6)	– –	70 (3.7)	– –	2 (1.2)	– –
Latvia	25 (4.0)	– –	68 (4.6)	– –	7 (2.5)	– –
Cyprus r	19 (3.4)	24 (3.5)	68 (4.6)	72 (3.8)	12 (3.3)	4 (1.8) ▲
Chinese Taipei	18 (3.1)	✧ ✧	78 (3.3)	✧ ✧	4 (1.3)	✧ ✧
Tunisia	14 (2.8)	✧ ✧	64 (4.1)	✧ ✧	22 (3.8)	✧ ✧
Iran, Islamic Rep. of	13 (3.6)	7 (2.5)	63 (5.1)	67 (4.2)	24 (4.4)	26 (4.1)
Philippines	12 (3.1)	✧ ✧	62 (5.1)	✧ ✧	26 (4.6)	✧ ✧
Lithuania	11 (2.6)	✧ ✧	81 (3.4)	✧ ✧	8 (2.2)	✧ ✧
Russian Federation	10 (1.9)	✧ ✧	72 (3.3)	✧ ✧	19 (3.2)	✧ ✧
Armenia	7 (2.7)	✧ ✧	71 (4.5)	✧ ✧	23 (4.0)	✧ ✧
Moldova, Rep. of	3 (1.6)	✧ ✧	76 (4.9)	✧ ✧	20 (4.7)	✧ ✧
International Avg.	33 (0.7)	26 (1.1) ▲	58 (0.9)	68 (1.2) ▼	10 (0.5)	6 (0.6) ▲
Benchmarking Participants						
Indiana State, US	50 (6.1)	✧ ✧	49 (6.3)	✧ ✧	1 (1.4)	✧ ✧
Ontario Province, Can.	35 (4.9)	22 (4.0) ▲	59 (5.0)	74 (4.4) ▼	6 (2.4)	4 (2.0)
Quebec Province, Can.	45 (4.6)	54 (8.5)	52 (4.3)	46 (8.5)	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.

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 schools' 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)

MATHEMATICS Grade 8

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)	534 (4.9)	49 (3.3)	491 (5.1)	8 (1.9)	470 (7.0)
Scotland s	42 (4.3)	527 (7.7)	52 (4.7)	490 (7.2)	6 (2.6)	459 (34.5)
Chinese Taipei	37 (3.8)	601 (7.3)	60 (4.0)	578 (5.4)	3 (1.0)	534 (33.8)
Philippines	35 (4.1)	393 (8.0)	59 (4.1)	371 (7.5)	6 (2.2)	361 (14.5)
New Zealand	34 (4.7)	525 (8.5)	58 (4.7)	481 (8.0)	8 (3.2)	479 (12.1)
Australia	31 (4.3)	520 (9.4)	61 (4.8)	506 (6.3)	8 (2.7)	444 (20.6)
Singapore	30 (0.0)	649 (5.1)	65 (0.0)	589 (5.5)	5 (0.0)	556 (17.7)
Japan	29 (3.4)	585 (5.1)	69 (3.4)	564 (2.2)	3 (1.3)	556 (5.6)
Israel	28 (4.0)	521 (6.9)	69 (4.1)	489 (4.4)	2 (1.0)	~ ~
Egypt	26 (3.3)	418 (6.8)	62 (4.2)	402 (4.6)	12 (3.0)	402 (12.4)
Sweden	21 (3.2)	513 (5.0)	72 (3.8)	497 (3.8)	7 (2.2)	483 (14.7)
Cyprus	20 (0.2)	476 (2.9)	76 (0.2)	455 (1.9)	4 (0.1)	470 (5.5)
Indonesia	19 (3.2)	424 (13.7)	71 (3.8)	412 (5.8)	11 (2.8)	377 (19.5)
Jordan	18 (3.2)	455 (12.9)	71 (4.2)	420 (4.4)	11 (2.7)	404 (11.0)
Lebanon	18 (3.5)	457 (7.9)	63 (4.6)	439 (4.3)	19 (2.9)	398 (6.2)
Malaysia	17 (3.3)	540 (11.1)	70 (4.1)	504 (4.9)	13 (3.1)	490 (11.3)
Korea, Rep. of	16 (3.3)	609 (5.6)	68 (3.8)	588 (2.9)	15 (3.0)	576 (4.5)
Belgium (Flemish)	16 (2.7)	567 (8.2)	74 (3.8)	539 (4.2)	10 (2.6)	473 (19.1)
Chile	14 (2.8)	421 (11.8)	67 (3.6)	387 (4.3)	19 (3.2)	361 (7.2)
Palestinian Nat'l Auth.	14 (3.1)	413 (10.5)	77 (3.5)	389 (3.7)	8 (2.5)	361 (13.8)
Saudi Arabia	14 (4.5)	313 (22.7)	68 (5.1)	334 (4.4)	18 (3.8)	336 (9.1)
Macedonia, Rep. of	14 (3.0)	468 (13.2)	74 (3.7)	434 (4.1)	12 (2.8)	419 (15.9)
Ghana	13 (3.4)	310 (21.3)	68 (4.4)	270 (5.3)	18 (3.3)	261 (9.4)
Norway	13 (2.6)	473 (5.3)	82 (3.4)	461 (2.7)	5 (2.2)	459 (21.4)
Italy	12 (2.7)	505 (7.7)	75 (3.6)	483 (3.8)	13 (2.3)	464 (9.3)
Hong Kong, SAR	12 (2.7)	619 (13.6)	70 (4.1)	585 (3.8)	18 (3.4)	557 (11.5)
Bahrain	11 (0.1)	413 (2.4)	74 (0.2)	400 (2.1)	15 (0.2)	394 (5.1)
Iran, Islamic Rep. of	10 (2.2)	458 (9.2)	69 (3.7)	411 (3.2)	21 (3.0)	389 (4.5)
Slovenia	9 (2.2)	497 (5.6)	83 (2.8)	493 (2.7)	8 (2.4)	487 (11.7)
Lithuania	8 (2.4)	514 (13.6)	88 (3.0)	500 (2.7)	4 (1.9)	497 (9.1)
Romania	7 (2.2)	538 (11.8)	69 (4.1)	482 (5.4)	24 (3.7)	440 (8.1)
South Africa	7 (2.1)	347 (43.0)	45 (4.1)	273 (11.0)	48 (3.9)	244 (5.4)
Hungary	7 (2.1)	569 (11.3)	84 (3.3)	527 (3.9)	10 (2.6)	526 (13.2)
Netherlands	5 (2.1)	586 (9.7)	81 (3.7)	538 (4.5)	13 (3.2)	508 (16.4)
Bulgaria	4 (1.4)	527 (19.0)	72 (3.4)	482 (5.6)	23 (3.1)	448 (9.9)
Morocco s	3 (1.7)	374 (17.1)	37 (5.6)	389 (5.2)	59 (5.7)	385 (3.4)
Slovak Republic	3 (1.6)	586 (13.8)	78 (3.9)	510 (3.1)	19 (3.9)	488 (8.9)
Serbia	3 (1.4)	519 (31.2)	71 (4.1)	475 (3.0)	26 (3.8)	476 (5.2)
Armenia r	3 (1.5)	506 (32.5)	79 (4.1)	480 (3.4)	18 (4.0)	460 (5.7)
Estonia	1 (1.1)	~ ~	79 (3.1)	532 (3.8)	20 (2.9)	523 (4.0)
Tunisia	1 (1.0)	~ ~	30 (3.7)	421 (4.1)	69 (3.7)	405 (2.7)
Botswana	1 (1.0)	~ ~	31 (4.2)	367 (5.1)	68 (4.3)	361 (2.9)
Moldova, Rep. of r	1 (0.0)	~ ~	50 (5.1)	467 (5.7)	49 (5.1)	451 (7.9)
Russian Federation	1 (0.5)	~ ~	70 (2.9)	511 (4.4)	29 (2.9)	499 (6.3)
Latvia	0 (0.0)	~ ~	84 (3.8)	510 (3.7)	16 (3.8)	501 (8.4)
‡ England s	33 (5.8)	526 (11.2)	63 (6.2)	493 (9.0)	5 (3.1)	456 (16.1)
International Avg.	15 (0.4)	495 (2.3)	67 (0.6)	466 (0.8)	18 (0.4)	446 (2.0)
Benchmarking Participants						
Basque Country, Spain	12 (3.3)	502 (8.2)	79 (3.8)	488 (3.1)	9 (2.4)	464 (8.4)
Indiana State, US	29 (6.4)	537 (10.3)	67 (6.7)	502 (5.3)	5 (2.2)	444 (13.6)
Ontario Province, Can.	42 (4.3)	534 (3.8)	52 (4.7)	512 (4.2)	5 (2.1)	516 (10.2)
Quebec Province, Can.	14 (2.2)	582 (9.5)	78 (3.1)	540 (3.7)	8 (2.2)	526 (7.1)

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 insufficient data to report achievement.

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

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)	570 (2.2)	41 (3.8)	558 (3.5)	2 (0.9)	~ ~
Scotland	51 (5.0)	498 (4.9)	45 (4.9)	488 (4.9)	4 (1.8)	451 (10.2)
New Zealand	48 (3.3)	520 (3.1)	48 (3.3)	475 (4.4)	4 (1.5)	445 (11.5)
United States	48 (3.5)	543 (3.2)	45 (3.5)	503 (3.7)	7 (1.6)	473 (8.5)
Australia	38 (4.6)	517 (5.6)	55 (5.1)	492 (4.7)	7 (3.6)	457 (20.3)
England r	34 (4.7)	550 (7.6)	64 (4.9)	521 (6.0)	2 (1.3)	~ ~
Singapore	32 (4.1)	611 (7.5)	63 (4.1)	587 (7.3)	5 (1.6)	557 (17.3)
Hong Kong, SAR	30 (4.6)	586 (5.7)	65 (4.8)	573 (3.4)	5 (2.1)	556 (6.4)
Cyprus	28 (4.0)	513 (5.9)	66 (4.3)	510 (2.9)	6 (2.3)	504 (8.8)
Philippines	27 (3.9)	378 (13.7)	66 (4.2)	341 (7.0)	7 (2.2)	344 (21.5)
Norway	26 (3.9)	456 (5.4)	72 (4.0)	449 (2.6)	2 (1.0)	~ ~
Lithuania	25 (3.5)	542 (7.1)	72 (3.7)	532 (3.4)	3 (1.4)	505 (17.3)
Iran, Islamic Rep. of	25 (4.0)	407 (9.1)	67 (4.3)	386 (5.3)	8 (2.6)	351 (11.2)
Belgium (Flemish)	21 (3.3)	558 (3.2)	77 (3.2)	551 (2.0)	3 (1.4)	508 (25.2)
Netherlands	20 (3.8)	544 (4.5)	79 (4.0)	541 (2.7)	2 (1.2)	~ ~
Japan	18 (3.1)	576 (5.2)	77 (3.3)	563 (1.7)	5 (1.8)	547 (7.2)
Italy	15 (2.8)	516 (10.0)	76 (3.4)	502 (4.5)	10 (2.4)	491 (10.8)
Tunisia	9 (2.4)	380 (17.2)	49 (3.9)	350 (6.9)	42 (3.9)	316 (6.6)
Slovenia	8 (2.1)	487 (8.4)	85 (2.7)	478 (2.9)	7 (2.0)	470 (11.3)
Hungary	8 (2.2)	561 (8.1)	85 (3.0)	524 (3.5)	7 (2.3)	535 (23.0)
Latvia	6 (2.2)	547 (10.9)	83 (3.6)	537 (3.4)	11 (2.9)	520 (8.7)
Russian Federation	4 (1.3)	559 (22.9)	84 (2.6)	531 (5.4)	12 (2.4)	528 (10.5)
Morocco r	3 (1.4)	431 (11.1)	41 (4.7)	344 (7.1)	57 (4.7)	349 (8.3)
Armenia r	2 (1.3)	~ ~	80 (3.7)	460 (4.3)	18 (3.5)	433 (8.6)
Moldova, Rep. of r	0 (0.0)	~ ~	55 (5.0)	515 (6.5)	45 (5.0)	486 (10.5)
International Avg.	23 (0.7)	515 (1.9)	66 (0.8)	492 (0.9)	11 (0.5)	468 (3.0)
Benchmarking Participants						
Indiana State, US	55 (7.2)	546 (4.4)	42 (7.1)	520 (5.0)	3 (0.3)	464 (6.8)
Ontario Province, Can.	43 (4.5)	530 (6.6)	52 (4.6)	500 (4.0)	5 (2.4)	490 (7.2)
Quebec Province, Can.	25 (3.6)	518 (2.8)	70 (3.9)	503 (2.9)	5 (2.1)	485 (8.9)

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 tilde (~) indicates insufficient data to report achievement.

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

Exhibit 8.5: Index of Mathematics Teachers' Perception of School Climate (TPSC)

MATHEMATICS Grade 8

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
Israel	27 (4.1)	517 (7.7)	60 (4.3)	492 (4.4)	13 (2.1)	464 (12.5)
Philippines	25 (4.0)	395 (13.5)	57 (4.4)	381 (6.8)	18 (3.2)	344 (9.9)
United States	21 (2.8)	542 (6.6)	56 (3.2)	507 (3.8)	22 (2.6)	476 (7.3)
Chinese Taipei	21 (3.3)	617 (9.4)	69 (3.9)	579 (5.5)	10 (2.6)	563 (10.9)
Lebanon	21 (4.0)	449 (8.8)	56 (4.8)	432 (4.8)	23 (3.3)	419 (8.1)
Egypt	19 (3.3)	431 (7.8)	58 (4.2)	403 (4.5)	22 (3.4)	390 (8.2)
Indonesia	18 (3.5)	437 (13.4)	63 (4.4)	415 (6.1)	19 (3.7)	378 (14.8)
Ghana	17 (3.9)	308 (13.2)	54 (4.6)	272 (5.6)	30 (4.5)	255 (8.7)
New Zealand	17 (3.1)	512 (8.6)	62 (4.3)	499 (6.8)	21 (3.7)	472 (9.7)
Australia	16 (2.6)	530 (9.1)	58 (4.4)	514 (7.6)	27 (4.0)	462 (7.9)
Scotland	15 (3.4)	534 (15.2)	60 (4.6)	502 (5.6)	25 (3.8)	481 (8.5)
Malaysia	15 (2.9)	510 (13.5)	67 (3.5)	514 (5.1)	18 (3.1)	486 (8.1)
Cyprus	15 (1.9)	463 (5.0)	68 (2.3)	460 (2.1)	17 (1.9)	457 (4.7)
Singapore	14 (1.2)	646 (9.4)	61 (2.1)	610 (3.9)	25 (2.0)	574 (7.1)
Macedonia, Rep. of	14 (3.0)	453 (12.8)	65 (4.0)	438 (4.7)	21 (3.4)	413 (11.1)
Iran, Islamic Rep. of	13 (2.6)	441 (9.8)	35 (3.7)	423 (4.7)	53 (3.9)	397 (3.5)
Chile	11 (2.4)	434 (12.9)	54 (3.4)	394 (5.0)	35 (3.7)	365 (5.7)
South Africa	10 (2.1)	259 (22.4)	46 (4.0)	276 (10.2)	44 (4.3)	251 (5.6)
Romania	10 (2.7)	514 (26.1)	58 (4.1)	479 (5.3)	32 (3.9)	456 (7.3)
Sweden	9 (2.5)	540 (7.5)	67 (3.6)	499 (3.4)	24 (3.2)	482 (5.5)
Armenia	9 (2.2)	488 (10.7)	60 (4.0)	482 (4.5)	31 (3.7)	464 (4.3)
Norway	8 (2.1)	472 (8.4)	82 (3.0)	461 (2.9)	10 (2.4)	456 (5.3)
Palestinian Nat'l Auth.	8 (2.4)	405 (14.1)	66 (3.8)	390 (3.9)	26 (3.2)	388 (6.3)
Bahrain	7 (1.8)	405 (7.5)	49 (3.5)	406 (2.4)	43 (3.4)	396 (3.6)
Serbia	7 (2.0)	481 (12.0)	69 (3.9)	476 (3.4)	24 (3.7)	475 (6.9)
Hong Kong, SAR	7 (2.5)	625 (10.8)	58 (3.6)	596 (4.9)	35 (3.5)	557 (6.8)
Jordan	7 (2.7)	490 (22.8)	55 (4.2)	425 (4.3)	38 (4.1)	412 (6.4)
Korea, Rep. of s	7 (1.9)	604 (15.5)	61 (3.7)	593 (3.0)	33 (3.5)	581 (3.9)
Saudi Arabia	6 (2.4)	355 (23.6)	59 (5.9)	332 (5.1)	34 (5.8)	335 (6.0)
Tunisia	6 (1.8)	427 (14.3)	50 (4.2)	414 (3.5)	44 (4.2)	404 (2.9)
Lithuania	5 (1.7)	525 (7.2)	86 (2.9)	500 (2.9)	9 (2.3)	497 (9.5)
Japan	5 (1.8)	636 (22.2)	70 (3.7)	565 (2.4)	25 (3.6)	564 (4.8)
Morocco s	4 (3.0)	398 (6.5)	25 (5.0)	386 (9.2)	71 (5.7)	389 (3.7)
Belgium (Flemish)	4 (1.3)	578 (7.9)	78 (2.8)	552 (4.0)	18 (2.5)	466 (10.0)
Slovenia	4 (1.7)	517 (10.2)	79 (3.7)	493 (2.6)	17 (3.3)	491 (6.5)
Italy	4 (1.8)	485 (29.2)	49 (4.2)	494 (4.7)	48 (3.9)	473 (4.5)
Netherlands	3 (2.7)	521 (59.9)	49 (4.6)	567 (6.9)	48 (4.7)	508 (7.0)
Botswana	3 (1.7)	405 (40.7)	29 (4.4)	373 (6.1)	68 (4.5)	361 (3.0)
Hungary	3 (1.4)	563 (23.7)	83 (2.9)	532 (3.5)	14 (2.5)	502 (9.2)
Slovak Republic	2 (1.4)	~ ~	57 (4.2)	512 (4.4)	41 (4.4)	497 (5.2)
Estonia	2 (1.1)	~ ~	64 (4.2)	536 (4.0)	34 (4.2)	521 (5.1)
Latvia	2 (1.3)	~ ~	70 (4.0)	507 (3.9)	28 (4.0)	514 (7.2)
Bulgaria	1 (0.9)	~ ~	58 (4.2)	483 (6.4)	41 (4.1)	463 (5.9)
Russian Federation	1 (0.7)	~ ~	59 (4.2)	518 (3.8)	40 (4.1)	495 (5.1)
Moldova, Rep. of r	1 (0.5)	~ ~	45 (4.5)	466 (7.8)	54 (4.6)	451 (5.9)
‡ England r	13 (3.3)	525 (21.5)	73 (5.0)	511 (8.2)	14 (4.3)	467 (15.0)
International Avg.	10 (0.4)	486 (2.9)	60 (0.6)	471 (0.8)	30 (0.5)	450 (1.1)
Benchmarking Participants						
Basque Country, Spain	6 (2.7)	493 (13.0)	63 (4.9)	491 (3.9)	31 (4.9)	479 (5.0)
Indiana State, US	16 (4.3)	526 (17.3)	59 (4.8)	515 (6.1)	25 (4.2)	485 (10.1)
Ontario Province, Can.	24 (4.8)	537 (5.5)	61 (4.9)	517 (3.8)	15 (3.5)	512 (7.2)
Quebec Province, Can.	14 (2.7)	570 (9.2)	64 (4.4)	541 (4.2)	22 (4.0)	536 (6.2)

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 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 8.5: Index of Mathematics 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		41 (2.6)	538 (3.4)	47 (2.6)	512 (3.2)	12 (1.6)	477 (4.9)
Scotland	r	41 (5.1)	507 (5.5)	58 (5.0)	485 (4.9)	2 (1.1)	~ ~
New Zealand		38 (2.8)	510 (4.6)	58 (3.1)	490 (3.1)	5 (1.1)	432 (7.4)
Chinese Taipei		35 (4.0)	571 (3.1)	61 (4.1)	561 (2.4)	4 (1.5)	544 (11.3)
Philippines		34 (4.5)	380 (19.2)	57 (4.7)	351 (8.1)	9 (2.8)	331 (18.9)
Lithuania		34 (3.4)	544 (5.2)	65 (3.4)	527 (3.4)	0 (0.0)	~ ~
Australia		31 (3.6)	508 (8.5)	59 (3.7)	504 (3.7)	11 (2.5)	452 (15.9)
England	r	29 (4.4)	544 (6.5)	63 (4.9)	525 (5.5)	8 (2.4)	519 (17.7)
Cyprus		27 (3.4)	514 (4.6)	64 (3.8)	510 (3.2)	9 (2.2)	498 (7.7)
Iran, Islamic Rep. of		25 (4.0)	415 (8.4)	60 (4.6)	382 (5.9)	15 (3.5)	378 (8.3)
Singapore		21 (3.9)	629 (9.9)	72 (3.9)	588 (6.3)	7 (2.0)	570 (25.8)
Belgium (Flemish)		18 (2.6)	555 (3.8)	76 (3.2)	553 (1.6)	6 (1.9)	511 (15.2)
Norway		18 (3.6)	459 (6.9)	76 (3.7)	450 (2.7)	6 (1.9)	448 (8.8)
Slovenia		16 (3.6)	484 (7.1)	80 (4.0)	478 (3.5)	4 (1.8)	478 (6.3)
Hungary		15 (2.8)	535 (8.2)	79 (3.2)	529 (3.6)	7 (2.1)	488 (16.6)
Armenia	r	14 (2.9)	466 (11.1)	71 (3.5)	455 (4.4)	16 (2.8)	436 (10.0)
Japan		12 (2.7)	581 (7.1)	76 (3.4)	563 (1.8)	12 (2.6)	554 (4.5)
Italy		8 (2.2)	506 (11.7)	73 (3.3)	508 (4.2)	19 (2.7)	480 (8.6)
Hong Kong, SAR		8 (2.4)	573 (11.7)	78 (3.8)	577 (3.1)	14 (3.3)	564 (7.1)
Netherlands		8 (2.6)	556 (5.8)	84 (3.6)	543 (2.6)	8 (2.5)	521 (10.6)
Tunisia	r	6 (2.2)	390 (15.5)	58 (3.8)	345 (6.9)	36 (3.7)	321 (9.2)
Latvia		6 (2.1)	562 (6.7)	84 (3.0)	536 (3.2)	10 (2.5)	519 (9.9)
Russian Federation		5 (1.8)	573 (17.2)	80 (3.4)	533 (5.3)	15 (3.1)	510 (9.5)
Morocco	s	4 (1.4)	381 (34.2)	34 (4.0)	343 (14.0)	62 (4.1)	347 (6.1)
Moldova, Rep. of		2 (0.7)	~ ~	63 (4.1)	505 (7.5)	35 (4.1)	501 (6.2)
International Avg.		20 (0.6)	512 (2.3)	67 (0.8)	494 (1.1)	13 (0.5)	473 (2.5)
Benchmarking Participants							
Indiana State, US		35 (5.3)	549 (6.8)	59 (4.8)	524 (3.6)	6 (2.4)	523 (22.2)
Ontario Province, Can.		37 (4.2)	531 (7.4)	55 (4.5)	503 (2.7)	9 (3.1)	484 (13.7)
Quebec Province, Can.		13 (2.5)	522 (5.3)	73 (3.6)	505 (3.1)	13 (3.0)	497 (3.9)

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 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.

there was a strong positive relationship between the principals' perception of school climate and average mathematics achievement.

The Index of Mathematics 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 13 percent attended schools in the low category. At the eighth grade, teachers had a somewhat more gloomy view of the climates in schools than did the principals. According to their teachers, on average, 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 mathematics 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)

MATHEMATICS 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 Mathematics 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 Mathematics 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 (72 percent of the eighth-grade students and 75 percent of the fourth-grade students). One-fifth were in the medium category (22 to 21 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 mathematics 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. Eighth-grade students in the low category had lower average mathematics achievement than their counterparts in safer schools.

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. At the fourth grade, there was a direct relationship between students' reporting being in safer schools and having higher mathematics achievement.

Exhibit 8.7: Index of Mathematics Teachers' Perception of Safety in the Schools (TPSS)

MATHEMATICS 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)	609 (3.7)	8 (1.5)	582 (16.6)	1 (0.5)	~ ~
New Zealand	90 (2.4)	501 (5.4)	7 (1.8)	460 (12.2)	3 (1.6)	454 (25.7)
Norway	88 (2.6)	461 (2.8)	12 (2.6)	463 (4.7)	0 (0.0)	~ ~
Hungary	88 (2.5)	530 (3.5)	10 (2.0)	519 (12.8)	2 (1.3)	~ ~
Egypt	87 (2.8)	408 (3.9)	8 (2.2)	397 (12.5)	5 (1.9)	376 (13.5)
Bahrain	87 (1.2)	404 (1.8)	11 (1.6)	383 (11.1)	2 (1.1)	~ ~
Belgium (Flemish)	85 (2.7)	539 (3.5)	15 (2.6)	533 (11.5)	0 (0.0)	~ ~
Lithuania	85 (2.5)	501 (2.7)	13 (2.3)	508 (8.4)	2 (1.0)	~ ~
Indonesia	84 (2.6)	411 (5.6)	13 (2.0)	418 (12.0)	4 (1.7)	386 (24.9)
Malaysia	84 (3.2)	508 (4.4)	15 (3.1)	511 (10.4)	1 (0.8)	~ ~
United States	84 (2.2)	513 (3.2)	16 (2.2)	488 (10.0)	0 (0.3)	~ ~
Saudi Arabia	83 (3.4)	336 (4.6)	13 (3.1)	330 (6.8)	4 (1.7)	320 (11.0)
Sweden	83 (3.1)	501 (2.8)	17 (3.0)	493 (8.3)	1 (0.4)	~ ~
Slovak Republic	82 (3.3)	510 (3.9)	16 (3.3)	496 (7.6)	2 (1.2)	~ ~
Australia	81 (3.4)	508 (5.9)	15 (3.1)	489 (12.1)	4 (1.5)	467 (12.2)
Serbia	81 (3.6)	473 (2.6)	12 (2.9)	476 (9.8)	6 (2.2)	518 (11.9)
Netherlands	81 (4.1)	541 (5.2)	19 (4.1)	518 (13.5)	0 (0.0)	~ ~
Israel	80 (2.8)	497 (3.5)	19 (2.8)	490 (10.0)	2 (0.7)	~ ~
Hong Kong, SAR	79 (3.5)	588 (3.9)	21 (3.5)	580 (9.6)	0 (0.0)	~ ~
Romania	79 (3.8)	474 (6.0)	16 (3.4)	481 (10.9)	5 (1.8)	473 (15.9)
Lebanon	79 (4.1)	440 (3.5)	19 (4.0)	407 (6.3)	2 (1.0)	~ ~
Cyprus	78 (1.6)	458 (2.0)	19 (1.5)	467 (3.0)	3 (0.6)	467 (9.7)
Tunisia	78 (3.7)	411 (2.7)	19 (3.5)	410 (4.0)	3 (1.4)	398 (12.4)
Jordan	77 (3.3)	429 (4.2)	16 (3.3)	416 (10.0)	6 (2.3)	385 (24.0)
Armenia	77 (3.1)	477 (3.2)	21 (3.0)	479 (7.2)	2 (1.1)	~ ~
Philippines	74 (4.2)	387 (6.7)	23 (4.0)	350 (10.7)	3 (1.5)	362 (42.7)
Estonia	72 (3.6)	530 (3.6)	24 (3.4)	534 (5.4)	4 (1.4)	532 (19.8)
Iran, Islamic Rep. of	72 (3.8)	415 (3.0)	25 (3.5)	404 (4.1)	4 (1.5)	403 (17.6)
Slovenia	70 (4.1)	492 (2.8)	26 (3.9)	497 (4.1)	4 (1.4)	493 (13.4)
Chinese Taipei	70 (3.6)	584 (5.2)	27 (3.2)	588 (8.6)	3 (1.6)	582 (19.8)
Bulgaria	69 (3.7)	471 (5.1)	27 (3.6)	481 (10.5)	4 (1.5)	501 (26.2)
Italy	68 (3.3)	492 (3.6)	23 (3.0)	466 (6.5)	9 (2.2)	465 (8.8)
Macedonia, Rep. of	68 (4.1)	431 (5.1)	23 (3.8)	431 (8.4)	9 (2.4)	477 (12.6)
Latvia	66 (4.1)	509 (3.6)	31 (3.9)	507 (6.8)	3 (1.0)	498 (16.2)
Russian Federation	61 (3.5)	508 (4.4)	35 (3.6)	511 (5.3)	4 (1.3)	499 (11.0)
Scotland	59 (4.1)	510 (5.8)	34 (4.1)	488 (7.4)	7 (2.5)	508 (12.9)
Moldova, Rep. of r	59 (4.9)	463 (6.3)	33 (4.4)	452 (9.0)	8 (2.5)	451 (12.7)
Chile	56 (3.9)	401 (5.4)	36 (3.9)	369 (5.1)	8 (2.2)	376 (10.2)
Morocco s	55 (6.9)	386 (4.7)	30 (5.5)	397 (5.0)	16 (4.8)	378 (6.3)
Japan	54 (4.0)	574 (3.0)	34 (3.9)	569 (3.5)	12 (2.9)	555 (5.4)
Palestinian Nat'l Auth.	51 (4.7)	391 (5.1)	35 (4.3)	388 (5.5)	13 (3.1)	396 (12.8)
Korea, Rep. of s	50 (3.7)	594 (2.9)	36 (3.6)	585 (4.9)	14 (2.8)	587 (3.6)
Ghana	40 (4.7)	276 (8.3)	46 (4.7)	276 (6.0)	14 (3.0)	256 (12.3)
South Africa	30 (3.5)	306 (14.6)	42 (4.1)	244 (5.1)	28 (3.4)	242 (4.4)
Botswana	22 (3.7)	379 (8.4)	46 (4.7)	360 (3.6)	32 (4.7)	366 (4.5)
‡ England r	69 (7.0)	506 (8.9)	24 (5.9)	517 (13.9)	7 (3.5)	474 (22.1)
International Avg.	72 (0.5)	470 (0.8)	22 (0.5)	461 (1.3)	6 (0.3)	440 (3.1)
Benchmarking Participants						
Basque Country, Spain	73 (4.8)	488 (3.0)	25 (4.8)	488 (6.8)	1 (1.0)	~ ~
Indiana State, US	84 (4.1)	515 (5.5)	12 (3.2)	470 (12.6)	4 (2.7)	481 (51.7)
Ontario Province, Can.	84 (2.8)	522 (3.2)	13 (3.2)	520 (11.0)	3 (1.5)	501 (21.2)
Quebec Province, Can.	93 (2.0)	545 (3.2)	6 (2.1)	527 (16.6)	1 (1.2)	~ ~

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.

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 Mathematics 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)	451 (2.5)	9 (2.7)	451 (10.4)	1 (0.7)	~ ~
Hungary	88 (3.0)	526 (3.2)	11 (2.8)	541 (16.7)	1 (1.0)	~ ~
Singapore	87 (2.8)	599 (5.8)	12 (2.8)	563 (14.8)	0 (0.2)	~ ~
New Zealand	87 (2.0)	498 (2.5)	13 (1.9)	470 (11.6)	0 (0.4)	~ ~
Netherlands	85 (2.2)	547 (2.0)	13 (2.1)	513 (9.5)	2 (1.5)	~ ~
United States	82 (2.2)	526 (2.5)	15 (2.0)	486 (5.8)	2 (0.8)	~ ~
Iran, Islamic Rep. of	81 (4.3)	392 (5.1)	16 (4.1)	378 (8.9)	2 (1.5)	~ ~
Lithuania	81 (3.1)	535 (3.3)	17 (2.8)	523 (6.7)	3 (1.1)	519 (11.1)
Tunisia r	79 (3.8)	342 (5.8)	11 (2.6)	319 (20.8)	10 (2.8)	331 (13.0)
Armenia r	79 (3.2)	457 (4.7)	18 (3.5)	443 (8.6)	3 (1.3)	439 (13.7)
Hong Kong, SAR	79 (3.9)	576 (3.7)	17 (3.8)	570 (4.9)	4 (1.7)	561 (9.0)
Australia	79 (3.5)	506 (4.4)	20 (3.5)	479 (10.5)	1 (0.7)	~ ~
Philippines	78 (3.7)	366 (9.7)	17 (3.3)	336 (11.0)	5 (2.1)	327 (25.6)
Cyprus	78 (3.3)	512 (2.7)	20 (3.3)	501 (5.3)	2 (0.9)	~ ~
Scotland r	77 (3.2)	501 (4.4)	22 (3.1)	471 (5.1)	1 (0.0)	~ ~
Slovenia	73 (4.1)	475 (3.3)	23 (4.0)	493 (5.7)	4 (1.7)	476 (13.6)
Russian Federation	72 (3.2)	533 (5.8)	26 (3.2)	529 (7.8)	1 (0.7)	~ ~
England r	70 (4.0)	541 (4.9)	28 (4.0)	507 (7.7)	2 (1.2)	~ ~
Belgium (Flemish)	70 (2.9)	552 (1.8)	29 (2.8)	548 (4.2)	1 (0.4)	~ ~
Chinese Taipei	69 (3.7)	564 (2.2)	28 (3.6)	568 (3.0)	3 (1.3)	519 (12.5)
Italy	65 (3.5)	509 (4.3)	24 (3.0)	489 (8.2)	12 (2.2)	499 (12.0)
Moldova, Rep. of	63 (4.3)	501 (7.5)	32 (4.1)	511 (7.3)	4 (1.6)	488 (15.5)
Latvia	63 (3.8)	537 (3.7)	34 (3.6)	534 (6.0)	3 (1.4)	531 (15.7)
Japan	55 (4.0)	566 (2.3)	37 (4.1)	563 (3.0)	8 (2.3)	561 (4.8)
Morocco s	47 (4.7)	348 (8.5)	31 (4.6)	361 (7.2)	21 (4.2)	325 (12.1)
International Avg.	75 (0.7)	498 (0.9)	21 (0.7)	486 (1.9)	4 (0.3)	465 (4.0)
Benchmarking Participants						
Indiana State, US	88 (3.3)	534 (3.1)	10 (2.7)	529 (8.7)	2 (1.2)	~ ~
Ontario Province, Can.	90 (3.1)	513 (4.0)	10 (3.1)	492 (9.9)	0 (0.3)	~ ~
Quebec Province, Can.	81 (3.6)	508 (2.5)	17 (3.4)	500 (7.3)	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)

MATHEMATICS Grade 8

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)	501 (2.6)	20 (0.8)	501 (3.8)	3 (0.3)	482 (7.9)
Armenia	72 (1.0)	487 (3.4)	23 (0.8)	471 (4.3)	6 (0.6)	455 (6.8)
Bulgaria	69 (1.1)	485 (4.8)	25 (0.9)	466 (4.7)	6 (0.5)	440 (8.9)
Serbia	67 (1.2)	484 (2.8)	27 (1.0)	472 (3.7)	5 (0.5)	450 (7.4)
Netherlands	66 (1.4)	540 (4.1)	29 (1.1)	533 (4.8)	5 (0.5)	519 (8.3)
Belgium (Flemish)	64 (1.1)	544 (2.9)	31 (1.0)	530 (3.2)	5 (0.4)	510 (6.7)
Estonia	64 (1.2)	534 (3.2)	30 (1.0)	529 (3.9)	6 (0.5)	518 (5.8)
Norway	63 (1.1)	468 (2.5)	30 (0.8)	457 (2.9)	6 (0.5)	437 (6.3)
Korea, Rep. of	62 (1.1)	591 (2.2)	32 (0.8)	589 (3.1)	6 (0.5)	578 (6.1)
Hungary	61 (1.2)	534 (3.3)	32 (1.0)	530 (3.9)	7 (0.5)	508 (6.3)
Japan	61 (1.0)	571 (2.5)	31 (0.8)	573 (3.1)	8 (0.5)	554 (5.5)
Lithuania	60 (1.1)	506 (2.8)	34 (0.8)	499 (3.1)	7 (0.5)	481 (6.0)
Russian Federation	60 (0.9)	513 (3.7)	35 (0.9)	505 (4.5)	6 (0.4)	501 (5.3)
Scotland	59 (1.2)	501 (4.1)	33 (1.0)	500 (4.1)	8 (0.6)	479 (8.3)
Italy	56 (1.1)	491 (3.3)	35 (0.9)	480 (3.5)	9 (0.6)	462 (5.6)
Latvia	56 (1.4)	517 (3.2)	36 (1.3)	503 (3.9)	7 (0.6)	488 (6.5)
Macedonia, Rep. of	56 (1.2)	453 (4.0)	33 (0.9)	435 (4.0)	11 (0.8)	395 (7.2)
Saudi Arabia	55 (1.9)	334 (5.0)	35 (1.4)	339 (5.0)	11 (0.8)	327 (6.4)
Israel	53 (1.2)	505 (3.7)	35 (1.2)	500 (3.9)	11 (0.6)	465 (5.9)
Slovenia	53 (1.3)	495 (2.7)	38 (1.3)	497 (3.1)	10 (0.6)	478 (4.0)
Malaysia	51 (1.1)	516 (4.6)	41 (1.0)	502 (3.8)	8 (0.5)	495 (6.0)
Slovak Republic	50 (1.2)	519 (3.7)	38 (0.9)	502 (3.6)	12 (0.7)	483 (5.8)
Iran, Islamic Rep. of	49 (1.5)	421 (2.4)	39 (1.1)	405 (3.0)	11 (0.7)	398 (4.9)
Romania	48 (1.4)	490 (5.4)	38 (1.0)	472 (4.6)	14 (0.9)	450 (7.3)
Moldova, Rep. of	48 (1.2)	473 (4.7)	38 (1.0)	456 (4.2)	14 (0.8)	439 (6.1)
Chinese Taipei	47 (0.9)	593 (4.9)	36 (0.7)	583 (5.0)	17 (0.6)	568 (5.9)
Tunisia	47 (1.0)	413 (2.5)	40 (0.9)	409 (2.6)	13 (0.6)	412 (3.9)
Hong Kong, SAR	46 (1.3)	589 (3.3)	42 (1.0)	588 (4.0)	12 (0.7)	573 (5.8)
Singapore	44 (0.7)	618 (3.2)	43 (0.6)	602 (4.0)	13 (0.5)	576 (5.7)
Australia	43 (1.2)	510 (4.7)	40 (1.0)	507 (5.3)	18 (0.9)	499 (5.0)
Egypt	42 (1.3)	443 (3.1)	40 (1.0)	400 (3.5)	18 (0.9)	360 (5.4)
Bahrain	41 (1.0)	413 (2.3)	42 (0.9)	403 (2.2)	17 (0.8)	376 (3.9)
Cyprus	41 (0.9)	476 (1.9)	42 (0.8)	461 (2.2)	17 (0.8)	434 (4.0)
Palestinian Nat'l Auth.	41 (1.3)	411 (3.2)	42 (0.9)	387 (3.6)	17 (0.9)	360 (4.2)
New Zealand	40 (1.5)	506 (5.7)	41 (1.3)	492 (5.4)	19 (1.2)	482 (7.6)
Indonesia	39 (1.2)	419 (4.8)	45 (1.1)	413 (5.3)	16 (0.8)	402 (6.5)
Lebanon	36 (1.8)	458 (4.1)	37 (0.9)	432 (3.4)	26 (1.8)	406 (3.6)
Morocco	35 (1.2)	393 (3.6)	48 (1.1)	388 (3.3)	17 (0.8)	384 (4.3)
Chile	31 (1.0)	400 (3.9)	51 (0.7)	387 (3.6)	18 (0.8)	366 (4.7)
Jordan	17 (2.3)	443 (12.3)	22 (1.6)	410 (6.2)	61 (3.2)	431 (3.3)
Philippines	15 (0.9)	413 (7.2)	47 (0.9)	382 (5.1)	38 (1.1)	360 (5.4)
Ghana	13 (1.0)	301 (6.8)	49 (1.0)	288 (5.2)	38 (1.3)	265 (4.5)
South Africa	13 (0.9)	341 (14.9)	47 (0.9)	272 (5.5)	40 (1.2)	231 (3.6)
Botswana	12 (0.6)	388 (4.5)	56 (0.8)	371 (3.3)	32 (0.9)	356 (2.2)
United States	– –	– –	– –	– –	– –	– –
‡ England	51 (1.4)	503 (5.9)	37 (1.0)	503 (5.4)	12 (1.0)	488 (7.0)
International Avg.	48 (0.2)	478 (0.7)	37 (0.1)	465 (0.6)	15 (0.1)	447 (0.9)
Benchmarking Participants						
Basque Country, Spain	62 (2.0)	493 (3.0)	32 (1.6)	484 (3.7)	6 (0.7)	454 (7.1)
Indiana State, US	– –	– –	– –	– –	– –	– –
Ontario Province, Can.	45 (1.4)	522 (3.6)	40 (1.1)	522 (3.6)	15 (1.1)	517 (5.7)
Quebec Province, Can.	55 (1.2)	546 (3.3)	36 (1.0)	542 (3.3)	9 (0.6)	535 (4.9)

Background data provided by students.

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

‡ 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)	474 (4.2)	37 (1.4)	451 (3.5)	5 (0.4)	430 (8.5)
Norway		53 (1.2)	467 (2.3)	34 (1.0)	453 (3.1)	13 (0.7)	426 (4.0)
Japan		45 (1.2)	573 (1.9)	39 (0.9)	566 (2.2)	17 (0.8)	543 (3.2)
Lithuania		44 (1.2)	549 (3.0)	43 (1.1)	530 (3.9)	13 (0.7)	511 (5.2)
Netherlands		44 (1.5)	550 (2.2)	40 (1.1)	539 (2.9)	17 (1.0)	523 (3.6)
Latvia		41 (1.3)	549 (3.2)	45 (1.0)	536 (3.0)	14 (0.8)	504 (5.8)
Russian Federation		40 (1.3)	546 (5.1)	46 (1.0)	528 (4.9)	14 (0.8)	515 (6.1)
Hong Kong, SAR		40 (1.5)	585 (3.6)	40 (0.9)	572 (3.3)	21 (1.1)	562 (3.7)
Slovenia		40 (1.4)	489 (3.5)	40 (1.1)	481 (3.7)	20 (1.2)	461 (4.1)
Hungary		37 (1.2)	541 (3.5)	43 (1.0)	530 (3.8)	20 (0.8)	511 (4.9)
Moldova, Rep. of		37 (2.0)	527 (6.4)	43 (1.4)	502 (4.8)	20 (1.3)	475 (7.2)
Belgium (Flemish)		35 (1.2)	561 (2.4)	41 (0.8)	549 (2.2)	24 (0.9)	540 (2.4)
Iran, Islamic Rep. of		33 (2.2)	396 (5.3)	44 (1.4)	389 (4.9)	23 (1.6)	387 (5.6)
Italy		33 (1.1)	510 (5.2)	42 (0.9)	508 (4.1)	25 (1.0)	491 (4.6)
Scotland		33 (1.4)	506 (3.5)	40 (1.0)	492 (3.6)	27 (1.2)	472 (4.9)
England		32 (1.2)	550 (4.7)	42 (0.9)	538 (4.1)	26 (1.2)	502 (4.3)
Australia		29 (1.0)	516 (3.6)	39 (1.0)	504 (4.7)	32 (1.4)	482 (4.8)
Chinese Taipei		28 (1.0)	575 (2.5)	37 (0.8)	568 (1.6)	35 (1.0)	552 (2.8)
Cyprus		27 (1.0)	533 (3.1)	47 (0.8)	514 (2.8)	25 (1.0)	484 (3.4)
New Zealand		26 (0.8)	515 (3.0)	42 (1.0)	497 (2.6)	32 (0.9)	477 (3.5)
Singapore		25 (0.9)	616 (5.1)	47 (0.7)	598 (5.8)	28 (0.9)	572 (6.5)
Morocco	r	25 (2.1)	361 (9.1)	52 (1.7)	352 (4.8)	23 (1.4)	345 (6.4)
Tunisia		23 (1.8)	365 (8.4)	50 (1.2)	347 (5.1)	27 (1.4)	332 (5.6)
Philippines		7 (0.8)	387 (20.2)	43 (1.1)	367 (9.0)	50 (1.5)	352 (6.8)
United States		– –	– –	– –	– –	– –	– –
International Avg.		35 (0.3)	510 (1.2)	42 (0.2)	496 (0.9)	23 (0.2)	477 (1.1)
Benchmarking Participants							
Indiana State, US		– –	– –	– –	– –	– –	– –
Ontario Province, Can.		30 (1.1)	527 (4.6)	40 (1.0)	513 (4.3)	29 (1.1)	497 (4.1)
Quebec Province, Can.		34 (1.1)	517 (3.1)	42 (0.8)	508 (2.7)	24 (1.1)	490 (3.6)

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.


A

Appendix A

Overview of TIMSS Procedures for Assessing Mathematics

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 US 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 adminis

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					
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 Mathematics Assessment

The development of the TIMSS 2003 mathematics assessment was a collaborative process spanning a two-and-a-half-year period and involving mathematics 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 mathematics 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 mathematics assessment framework for TIMSS 2003 is framed by two organizing dimensions or aspects, a content domain and a cognitive domain. The five content domains, number, algebra, measurement, geometry, and data, define the specific mathematics subject matter covered by the assessment, and the four cognitive domains define the sets of behaviors expected of students as they engage with the mathematics content. The cognitive domains include knowing facts and procedures, using concepts, solving routine problems, and reasoning.

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 mathematics coordinator and two experienced mathematics item writers

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 Mathematics Frameworks**

Content Domain

- Number
- Algebra*
- Measurement
- Geometry
- Data

Cognitive Domain

- Knowing Facts and Procedures
- Using Concepts
- Solving Routine Problems
- Reasoning

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

* At fourth grade, the Algebra content domain is called Patterns and Relationships.

reviewed general item-writing guidelines for multiple-choice and constructed-response items and provided specific training in writing mathematics and 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 mathematics tests contained 194 items at the eighth grade and 161 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 five mathematics content domains for eighth and fourth grades. Comparable information is presented for the four cognitive domains. About one-fourth of the eighth-grade items and more than two-fifths of the fourth-grade items 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 (215 and 169 score points for eighth- and fourth-grades, respectively). About 40% of students' testing time at eighth grade and almost half 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 215 score points available in the entire 2003 mathematics assessment, 23 came from items used also in 1995, 60 from items used also in 1999, and 132 from items used for the first time in 2003. At fourth grade, 37 score points came from 1995 items, and the remaining 132 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 Mathematics Items by Content Domain and Cognitive Domain**

MATHEMATICS Grade 8

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]
Number	30	57	43	14	60
Algebra	24	47	29	18	53
Measurement	16	31	19	12	34
Geometry	16	31	22	9	34
Data	14	28	15	13	34
Total	100	194	128	66	215

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]
Knowing Facts and Procedures	23	45	35	10	45
Using Concepts	19	37	31	6	39
Solving Routine Problems	36	70	43	27	76
Reasoning	22	42	19	23	55
Total	100	194	128	66	215

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.3: **Distribution of Mathematics Items by Content Domain and Cognitive Domain**

MATHEMATICS Grade 4

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]
Number	39	63	30	33	68
Patterns and Relationships	15	24	16	8	25
Measurement	20	33	23	10	33
Geometry	15	24	12	12	25
Data	11	17	11	6	18
Total	100	161	92	69	169

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

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]
Knowing Facts and Procedures	24	38	20	18	39
Using Concepts	23	37	24	13	39
Solving Routine Problems	37	60	35	25	61
Reasoning	16	26	13	13	30
Total	100	161	92	69	169

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 Mathematics Content Domain**

Grade 8

Content Domain	From 1995	From 1999	New in 2003	Total
Number	6	20	34	60
Algebra	6	11	36	53
Measurement	4	14	16	34
Geometry	4	8	22	34
Data	3	7	24	34
Total	23	60	132	215

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

Grade 4

Content Domain	From 1995	From 1999	New in 2003	Total
Number	19	N/A	49	68
Patterns and Relationships	2	N/A	23	25
Measurement	8	N/A	25	33
Geometry	4	N/A	21	25
Data	4	N/A	14	18
Total	37	N/A	132	169

TIMSS 2003 Assessment Design

Not all of the students in the TIMSS assessment responded to all of the mathematics 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),

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

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.

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

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.

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.

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

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.

populations for eighth and fourth grades. Almost all participants at the 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 5%) 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 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.

Exhibit A.6: Coverage of TIMSS 2003 Target Population

MATHEMATICS 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**

MATHEMATICS Grade 4

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

MATHEMATICS Grade 8

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

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 mathematics 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

Exhibit A.10: TIMSS 2003 Within-Country Scoring Reliability for the Constructed-Response Mathematics Items

MATHEMATICS 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	99	94	100	98	92	100
Australia	100	97	100	99	95	100
Bahrain	99	98	100	98	91	100
Belgium (Flemish)	99	96	100	98	91	100
Botswana	99	91	100	94	81	100
Bulgaria	96	70	100	92	64	99
Chile	99	95	100	97	91	100
Chinese Taipei	100	91	100	99	91	100
Cyprus	98	86	100	96	79	100
Egypt	100	97	100	99	97	100
England	99	93	100	98	91	100
Estonia	100	98	100	99	96	100
Ghana	99	97	100	95	90	99
Hong Kong, SAR	100	98	100	99	98	100
Hungary	98	90	100	96	80	100
Indonesia	98	90	100	94	82	100
Iran, Islamic Rep. of	99	94	100	96	90	100
Israel	98	93	100	93	83	99
Italy	99	95	100	98	92	100
Japan	99	94	100	98	91	100
Jordan	99	98	100	98	92	100
Korea, Rep. of	99	87	100	98	87	100
Latvia	98	90	100	96	79	100
Lebanon	100	94	100	99	91	100
Lithuania	97	71	100	95	62	100
Macedonia, Rep. of	100	97	100	99	95	100
Malaysia	100	98	100	99	97	100
Moldova, Rep. of	100	99	100	100	99	100
Morocco	97	89	100	92	82	99
Netherlands	97	84	100	95	78	100
New Zealand	99	96	100	97	88	100
Norway	98	91	100	96	86	100
Palestinian Nat'l Auth.	99	94	100	97	88	100
Philippines	99	97	100	97	92	100
Romania	100	98	100	99	94	100
Russian Federation	99	95	100	97	89	100
Saudi Arabia	99	94	100	95	81	99
Scotland	99	95	100	98	92	100
Serbia	99	96	100	98	94	100
Singapore	100	98	100	100	98	100
Slovak Republic	100	98	100	99	96	100
Slovenia	97	86	100	94	75	100
South Africa	99	95	100	97	90	99
Sweden	98	89	100	95	84	99
Tunisia	98	89	100	95	78	99
United States	97	86	100	94	75	99
International Avg.	99	92	100	97	87	100
Benchmarking Participants						
Basque Country, Spain	98	87	100	96	83	100
Indiana State, US	98	88	100	95	76	100
Ontario Province, Can.	97	80	100	93	72	100
Quebec Province, Can.	97	81	100	94	79	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 Mathematics 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	98	100	98	95	100
Australia	100	98	100	99	97	100
Belgium (Flemish)	100	96	100	98	87	100
Chinese Taipei	99	83	100	97	76	100
Cyprus	98	91	100	95	82	100
England	99	91	100	98	90	100
Hong Kong, SAR	100	98	100	99	87	100
Hungary	98	91	100	95	78	100
Iran, Islamic Rep. of	100	98	100	99	96	100
Italy	98	92	100	96	81	100
Japan	99	95	100	98	94	100
Latvia	98	87	100	96	78	100
Lithuania	97	77	100	94	69	100
Moldova, Rep. of	100	100	100	100	100	100
Morocco	98	93	100	94	86	98
Netherlands	97	86	100	94	73	100
New Zealand	99	94	100	96	85	100
Norway	99	95	100	97	92	100
Philippines	99	96	100	97	91	100
Russian Federation	100	97	100	99	96	100
Scotland	99	98	100	98	93	100
Singapore	100	99	100	100	99	100
Slovenia	98	84	100	96	73	100
Tunisia	97	89	100	91	77	98
United States	97	88	100	95	82	100
International Avg.	99	92	100	97	86	100
Benchmarking Participants						
Indiana State, US	99	92	100	96	83	100
Ontario Province, Can.	98	87	100	96	84	100
Quebec Province, Can.	98	92	100	96	86	100

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 Mathematics Items

MATHEMATICS 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
Australia	98	88	100	94	73	100
Belgium (Flemish)	98	92	100	94	78	100
Bulgaria	99	82	100	94	71	100
Chile	99	97	100	92	73	100
Chinese Taipei	98	95	100	94	79	100
Cyprus	98	91	100	94	79	100
Hong Kong, SAR	98	91	100	96	84	100
Hungary	98	89	100	95	86	100
Indonesia	98	90	100	93	60	100
Iran, Islamic Rep.	98	83	100	89	24	99
Israel	98	91	100	92	74	100
Italy	99	91	100	97	86	100
Japan	98	87	100	96	76	100
Jordan	99	96	100	96	87	100
Korea, Rep. of	98	88	100	94	67	100
Latvia	90	34	100	78	32	100
Lithuania	98	93	100	94	74	100
Macedonia, Rep. of	99	85	100	96	70	100
Malaysia	99	91	100	95	84	100
New Zealand	99	96	100	94	85	100
Philippines	99	86	100	95	75	100
Romania	99	97	100	97	90	100
Russian Federation	98	94	100	92	62	100
Singapore	99	96	100	98	89	100
Slovak Republic	93	54	100	87	50	99
Slovenia	99	95	100	95	81	100
South Africa	99	92	100	93	47	100
United States	98	91	100	94	76	100
International Avg.	98	88	100	93	72	100
Benchmarking Participants						
Ontario Province, Can.	98	85	100	93	65	100
Quebec Province, Can.	98	85	100	93	65	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 Mathematics Items

MATHEMATICS Grade 8

Item Label	Total Valid Comparisons	Exact Percent Agreement	
		Correctness Score Agreement	Diagnostic Score Agreement
M022202	99900	99	98
M022156	99900	99	91
M022012	99900	94	86
M022261A	99900	99	98
M022261B	99900	99	98
M022261C	99900	90	84
M022227A	99900	99	99
M022227B	99900	97	90
M022227C	99900	94	86
M022234A	99900	95	88
M022234B	99900	91	87
M022110	99900	98	93
M032691	99900	98	94
M032640	99900	93	93
M032683	99900	92	85
M032681A	99900	99	99
M032681B	99900	99	98
M032681C	99900	97	97
M032233	99900	93	91
M032692	99900	95	95
Average Percent Agreement		96	92

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

the within-country exact percent of agreement between scorers on the constructed-response items in the mathematics 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 99 percent for correctness score and 97 percent for diagnostic score at both fourth and eighth grades. The TIMSS data from the reliability studies indicate that scoring procedures were robust for the mathematics 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 98 percent exact agreement, on average, internationally, between the scores awarded in 1999 and those given by the 2003 scorers. There also was very high agreement at the diagnostic score level, with 93 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 20 constructed-response mathematics questions. This set of 3,000 student responses was then sent to each

Northern-Hemisphere 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 very high, with the percent exact agreement ranging from 90 percent to 99 percent across the 20 items for the correctness score and from 84 to 99 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 0.89 for eighth grade and 0.87 for fourth grade. Despite the generally high reliabilities, there were some countries with median reliabilities below 0.80, namely Botswana, Ghana, Morocco (both grades), Saudi Arabia, Syria, and Tunisia (both grades).

Exhibit A.13: Cronbach's Alpha Reliability Coefficient – TIMSS 2003 Mathematics Test

Countries	Reliability Coefficient[1]	
	Grade 8	Grade 4
Armenia	0.87	0.87
Australia	0.90	0.88
Bahrain	0.82	
Belgium (Flemish)	0.90	0.83
Botswana	0.71	
Bulgaria	0.90	
Chile	0.86	
Chinese Taipei	0.94	0.85
Cyprus	0.89	0.89
Egypt	0.86	
England	0.90	0.91
Estonia	0.90	
Ghana	0.51	
Hong Kong, SAR	0.91	0.83
Hungary	0.92	0.88
Indonesia	0.87	
Iran, Islamic Rep. of	0.84	0.80
Israel	0.91	
Italy	0.89	0.88
Japan	0.92	0.87
Jordan	0.87	
Korea, Rep. of	0.93	
Latvia	0.90	0.87
Lebanon	0.84	
Lithuania	0.90	0.88
Macedonia, Rep. of	0.88	
Malaysia	0.90	
Moldova, Rep. of	0.87	0.90
Morocco	0.74	0.76
Netherlands	0.90	0.83
New Zealand	0.90	0.88
Norway	0.85	0.87
Palestinian Nat'l Auth.	0.83	
Philippines	0.83	0.87
Romania	0.91	
Russian Federation	0.90	0.88
Saudi Arabia	0.64	
Scotland	0.90	0.88
Serbia	0.91	
Singapore	0.92	0.91
Slovak Republic	0.91	
Slovenia	0.88	0.87
South Africa	0.85	
Sweden	0.89	
Syrian Arab Republic	0.72	
Tunisia	0.77	0.83
United States	0.90	0.88
Yemen		0.77
International Median	0.89	0.87
Benchmarking Participants		
Basque Country, Spain	0.85	
Indiana State, US	0.89	0.86
Ontario Province, Can.	0.89	0.87
Quebec Province, Can.	0.87	0.84

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 mathematics test, two items were deleted for all countries. In addition, 7 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 mathematics items were deleted for all countries, but 17 countries had one or more items deleted (mostly one or two). Because of a major booklet printing error, more than 40 mathematics items had to be deleted for Ghana, which may have contributed to its low Cronbach's alpha reliability.

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 mathematics 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 mathematics item pool. Achievement scales were produced for each of the five mathematics content areas (number, algebra, measurement, geometry, and data), as well as for mathematics 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 effect occurred

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.

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 mathematics 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 students tested in 2003 but not 1995 were assigned scores on the basis of the scale.

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.

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 mathematics overall, IRT scales also were created for each of the five mathematics 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 Diancou, D. (2004), "Reporting Student Achievement in Mathematics and Science" in M.O. Martin, I.V.S. Mullis, and S.J. Chrostowski (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 mathematics scale could mean in terms of the mathematics 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.

In order 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]

Calculator Use in the TIMSS 2003 Mathematics Assessment

Because calculators were permitted in TIMSS for the first time in the 2003 assessment at the eighth grade (not the fourth grade), TIMSS placed all the trend items in the first half of the test and only permitted eighth-grade students to use calculators for the second half. Nevertheless, capitalizing on the counterbalanced TIMSS booklet design, one block of mathematics items was included in both the testing session before the break, when calculators were not permitted, and in the session after the break, when they were allowed. This enabled a comparison of the mathematics achievement of those students having a calculator available and those that did not.

As shown in Exhibit A.14, calculator usage in the assessment was quite low. On average, internationally, 37 percent of students reported that they did not have a calculator for the test, and a further 47 percent that although they had them, they used them very little (39%) or not at all (8%). Most of the TIMSS mathematics items were designed so that they could be answered readily without the use of a calculator, and consequently having a calculator available may not be a great advantage. However, the Science and Mathematics Item Review Committee identified five items in the calculator block for which a calculator should be and was helpful, and Exhibit A.14 presents for each country the average percent correct across these five calculator-sensitive items for students when they had a calculator and when they did not. On average, internationally, performance on the calculator-sensitive items was superior when students had calculators (66% correct with calculator vs 57% correct without a calculator). The difference was significant in almost every country where calculators were used.

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.

Exhibit A.14: Students' Reports on the Frequency of Calculator Use During the TIMSS 2003 Test

MATHEMATICS Grade 8

Countries	Percentage of Students Using a Calculator During the TIMSS Test					Average Percent Correct for the Five Calculator-Sensitive Items*	
	Quite a Lot	Somewhat	Very Little	Not at All	Did Not Have a Calculator for the Test	With Calculator	Without Calculator
Armenia	3 (0.4)	4 (0.3)	15 (1.0)	2 (0.3)	75 (1.3)	57 (2.1)	67 (1.3) ▲
Australia	2 (0.3)	12 (1.0)	46 (1.6)	12 (0.7)	28 (2.2)	69 (1.7) ▲	53 (1.6)
Bahrain	3 (0.3)	8 (0.5)	38 (0.9)	14 (0.6)	37 (1.1)	45 (1.7) ▲	36 (1.2)
Belgium (Flemish)	1 (0.2)	16 (0.8)	54 (1.3)	11 (0.5)	18 (1.6)	82 (1.2) ▲	65 (1.3)
Botswana	10 (0.6)	17 (0.8)	45 (1.0)	22 (0.9)	6 (0.9)	57 (1.3) ▲	34 (0.9)
Bulgaria	1 (0.2)	5 (0.6)	16 (1.3)	4 (0.5)	74 (1.8)	64 (2.0)	62 (1.6)
Chile	1 (0.2)	11 (0.8)	44 (1.7)	13 (0.6)	31 (2.4)	55 (1.6) ▲	39 (1.1)
Chinese Taipei	0 (0.1)	2 (0.3)	12 (1.1)	5 (0.5)	80 (1.6)	83 (1.3)	83 (1.0)
Cyprus	3 (0.4)	10 (0.6)	29 (0.8)	5 (0.4)	52 (1.0)	60 (1.7) ▲	51 (1.0)
Egypt	20 (0.9)	36 (0.9)	37 (0.9)	4 (0.3)	3 (0.3)	56 (1.6)	58 (1.1)
England	1 (0.2)	9 (0.8)	48 (1.9)	15 (1.1)	27 (2.5)	62 (1.9) ▲	44 (1.2)
Estonia	1 (0.2)	12 (0.8)	57 (1.2)	2 (0.3)	27 (1.3)	85 (1.0) ▲	73 (0.9)
Ghana	10 (0.6)	12 (0.8)	15 (0.8)	10 (0.7)	54 (1.6)	30 (1.7) ▲	26 (1.1)
Hong Kong, SAR	2 (0.4)	18 (1.0)	51 (1.3)	6 (0.5)	23 (1.8)	88 (1.0) ▲	81 (0.9)
Hungary	1 (0.3)	12 (0.9)	60 (1.4)	10 (0.6)	17 (1.6)	84 (1.1) ▲	75 (1.3)
Indonesia	3 (0.3)	10 (0.9)	18 (1.5)	1 (0.1)	69 (2.3)	57 (1.8)	55 (1.5)
Iran, Islamic Rep. of	2 (0.3)	4 (0.4)	11 (1.2)	4 (0.5)	79 (1.9)	48 (1.6)	48 (1.1)
Israel	2 (0.3)	15 (0.8)	52 (1.4)	13 (0.7)	18 (1.4)	74 (1.4) ▲	59 (1.4)
Italy	1 (0.2)	13 (0.8)	49 (1.4)	0 (0.1)	36 (1.7)	71 (1.4) ▲	60 (1.3)
Japan	1 (0.1)	12 (0.6)	47 (1.3)	22 (1.1)	19 (2.0)	85 (1.1) ▲	77 (0.9)
Jordan	3 (0.3)	7 (0.5)	26 (1.6)	7 (0.6)	56 (2.0)	50 (1.9)	48 (1.5)
Korea, Rep. of	0 (0.0)	0 (0.1)	5 (0.9)	0 (0.0)	95 (0.9)	79 (1.0)	81 (0.8)
Latvia	1 (0.2)	12 (0.9)	43 (1.4)	6 (0.6)	38 (1.9)	81 (1.4) ▲	67 (1.5)
Lebanon	8 (0.8)	18 (1.0)	43 (1.2)	15 (0.9)	17 (1.1)	70 (1.7) ▲	61 (1.4)
Lithuania	2 (0.3)	17 (0.8)	49 (1.1)	5 (0.5)	26 (1.4)	82 (1.2) ▲	67 (1.1)
Macedonia, Rep. of	3 (0.4)	13 (1.0)	33 (1.3)	8 (0.6)	43 (2.1)	61 (1.5)	60 (1.4)
Malaysia	2 (0.3)	19 (0.8)	47 (1.6)	1 (0.2)	31 (1.9)	82 (0.9) ▲	73 (1.2)
Moldova, Rep. of	1 (0.2)	11 (0.9)	39 (1.5)	4 (0.5)	45 (1.9)	65 (1.9)	65 (1.4)
Morocco	1 (0.2)	6 (0.6)	19 (1.6)	3 (0.5)	71 (2.2)	54 (2.0) ▲	48 (1.4)
Netherlands	4 (0.4)	25 (1.2)	51 (1.2)	0 (0.1)	19 (1.3)	80 (1.8) ▲	68 (1.4)
New Zealand	2 (0.5)	14 (0.7)	49 (1.6)	8 (0.6)	27 (1.9)	68 (1.9) ▲	50 (1.8)
Norway	1 (0.1)	7 (0.6)	54 (1.3)	18 (0.7)	20 (1.5)	59 (1.4) ▲	40 (1.1)
Palestinian Nat'l Auth.	6 (0.4)	13 (0.6)	46 (1.2)	11 (0.6)	24 (1.5)	48 (1.7) ▲	41 (1.2)
Philippines	7 (0.6)	12 (0.7)	19 (1.1)	8 (0.7)	54 (1.9)	51 (1.5)	48 (1.6)
Romania	2 (0.3)	9 (0.6)	31 (1.6)	5 (0.5)	53 (2.2)	69 (2.1) ▲	62 (1.8)
Russian Federation	1 (0.2)	15 (0.8)	49 (1.3)	6 (0.6)	29 (1.3)	83 (1.1) ▲	72 (1.3)
Saudi Arabia	4 (0.4)	11 (0.7)	48 (1.9)	2 (0.4)	35 (1.9)	29 (1.7) ▲	21 (1.2)
Scotland	1 (0.2)	7 (0.5)	55 (2.0)	17 (1.0)	19 (2.2)	65 (1.6) ▲	48 (1.1)
Serbia	0 (0.1)	4 (0.4)	29 (1.6)	11 (0.8)	57 (2.1)	69 (1.6) ▲	61 (1.2)
Singapore	5 (0.4)	20 (0.7)	53 (0.8)	9 (0.4)	12 (0.5)	87 (1.0) ▲	78 (0.8)
Slovak Republic	2 (0.3)	15 (0.9)	52 (1.4)	15 (1.0)	16 (1.1)	77 (2.0) ▲	66 (1.3)
Slovenia	2 (0.3)	8 (0.7)	34 (1.6)	3 (0.3)	53 (1.9)	71 (1.6)	68 (1.3)
South Africa	9 (0.5)	12 (0.6)	23 (1.0)	12 (0.6)	45 (1.4)	26 (1.4) ▲	19 (0.9)
Sweden	1 (0.2)	14 (0.7)	58 (1.0)	15 (0.6)	11 (0.9)	66 (1.3) ▲	45 (1.0)
Tunisia	6 (0.5)	16 (1.0)	36 (1.5)	7 (0.5)	35 (2.4)	64 (1.5)	62 (1.1)
United States	3 (0.2)	22 (0.6)	61 (0.8)	11 (0.4)	4 (0.4)	75 (1.3) ▲	65 (1.1)
International Avg.	3 (0.1)	12 (0.1)	39 (0.2)	8 (0.1)	37 (0.3)	66 (0.2) ▲	57 (0.2)
Benchmarking Participants							
Basque Country, Spain	1 (0.2)	10 (0.8)	58 (1.7)	14 (0.9)	17 (1.8)	76 (1.5) ▲	65 (1.4)
Indiana State, US	2 (0.3)	23 (1.1)	59 (1.0)	13 (0.9)	4 (0.5)	78 (1.9) ▲	70 (1.5)
Ontario Province, Can.	1 (0.3)	15 (0.9)	62 (1.2)	11 (0.9)	10 (0.9)	78 (1.4) ▲	59 (1.5)
Quebec Province, Can.	3 (0.5)	21 (0.9)	59 (1.2)	6 (0.4)	10 (1.0)	85 (1.2) ▲	71 (1.3)

▲ Significantly higher

* Five calculator-sensitive items are M05_02, M06_07, M06_11, M06_12, M06_13.

( ) Stan

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

In scaling the mathematics achievement test, each of the five calculator-sensitive items was treated as two distinct items – one item when a calculator was available and the other item when a calculator was unavailable.


B

Appendix B

Multiple Comparisons of Average Achievement in Mathematics Content Areas

Exhibit B.1: Multiple Comparisons of Average Achievement in Number

MATHEMATICS 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	Korea, Rep. of	Hong Kong, SAR	Chinese Taipei	Japan	Belgium (Flemish)	Netherlands	Hungary	Malaysia	Estonia	Slovak Republic	United States	Latvia	Russian Federation	Israel	Lithuania	Australia	Slovenia	Sweden	England	Scotland	New Zealand	Italy	Serbia	Bulgaria	Romania	Armenia	Cyprus	Moldova, Rep. of	Norway
Singapore		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Korea, Rep. of	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong, SAR	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan	▼	▼	▼	▼		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Belgium (Flemish)	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Netherlands	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hungary	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Malaysia	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Estonia	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovak Republic	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
United States	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Latvia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Russian Federation	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼										▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Israel	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Lithuania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Australia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Sweden	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
England	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼										▲	▲	▲
Scotland	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲
New Zealand	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼									▲	▲	▲
Italy	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼									▲	▲	▲
Serbia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼									▲	▲	▲
Bulgaria	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼									▲	▲	▲
Romania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼									▲		▲
Armenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼							▲	▲	▲
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲
Moldova, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼			
Norway	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		
Macedonia, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Lebanon	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Indonesia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Egypt	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Iran, Islamic Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Jordan	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Chile	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Palestinian Nat'l Auth.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Botswana	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Bahrain	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Saudi Arabia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
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 Number

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

MATHEMATICS 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	Hong Kong, SAR	Japan	Hungary	Estonia	Belgium (Flemish)	Russian Federation	Netherlands	United States	Latvia	Slovak Republic	Lithuania	Australia	Israel	Malaysia	England	New Zealand	Armenia	Scotland	Serbia	Slovenia	Bulgaria	Romania	Sweden	Italy	Moldova, Rep. of	Cyprus	Lebanon
Korea, Rep. of			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Singapore				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong, SAR	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan	▼	▼	▼	▼		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hungary	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Estonia	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Belgium (Flemish)	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Russian Federation	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Netherlands	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
United States	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Latvia	▼	▼	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovak Republic	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Lithuania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Australia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼											▲	▲	▲	▲	▲	▲	▲	▲	▲
Israel	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲		▲	▲	▲	▲	▲	▲	▲	▲	▲
Malaysia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼											▲	▲	▲	▲	▲	▲	▲
England	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼													▲	▲	▲	▲	▲
New Zealand	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼													▲	▲	▲	▲
Armenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼										▲	▲	▲	▲	▲
Scotland	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼													▲	▲	▲	▲
Serbia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼											▲	▲	▲	▲
Slovenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼											▲	▲	▲	▲
Bulgaria	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼											▲	▲	▲
Romania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼											▲	▲	▲
Sweden	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼								▲	▲	▲
Italy	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲
Moldova, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲
Lebanon	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	
Macedonia, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	
Jordan	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Norway	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Indonesia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Iran, Islamic Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Bahrain	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Egypt	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Palestinian Nat'l Auth.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Chile	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Botswana	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Saudi Arabia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
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.2: Multiple Comparisons of Average Achievement in Algebra

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

MATHEMATICS 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	Hong Kong, SAR	Korea, Rep. of	Chinese Taipei	Japan	Netherlands	Belgium (Flemish)	Estonia	Hungary	Sweden	Australia	Scotland	Slovak Republic	Russian Federation	England	Malaysia	Latvia	New Zealand	Italy	Slovenia	United States	Lithuania	Armenia	Romania	Norway	Israel	Serbia	Bulgaria	Moldova, Rep. of	Cyprus
Singapore		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong, SAR	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Korea, Rep. of	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan	▼	▼	▼	▼		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Netherlands	▼	▼	▼	▼	▼		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Belgium (Flemish)	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Estonia	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hungary	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Sweden	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Australia	▼	▼	▼	▼	▼	▼	▼	▼	▼										▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Scotland	▼	▼	▼	▼	▼	▼	▼	▼	▼											▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovak Republic	▼	▼	▼	▼	▼	▼	▼	▼	▼											▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Russian Federation	▼	▼	▼	▼	▼	▼	▼	▼	▼											▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
England	▼	▼	▼	▼	▼	▼	▼	▼	▼													▲	▲	▲	▲	▲	▲	▲	▲	▲
Malaysia	▼	▼	▼	▼	▼	▼	▼	▼	▼													▲	▲	▲	▲	▲	▲	▲	▲	▲
Latvia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼													▲	▲	▲	▲	▲	▲	▲	▲
New Zealand	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼													▲	▲	▲	▲	▲	▲	▲	▲
Italy	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼												▲	▲	▲	▲	▲	▲	▲	▲
Slovenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼										▲	▲	▲	▲	▲	▲	▲
United States	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼											▲	▲	▲	▲	▲	▲
Lithuania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼									▲	▲	▲	▲	▲	▲
Armenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲
Romania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼									▲	▲
Norway	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲
Israel	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲
Serbia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲
Bulgaria	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲
Moldova, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	
Macedonia, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Lebanon	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Jordan	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Chile	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Egypt	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Iran, Islamic Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Indonesia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Bahrain	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Palestinian Nat'l Auth.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Botswana	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Saudi Arabia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
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 Measurement

MATHEMATICS 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	Lebanon	Jordan	Tunisia	Chile	Egypt	Iran, Islamic Rep. of	Indonesia	Bahrain	Palestinian Nat'l Auth.	Botswana	Morocco	Philippines	Saudi Arabia	South Africa	Ghana	Basque Country, Spain	Indiana State, US	Ontario Province, Can.	Quebec Province, Can.	Countries
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	Singapore
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	Hong Kong, SAR
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	Korea, Rep. of
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	Chinese Taipei
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	Japan
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		Netherlands
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		Belgium (Flemish)
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	Estonia
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▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			▼	▼	Lithuania
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▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Bulgaria
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Moldova, Rep. of
▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Cyprus
		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Macedonia, Rep. of
		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Lebanon
▼	▼		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Jordan
▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Tunisia
▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Chile
▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Egypt
▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Iran, Islamic Rep. of
▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Indonesia
▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Bahrain
▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▼	▼	▼	▼	Palestinian Nat'l Auth.
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▼	▼	▼	▼	Botswana
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▼	▼	▼	▼	Morocco
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▼	▼	▼	▼	Philippines
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲	▼	▼	▼	▼	Saudi Arabia
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▼	▼	▼	▼	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 Geometry

MATHEMATICS Grade 8

Instructions: Read across the row for a country to compare performance with the countries listed along the top of t
whether the average achievement of the country in the row is significantly lower than that of the comparison coun
that of the comparison country, or if there is no statistically significant difference between the average achievemen

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

Countries	Korea, Rep. of	Hong Kong, SAR	Chinese Taipei	Japan	Singapore	Estonia	Belgium (Flemish)	Hungary	Latvia	Russian Federation	Netherlands	Lithuania	Slovak Republic	Malaysia	England	Australia	Scotland	New Zealand	Israel	Bulgaria	Slovenia	Armenia
Korea, Rep. of		▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong, SAR	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Singapore	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Estonia	▼	▼	▼	▼	▼		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Belgium (Flemish)	▼	▼	▼	▼	▼	▼		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hungary	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Latvia	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Russian Federation	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Netherlands	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Lithuania	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovak Republic	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲
Malaysia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼									▲	▲
England	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼										▲
Australia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼										
Scotland	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼									▲
New Zealand	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼									
Israel	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼									
Bulgaria	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼									
Slovenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼								
Armenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼					
Romania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					
United States	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Serbia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Italy	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Sweden	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Moldova, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Norway	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Lebanon	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Jordan	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Macedonia, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Bahrain	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Iran, Islamic Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Palestinian Nat'l Auth.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Indonesia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Egypt	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Saudi Arabia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Chile	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
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.

Exhibit B.4: Multiple Comparisons of Average Achievement in Geometry

MATHEMATICS 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.

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

MATHEMATICS 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	Japan	Korea, Rep. of	Chinese Taipei	Hong Kong, SAR	Netherlands	Belgium (Flemish)	Sweden	Estonia	England	Australia	Scotland	United States	New Zealand	Hungary	Latvia	Malaysia	Lithuania	Norway	Slovak Republic	Slovenia	Israel	Italy	Russian Federation	Bulgaria	Cyprus	Serbia	Romania	Jordan	Moldova, Rep. of
Singapore			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Korea, Rep. of	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong, SAR	▼						▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Netherlands	▼	▼	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Belgium (Flemish)	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Sweden	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Estonia	▼	▼	▼	▼	▼	▼	▼						▲		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
England	▼	▼	▼	▼	▼	▼	▼									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Australia	▼	▼	▼	▼	▼	▼	▼									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Scotland	▼	▼	▼	▼	▼	▼	▼									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
United States	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
New Zealand	▼	▼	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hungary	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Latvia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Malaysia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Lithuania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Norway	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovak Republic	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲
Slovenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲	▲
Israel	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲
Italy	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▲	▲	▲	▲	▲	▲
Russian Federation	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲
Bulgaria	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲
Serbia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲
Romania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲
Jordan	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		
Moldova, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		
Macedonia, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	
Armenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Indonesia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	
Bahrain	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Chile	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Iran, Islamic Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Lebanon	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Egypt	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Palestinian Nat'l Auth.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Botswana	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Saudi Arabia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
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.5: Multiple Comparisons of Average Achievement in Data

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

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

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

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

Exhibit B.7: Multiple Comparisons of Average Achievement in Patterns and Relationships

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

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

MATHEMATICS 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	Japan	Singapore	Chinese Taipei	Hong Kong, SAR	Netherlands	England	United States	Belgium (Flemish)	Latvia	Australia	New Zealand	Lithuania	Scotland	Hungary	Cyprus	Russian Federation	Italy	Slovenia	Norway	Moldova, Rep. of	Armenia	Philippines	Iran, Islamic Rep. of	Morocco	Tunisia	Indiana State, US	Ontario Province, Can.	Quebec Province, Can.
Singapore			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan					▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong, SAR	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei	▼				▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
England	▼	▼	▼	▼		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲
Belgium (Flemish)	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▲
Russian Federation	▼	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲			
Lithuania	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	
Australia	▼	▼	▼	▼	▼	▼									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	
Latvia	▼	▼	▼	▼	▼	▼									▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	
Italy	▼	▼	▼	▼	▼	▼										▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	
Netherlands	▼	▼	▼	▼	▼	▼										▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	
United States	▼	▼	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	
New Zealand	▼	▼	▼	▼	▼	▼	▼	▼								▲	▲	▲	▲	▲	▲	▲	▲	▲	▲		▼	
Hungary	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼							▲	▲	▲	▲	▲	▲	▲	▲	▲	▼	▼	▼
Scotland	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▲	▼	▼	▼
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▲	▲	▲	▲	▲	▲	▲	▼	▼	▼
Moldova, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▲	▲	▲	▲	▲	▲	▼	▼	▼
Slovenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▲	▲	▲	▲	▲	▲	▼	▼	▼
Norway	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲	▲	▲	▲	▲	▼	▼	▼
Armenia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲	▲	▲	▲	▼	▼	▼
Iran, Islamic Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲	▲	▼	▼	▼
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲	▼	▼	▼
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▼	▼	▼
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▼	▼	▼
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.10: **Multiple Comparisons of Average Achievement in Data**

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

Appendix C

The Test-Curriculum Matching Analysis: Mathematics

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 mathematics 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 mathematics, 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' mathematics 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 mathematics curriculum would not be the same in all countries. To restrict test items to just those topics included in the curricula of all participating countries and covered in the same sequence would severely limit test coverage and restrict the research

1 See Appendix A for more information on test development.

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 mathematics 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 was 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 mathematics 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 that the countries varied substantially in the number of items (score points) identified as appropriate.[3] At the eighth grade, the percentage of score points ranged from 100 percent (213 score points) in Israel and Saudi Arabia to 71 percent (151 score points) in Ghana. Forty-seven of the

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.

50 participants indicated that items representing three-quarters or more of the score points (160 out of a possible 213) were appropriate. At the fourth grade, the percentage of score points ranged from 99 percent (164 score points) in Latvia, Lithuania, the United States, Moldova, and Armenia to 51 percent (85 score points) in Tunisia. Twenty-three of the 28 fourth-grade participants indicated that items representing three-quarters or more of the score points (125 out of a possible 166) were appropriate.

Since most countries indicated that some items were not included in their intended curricula 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 72 percent on its own set of items, also had 71 percent correct for the items selected by Korea, 72 percent for the items selected by Hong Kong SAR, 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 the Slovak Republic as an example, on average, 71 percent of these items were answered correctly by students in Singapore, 68 percent by students in Korea, 67 percent by those in Hong Kong SAR, and so forth. The shaded diagonal element in the exhibit shows how each country performed on the subset of items that it selected based on its

4 It should be noted that the mathematics 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 – Mathematics

Based on Subset of Items Specially Identified by Each Country as Addressing its Curriculum
(See Exhibit C.2 for corresponding standard errors)

MATHEMATICS 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	Korea, Rep. of	Hong Kong, SAR	Chinese Taipei	Japan	Belgium (Flemish)	Netherlands	Hungary	Estonia	Russian Federation	Slovak Republic	Latvia	Australia	Malaysia	United States	Lithuania	Sweden	Scotland	England	Israel	New Zealand	Slovenia	Italy	Romania	Serbia
Singapore	71 (0.9)	72	71	72	71	72	72	72	71	72	74	71	71	72	72	71	71	72	71	71	71	72	73	75	72	71
Korea, Rep. of	68 (0.4)	68	68	68	68	68	68	68	68	69	69	68	68	69	68	68	68	67	66	68	68	69	70	73	69	68
Hong Kong, SAR	67 (0.8)	67	67	67	67	67	68	67	67	67	69	67	67	68	67	67	67	66	66	67	67	68	69	72	68	67
Chinese Taipei	66 (1.0)	66	66	66	66	66	66	66	66	66	67	66	66	67	66	66	66	65	65	66	66	66	67	70	66	66
Japan	64 (0.5)	63	64	63	64	65	64	64	64	64	65	63	63	65	63	63	63	64	63	63	64	65	65	68	64	63
Belgium (Flemish)	56 (0.7)	56	56	56	56	57	57	58	56	57	59	56	56	58	56	56	56	57	56	56	56	58	57	61	56	56
Netherlands	55 (1.0)	55	55	54	55	56	55	59	55	56	57	55	55	57	56	55	55	57	57	56	55	57	56	59	55	54
Hungary	55 (0.8)	55	55	55	55	55	55	56	55	55	57	55	55	56	55	55	55	55	54	55	55	56	56	59	55	55
Estonia	54 (0.8)	54	54	54	54	55	55	55	54	55	57	54	54	56	54	54	54	55	54	54	54	56	55	59	54	54
Russian Federation	49 (0.9)	49	49	49	49	49	49	49	49	50	52	49	49	49	49	49	49	49	48	49	49	50	51	54	50	49
Slovak Republic	49 (0.8)	49	49	49	49	49	49	49	49	49	51	49	48	50	49	48	48	49	47	49	49	50	50	54	49	49
Latvia	48 (0.8)	48	48	48	48	49	49	49	48	49	51	48	48	49	49	48	48	48	47	48	48	49	50	53	49	48
Australia	48 (1.1)	48	48	48	48	49	49	51	48	49	50	48	48	50	49	48	48	49	49	49	48	50	49	52	48	48
Malaysia	48 (1.0)	48	48	48	48	48	48	49	48	48	50	48	48	49	48	48	48	48	48	48	48	49	50	53	48	48
United States	48 (0.8)	47	48	47	47	48	48	50	48	48	50	47	47	49	48	47	47	48	48	48	48	49	48	52	48	47
Lithuania	47 (0.6)	47	47	46	47	47	47	48	47	47	49	47	47	48	47	47	47	47	46	47	47	48	49	51	47	47
Sweden	47 (0.7)	46	47	46	47	47	47	50	47	47	48	46	47	49	47	47	47	49	49	47	47	49	47	51	47	46
Scotland	46 (1.0)	46	46	45	46	47	47	49	46	47	48	46	46	48	47	46	46	48	48	47	46	48	47	51	46	46
England	46 (1.2)	46	46	45	46	47	46	49	46	46	47	46	46	48	46	46	46	47	48	47	46	48	46	50	46	46
Israel	46 (0.8)	45	46	46	46	46	46	46	46	46	48	46	46	46	46	46	46	46	45	46	46	47	47	50	46	45
New Zealand	45 (1.3)	45	45	44	45	45	45	47	45	45	46	45	45	47	45	45	45	46	46	46	45	47	45	49	45	44
Slovenia	44 (0.6)	44	44	44	44	44	44	45	44	44	46	44	44	46	44	44	44	44	44	44	44	45	45	48	44	44
Italy	43 (0.7)	43	43	43	43	43	43	44	43	43	45	43	43	44	43	43	43	43	43	43	43	45	44	47	43	43
Romania	42 (1.1)	42	42	42	42	42	42	42	42	42	44	42	41	42	42	41	41	41	40	42	42	42	43	46	42	42
Serbia	41 (0.6)	41	41	42	41	41	41	41	41	42	44	41	41	42	42	41	41	40	40	41	41	42	43	46	42	41
Bulgaria	41 (0.9)	40	41	41	41	41	41	40	40	41	43	40	40	41	41	40	40	40	40	40	41	41	42	45	41	40
Armenia	39 (0.7)	39	39	40	39	39	39	38	39	39	40	39	39	39	39	39	39	38	38	39	39	39	41	42	40	39
Cyprus	37 (0.3)	37	37	37	37	38	38	38	37	38	39	37	37	38	38	37	37	37	37	37	37	38	39	41	38	37
Moldova, Rep. of	37 (0.8)	37	37	38	37	37	37	37	37	37	39	37	37	38	37	37	37	37	37	37	37	38	39	41	38	37
Norway	37 (0.5)	37	37	36	37	38	37	39	37	37	39	37	37	39	37	37	37	39	38	37	37	39	37	41	37	37
Macedonia, Rep. of	33 (0.6)	33	33	34	33	33	33	33	33	34	35	33	33	34	33	33	33	33	33	33	33	34	34	37	34	33
Lebanon	32 (0.6)	32	31	32	32	32	32	30	32	32	34	32	31	32	32	31	31	30	29	31	32	32	34	36	32	32
Jordan	31 (0.7)	31	31	31	31	31	30	30	31	31	32	31	31	31	31	31	31	30	30	31	31	31	32	34	31	31
Indonesia	29 (0.7)	29	29	29	29	30	29	30	29	30	31	29	29	30	30	29	29	29	29	30	29	30	31	33	30	29
Egypt	28 (0.5)	28	28	28	28	28	28	28	28	29	30	28	28	28	28	28	28	27	26	28	28	29	30	31	29	28
Iran, Islamic Rep. of	28 (0.4)	28	28	28	28	28	28	28	28	28	30	28	28	28	28	28	28	27	27	28	28	29	29	32	29	28
Bahrain	27 (0.2)	27	27	27	27	27	27	27	27	27	29	27	27	27	27	27	27	27	27	27	27	28	28	30	27	27
Tunisia	27 (0.4)	27	27	27	27	28	27	27	27	28	29	27	27	27	27	27	27	27	27	27	27	28	28	31	28	27
Chile	27 (0.5)	27	27	26	27	27	27	28	27	27	28	26	27	28	27	27	27	28	27	27	27	28	27	30	27	26
Palestinian Nat'l Auth.	26 (0.4)	26	26	26	26	26	26	25	26	26	27	26	26	26	26	26	26	25	25	26	26	26	27	29	26	26
Philippines	25 (0.8)	25	25	25	25	25	25	25	25	25	26	25	25	25	25	25	25	24	24	25	25	26	26	28	25	25
Morocco	25 (0.4)	25	24	24	24	25	25	24	25	25	26	25	24	25	25	24	24	24	24	25	25	25	26	28	25	25
Botswana	23 (0.3)	23	23	23	23	23	23	23	23	23	24	23	23	24	23	23	23	23	22	23	23	24	24	26	23	23
Saudi Arabia	19 (0.3)	19	19	19	19	19	19	18	19	19	20	19	19	19	19	19	19	18	18	19	19	19	20	21	19	19
South Africa	17 (0.7)	17	17	17	17	17	17	17	17	17	18	17	17	17	17	17	17	16	16	17	17	17	17	19	17	17
Ghana	15 (0.4)	15	15	15	15	15	15	15	15	15	16	15	15	15	15	15	15	15	15	15	15	15	15	17	15	15
International Avg.	41 (0.1)	41	41	41	41	41	41	42	41	42	43	41	41	42	41	41	41	41	41	41	41	42	42	45	42	41
Benchmarking Participants																										
Basque Country, Spain	43 (0.7)	43	43	43	43	44	44	45	43	44	46	43	43	45	44	43	43	44	43	43	43	45	44	48	44	43
Indiana State, US	47 (1.3)	47	47	47	47	48	48	50	47	48	50	47	47	49	48	47	47	48	47	48	47	49	48	52	48	47
Ontario Province, Can.	52 (0.7)	51	52	51	52	52	52	54	52	52	53	51	51	54	52	51	51	53	52	52	52	53	52	56	52	51
Quebec Province, Can.	57 (0.9)	57	58	57	57	58	58	59	57	58	60	57	57	59	58	57	57	58	58	58	57	59	59	62	58	57
Number of Items (Score Points) Identified*	213	206	211	193	210	199	198	169	212	204	177	206	209	182	208	209	209	172	158	208	213	191	187	178	207	205

* Of the 194 items in the Mathematics test, some extended-response items were scored on a two-point scale, resulting in 215 total score points. Following item review, response categories were combined for a number of items, resulting in 213 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 – Mathematics

Based on Subset of Items Specially Identified by Each Country as Addressing its Curriculum

(See Exhibit C.2 for corresponding standard errors)

MATHEMATICS 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	Armenia	Cyprus	Moldova, Rep. of	Norway	Macedonia, Rep. of	Lebanon	Jordan	Indonesia	Egypt	Iran, Islamic Rep. of	Bahrain	Tunisia	Chile	Palestinian Nat'l Auth.	Philippines	Morocco	Botswana	Saudi Arabia	South Africa	Ghana	Basque Country, Spain	Indiana State, US	Ontario Province, Can.	Quebec Province, Can.	Average Percent Correct on All Items	Countries
71	71	71	71	72	73	72	69	71	74	71	72	73	72	72	72	71	71	71	75	74	72	71	72	71	71 (0.9)	Singapore
68	68	68	68	68	68	68	66	68	71	68	68	69	67	68	69	68	68	68	70	70	69	68	68	68	68 (0.4)	Korea, Rep. of
67	67	67	67	68	68	67	65	67	70	67	67	68	67	67	68	67	67	67	71	69	68	67	68	67	67 (0.8)	Hong Kong, SAR
65	66	66	66	66	67	66	64	66	69	66	66	66	65	66	67	65	66	66	69	67	66	66	66	66	66 (1.0)	Chinese Taipei
63	63	63	63	64	63	63	61	63	66	63	63	64	63	64	64	63	64	64	64	65	64	63	64	64	64 (0.5)	Japan
55	56	55	56	58	56	56	52	56	58	56	56	57	57	56	56	55	57	56	59	58	56	56	57	56	56 (0.7)	Belgium (Flemish)
54	55	54	55	57	53	54	50	55	56	54	55	55	57	55	55	54	56	55	57	58	55	55	57	55	55 (1.0)	Netherlands
54	55	54	55	56	55	55	52	55	57	55	55	56	56	55	55	54	56	55	58	56	55	55	55	55	55 (0.8)	Hungary
53	54	53	54	56	54	54	51	54	56	54	54	55	55	54	55	53	55	54	57	56	54	54	55	54	54 (0.8)	Estonia
48	49	49	49	50	51	49	48	49	52	49	49	51	49	49	51	49	49	49	54	52	50	49	49	49	49 (0.9)	Russian Federation
48	48	49	48	50	50	49	46	48	51	49	49	51	50	49	50	48	49	49	53	52	49	49	49	49	49 (0.8)	Slovak Republic
48	48	48	48	49	49	49	46	48	51	48	48	50	48	48	49	48	49	48	52	51	49	48	49	48	48 (0.8)	Latvia
47	48	47	48	50	47	48	44	48	50	48	48	48	50	48	48	47	49	48	49	50	49	48	50	48	48 (1.1)	Australia
47	48	47	48	49	48	48	45	48	51	48	48	49	50	48	49	47	48	48	53	51	48	48	49	48	48 (1.0)	Malaysia
46	47	47	47	49	46	47	44	47	49	47	47	48	48	47	48	47	49	48	49	49	48	48	48	48	48 (0.8)	United States
46	47	46	47	48	47	47	45	47	49	47	47	48	47	47	48	46	48	47	50	49	47	47	48	47	47 (0.6)	Lithuania
46	47	46	47	49	45	46	41	47	48	46	46	46	49	47	46	46	49	47	48	49	47	47	48	47	47 (0.7)	Sweden
45	46	45	46	48	44	46	41	46	47	46	46	46	48	46	46	45	47	46	46	48	47	47	48	46	46 (1.0)	Scotland
45	46	45	46	48	44	46	41	46	47	45	46	45	47	46	46	45	47	46	46	48	46	46	47	46	46 (1.2)	England
45	46	45	46	47	46	46	43	46	48	45	45	47	46	46	47	45	47	46	49	48	46	46	46	46	46 (0.8)	Israel
44	45	44	45	47	43	44	40	45	46	44	45	44	46	45	44	44	46	45	45	46	45	45	46	45	45 (1.3)	New Zealand
43	44	43	44	45	44	44	41	44	46	44	44	45	45	44	45	43	45	44	47	46	44	44	45	44	44 (0.6)	Slovenia
42	43	43	43	44	43	43	40	43	45	43	43	44	44	43	43	42	44	43	46	45	43	43	44	43	43 (0.7)	Italy
41	41	42	41	42	43	42	41	41	44	42	41	43	42	42	43	41	42	42	46	44	42	42	42	41	42 (1.1)	Romania
41	41	41	41	42	43	41	40	41	44	42	41	43	41	41	43	41	42	41	46	44	42	41	41	41	41 (0.6)	Serbia
40	40	41	40	41	42	41	39	40	43	41	40	43	41	40	42	40	41	41	44	43	41	40	41	40	41 (0.9)	Bulgaria
39	39	40	39	39	42	40	40	39	42	40	39	41	37	40	41	39	39	39	44	40	40	39	39	39	39 (0.7)	Armenia
36	37	38	37	38	38	38	36	37	40	38	37	39	38	37	38	37	38	37	41	40	38	37	38	37	37 (0.3)	Cyprus
37	37	37	37	38	39	37	37	37	40	37	37	39	37	37	39	37	37	37	41	40	37	37	37	37	37 (0.8)	Moldova, Rep. of
36	37	36	37	39	36	37	33	37	38	37	36	37	39	37	37	36	38	37	38	39	37	37	38	37	37 (0.5)	Norway
33	33	33	33	34	34	33	32	33	35	33	33	35	33	33	34	33	34	33	36	35	34	33	33	33	33 (0.6)	Macedonia, Rep. of
32	31	32	31	32	34	32	33	31	34	32	32	33	31	32	34	32	31	32	36	33	32	31	31	31	32 (0.6)	Lebanon
30	31	30	31	31	31	31	32	31	32	31	30	32	30	31	31	30	31	31	32	32	31	31	31	30	31 (0.7)	Jordan
29	29	29	29	30	30	29	29	29	31	29	29	30	30	29	30	29	30	29	32	31	30	29	30	29	29 (0.7)	Indonesia
28	28	28	28	28	29	28	29	28	31	28	28	30	28	28	30	28	28	28	32	30	29	28	28	28	28 (0.5)	Egypt
27	28	28	28	28	29	28	28	28	30	28	28	29	28	28	29	27	28	28	30	30	28	28	28	28	28 (0.4)	Iran, Islamic Rep. of
27	27	27	27	28	27	27	28	27	29	27	27	28	28	27	28	27	28	27	28	29	27	27	28	27	27 (0.2)	Bahrain
27	27	27	27	28	28	28	27	27	29	27	27	30	28	27	28	27	27	27	30	29	27	27	27	27	27 (0.4)	Tunisia
26	27	26	27	28	26	27	24	27	28	26	26	27	28	26	27	26	27	27	28	29	27	27	28	26	27 (0.5)	Chile
25	26	26	26	26	27	26	26	26	28	26	26	27	26	26	27	25	26	26	28	27	26	26	26	26	26 (0.4)	Palestinian Nat'l Auth.
24	25	25	25	25	25	25	25	25	27	25	25	25	25	25	26	24	25	25	28	26	25	25	25	25	25 (0.8)	Philippines
24	24	24	24	25	25	25	25	24	26	25	25	26	25	24	25	24	25	25	27	26	25	24	25	24	25 (0.4)	Morocco
22	23	22	23	24	23	23	22	23	25	23	23	24	24	23	24	23	24	23	26	24	23	23	24	23	23 (0.3)	Botswana
18	19	19	19	19	19	19	19	19	20	19	19	20	19	19	20	18	19	19	21	20	19	19	19	19	19 (0.3)	Saudi Arabia
16	17	16	17	17	17	17	17	17	18	17	16	17	17	17	17	16	17	17	18	18	17	17	17	16	17 (0.7)	South Africa
14	15	15	15	15	15	15	15	15	16	15	15	15	15	15	15	14	15	15	17	16	15	15	15	15	15 (0.4)	Ghana
40	41	41	41	42	42	41	39	41	43	41	41	42	42	41	42	41	42	41	44	43	42	41	42	41	41 (0.1)	International Avg.
																										Benchmarking Participants
42	43	43	43	45	43	44	40	43	45	43	43	45	44	43	44	43	45	43	46	46	44	44	44	43	43 (0.7)	Basque Country, Spain
46	47	47	47	49	46	47	44	47	49	47	47	48	48	47	48	47	49	47	50	49	48	48	48	48	47 (1.3)	Indiana State, US
51	51	51	51	53	50	51	47	51	53	51	51	51	53	51	51	51	53	52	52	53	52	52	53	52	52 (0.7)	Ontario Province, Can.
57	57	57	57	59	58	57	54	57	60	57	57	58	59	57	58	56	59	57	60	60	58	58	58	58	57 (0.9)	Quebec Province, Can.
196	209	197	209	188	174	189	152	209	192	203	199	162	164	207	192	198	184	213	128	151	210	206	195	201	213	Number of Items (Score Points) Identified*

* Of the 194 items in the Mathematics test, some extended-response items were scored on a two-point scale, resulting in 215 total score points. Following item review, response categories were combined for a number of items, resulting in 213 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 – Mathematics

Based on Subset of Items Specially Identified by Each Country as Addressing its Curriculum
(See Exhibit C.2 for corresponding standard errors)

MATHEMATICS 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	Hong Kong, SAR	Japan	Chinese Taipei	Belgium (Flemish)	Netherlands	Lithuania	Latvia	England	Russian Federation	Hungary	United States	Cyprus	Moldova, Rep. of	Italy	Australia	New Zealand	Scotland	Slovenia	Norway	Armenia	Iran, Islamic Rep. of	Philippines	Morocco	Tunisia	Indiana State, US	Ontario Province, Can.	Quebec Province, Can.
Singapore	74 (1.2)	74	74	73	76	75	76	73	73	73	77	73	73	74	73	76	73	75	73	73	75	73	75	78	74	78	75	76	73
Hong Kong, SAR	70 (0.7)	70	69	70	72	71	73	70	70	69	74	69	70	70	70	74	70	71	69	70	71	70	71	73	70	74	71	72	70
Japan	69 (0.4)	68	69	70	73	70	71	69	69	68	73	69	69	69	69	72	69	70	68	69	70	69	70	69	69	72	69	72	69
Chinese Taipei	69 (0.5)	68	68	69	73	70	72	69	69	68	73	68	69	69	69	72	69	70	68	69	70	69	70	72	69	73	70	71	69
Belgium (Flemish)	65 (0.4)	65	65	65	69	67	68	65	65	65	70	65	65	66	65	69	66	67	65	65	67	65	67	67	66	69	66	68	65
Netherlands	62 (0.5)	62	61	62	66	64	66	62	62	61	67	62	62	62	62	66	63	64	62	62	64	62	63	62	62	65	63	65	62
Lithuania	62 (0.6)	62	62	62	64	63	65	61	61	61	69	62	61	62	61	65	62	64	61	63	64	61	63	66	63	67	63	65	62
Latvia	61 (0.7)	61	62	63	65	63	65	61	61	61	69	62	61	62	61	64	62	64	61	63	64	61	64	65	62	68	63	64	62
England	61 (0.8)	61	60	61	63	62	63	61	61	60	63	61	61	60	61	64	62	63	61	61	62	61	61	61	61	62	61	64	60
Russian Federation	60 (1.0)	60	60	61	64	61	63	60	60	60	70	61	60	60	60	64	60	62	60	62	62	60	63	66	62	67	62	63	61
Hungary	60 (0.7)	60	61	61	63	62	63	60	60	60	67	61	60	60	60	64	61	63	60	62	62	60	63	64	61	67	61	63	60
United States	58 (0.6)	58	57	58	61	60	60	58	58	57	62	58	58	58	58	62	58	61	58	58	59	58	60	60	58	61	59	61	58
Cyprus	57 (0.5)	58	58	58	61	59	60	57	57	57	63	57	57	57	57	61	58	60	57	58	59	57	59	61	57	62	59	60	57
Moldova, Rep. of	54 (1.0)	55	55	55	58	56	57	54	54	54	63	54	54	55	54	58	55	57	53	55	56	54	57	60	55	61	56	57	54
Italy	54 (0.8)	54	54	54	58	56	56	54	54	54	59	54	54	54	54	59	55	56	53	55	56	54	57	57	55	58	55	57	54
Australia	53 (0.9)	53	52	53	56	54	55	53	53	53	57	53	53	52	53	57	54	56	53	54	55	53	54	54	53	55	53	57	53
New Zealand	52 (0.5)	52	51	52	54	53	54	52	52	51	55	52	52	51	52	55	53	55	52	53	53	52	53	53	52	53	52	55	51
Scotland	51 (0.8)	51	51	52	54	53	54	51	51	51	55	51	51	51	51	55	52	54	52	52	53	51	53	52	52	54	52	55	51
Slovenia	48 (0.5)	48	48	49	51	49	51	48	48	48	55	49	48	48	48	52	49	51	49	50	50	48	51	50	49	53	49	51	49
Norway	43 (0.5)	43	43	44	46	45	46	44	44	43	48	44	44	43	44	47	44	46	44	44	45	44	45	44	44	46	44	46	44
Armenia	42 (0.7)	43	43	43	46	44	44	42	42	42	51	42	42	43	42	45	42	43	41	43	44	42	45	49	43	50	44	43	42
Iran, Islamic Rep. of	32 (0.6)	32	33	32	35	33	34	32	32	31	37	31	32	31	32	35	32	34	31	32	32	32	35	37	32	37	32	33	32
Philippines	29 (1.4)	29	28	28	31	30	30	29	29	28	32	28	29	29	29	32	29	30	27	28	29	29	30	30	29	31	29	30	28
Morocco	25 (0.7)	25	25	25	27	26	26	25	25	24	29	24	25	25	25	27	25	26	24	25	25	25	26	26	25	29	25	26	25
Tunisia	24 (0.7)	24	25	24	27	25	26	24	24	24	30	24	24	24	24	26	24	25	23	24	25	24	25	28	25	30	25	25	24
International Avg.	53 (0.2)	53	53	54	57	55	56	53	53	53	59	53	53	53	53	57	54	56	53	54	55	53	55	56	54	58	54	56	53
Benchmarking Participants																													
Indiana State, US	61 (0.7)	61	61	61	65	63	63	61	61	60	65	61	61	61	61	65	61	64	61	61	62	61	63	64	61	64	62	64	61
Ontario Province, Can.	56 (0.9)	56	55	56	60	58	59	57	57	56	59	57	57	56	57	60	58	60	57	57	58	57	58	57	57	58	57	60	57
Quebec Province, Can.	55 (0.6)	55	55	56	59	57	58	55	55	55	60	55	55	55	55	59	56	58	56	56	57	55	58	57	56	59	56	58	56
Number of Items (Score Points) Identified*	166	151	116	131	117	144	138	164	164	161	95	160	164	159	164	138	157	138	139	145	150	164	135	91	152	85	149	136	143

* Of the 161 items in the Mathematics test, some extended-response items were scored on a two-point scale, resulting in 169 total score points. Following item review, some items were deleted and response categories were combined for a number of items, resulting in 159 items and 166 score points.

( ) Standard errors appear in parentheses

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

own curriculum. Thus, Slovakian students averaged 49 percent correct on the set of items identified by the Slovak Republic for the analysis.

The international averages of 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 39 percent for those chosen by Jordan at the eighth grade to 45 percent for those chosen by Italy. Similarly at the fourth grade, the average percent correct ranged from 53 percent for those items chosen by England and Scotland to 59 percent for those chosen by the Russian Federation. 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 by the country 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 mathematics items was 71 percent. The diagonal element shows that Singaporean students had a slightly greater average percent correct (72 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 – four percent – for the Netherlands (55 percent compared with 59 percent).

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 mathematics items also had relatively high or low performance on each of the various sets of

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 – Mathematics

MATHEMATICS 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	Korea, Rep. of	Hong Kong, SAR	Chinese Taipei	Japan	Belgium (Flemish)	Netherlands	Hungary	Estonia	Russian Federation	Slovak Republic	Latvia	Australia	Malaysia	United States	Lithuania	Sweden	Scotland	England	Israel	New Zealand	Slovenia	Italy	Romania	Serbia
Singapore	71 (0.9)	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Korea, Rep. of	68 (0.4)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	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	67 (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
Chinese Taipei	66 (1.0)	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Japan	64 (0.5)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Belgium (Flemish)	56 (0.7)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	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	55 (1.0)	1.0	1.0	1.1	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Hungary	55 (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	54 (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	0.8
Russian Federation	49 (0.9)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Slovak Republic	49 (0.8)	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.8	0.8
Latvia	48 (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	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Australia	48 (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	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Malaysia	48 (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	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0
United States	48 (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
Lithuania	47 (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
Sweden	47 (0.7)	0.6	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.7	0.7	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.6
Scotland	46 (1.0)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
England	46 (1.2)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Israel	46 (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
New Zealand	45 (1.3)	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Slovenia	44 (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
Italy	43 (0.7)	0.8	0.7	0.8	0.7	0.7	0.8	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8
Romania	42 (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	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Serbia	41 (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	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Bulgaria	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	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Armenia	39 (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	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Cyprus	37 (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	0.3
Moldova, Rep. of	37 (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	0.9	0.9	0.8	0.8
Norway	37 (0.5)	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.5	0.5	0.6	0.5	0.5	0.6	0.6	0.5	0.5	0.6	0.6	0.5	0.5	0.6	0.5	0.6	0.5	0.5
Macedonia, Rep. of	33 (0.6)	0.6	0.6	0.7	0.6	0.6	0.6	0.7	0.6	0.6	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.7	0.6	0.7	0.7	0.6
Lebanon	32 (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	0.7	0.7	0.6	0.6
Jordan	31 (0.7)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	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
Indonesia	29 (0.7)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	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
Egypt	28 (0.5)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Iran, Islamic Rep. of	28 (0.4)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Bahrain	27 (0.2)	0.2	0.2	0.3	0.2	0.3	0.3	0.3	0.2	0.2	0.3	0.2	0.2	0.3	0.2	0.2	0.2	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.2
Tunisia	27 (0.4)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Chile	27 (0.5)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Palestinian Nat'l Auth.	26 (0.4)	0.4	0.4	0.4	0.4	0.4	0.5	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	0.5	0.5	0.4	0.4
Philippines	25 (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	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8
Morocco	25 (0.4)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4
Botswana	23 (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	0.4	0.3	0.3	0.3	0.4	0.4	0.3	0.3	0.3	0.3	0.4	0.3	0.3
Saudi Arabia	19 (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	0.4	0.3	0.3	0.3	0.4	0.4	0.3	0.3	0.4	0.4	0.4	0.4	0.3
South Africa	17 (0.7)	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Ghana	15 (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	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4
International Avg.	41 (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	43 (0.7)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Indiana State, US	47 (1.3)	1.3	1.3	1.4	1.3	1.3	1.3	1.4	1.3	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	1.3	1.4	1.3	1.3
Ontario Province, Can.	52 (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	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Quebec Province, Can.	57 (0.9)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Number of Items (Score Points) Identified*	213	206	211	193	210	199	198	169	212	204	177	206	209	182	208	209	209	172	158	208	213	191	187	178	207	205

* Of the 194 items in the Mathematics test, some extended-response items were scored on a two-point scale, resulting in 215 total score points. Following item review, response categories were combined for a number of items, resulting in 213 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 – Mathematics

MATHEMATICS 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	Armenia	Cyprus	Moldova, Rep. of	Norway	Macedonia, Rep. of	Lebanon	Jordan	Indonesia	Egypt	Iran, Islamic Rep. of	Bahrain	Tunisia	Chile	Palestinian Nat'l Auth.	Philippines	Morocco	Botswana	Saudi Arabia	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	0.9	0.9	1.0	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	71 (0.9)	Singapore
0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	68 (0.4)	Korea, Rep. of
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	67 (0.8)	Hong Kong, SAR
1.0	1.0	1.1	1.0	1.0	1.1	1.0	1.1	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.1	1.1	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	66 (1.0)	Chinese Taipei
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	0.5	0.5	0.5	64 (0.5)	Japan
0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	56 (0.7)	Belgium (Flemish)
1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	55 (1.0)	Netherlands
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	0.9	0.8	0.8	0.8	0.8	0.8	55 (0.8)	Hungary
0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	54 (0.8)	Estonia
0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9	49 (0.9)	Russian Federation
0.9	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.8	0.9	0.8	0.8	0.9	0.8	0.8	0.8	0.9	0.8	0.8	0.9	0.9	0.8	0.8	0.8	0.8	49 (0.8)	Slovak Republic
0.7	0.8	0.8	0.8	0.7	0.7	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.7	0.8	0.7	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	48 (0.8)	Latvia
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	1.1	1.1	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.1	48 (1.1)	Australia
1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.1	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	48 (1.0)	Malaysia
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	48 (0.8)	United States
0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	47 (0.6)	Lithuania
0.7	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.6	0.7	0.7	0.6	0.7	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.7	47 (0.7)	Sweden
1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	46 (1.0)	Scotland
1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	46 (1.2)	England
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	46 (0.8)	Israel
1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	45 (1.3)	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	44 (0.6)	Slovenia
0.8	0.7	0.8	0.7	0.7	0.8	0.7	0.7	0.7	0.8	0.7	0.8	0.7	0.7	0.8	0.8	0.8	0.7	0.7	0.8	0.8	0.8	0.7	0.7	0.7	43 (0.7)	Italy
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	1.1	1.1	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.1	42 (1.1)	Romania
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	41 (0.6)	Serbia
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	1.0	0.9	0.9	0.9	0.9	41 (0.9)	Bulgaria
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	0.7	0.7	0.8	0.8	0.7	0.7	0.7	0.7	39 (0.7)	Armenia
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	37 (0.3)	Cyprus
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	0.9	0.8	0.8	0.8	0.8	0.8	37 (0.8)	Moldova, Rep. of
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	0.6	0.5	0.5	0.6	0.5	0.6	0.6	0.6	37 (0.5)	Norway
0.6	0.7	0.6	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.6	0.7	0.7	0.6	0.7	0.6	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	33 (0.6)	Macedonia, Rep. of
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	0.7	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.6	0.6	0.6	0.6	32 (0.6)	Lebanon
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	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	31 (0.7)	Jordan
0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	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	29 (0.7)	Indonesia
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	28 (0.5)	Egypt
0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	28 (0.4)	Iran, Islamic Rep. of
0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.2	0.3	0.2	0.2	0.3	0.3	0.2	0.3	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.3	27 (0.2)	Bahrain
0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	27 (0.4)	Tunisia
0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	27 (0.5)	Chile
0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.5	0.5	0.4	0.4	0.4	0.4	26 (0.4)	Palestinian Nat'l Auth.
0.7	0.8	0.8	0.8	0.7	0.7	0.7	0.7	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	0.7	0.8	25 (0.8)	Philippines
0.4	0.4	0.4	0.4	0.3	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	0.4	0.4	0.4	0.3	25 (0.4)	Morocco
0.3	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	0.4	0.3	0.4	0.3	0.3	0.3	0.4	0.3	23 (0.3)	Botswana
0.3	0.3	0.4	0.3	0.4	0.4	0.4	0.3	0.3	0.4	0.3	0.4	0.4	0.3	0.4	0.4	0.3	0.4	0.3	0.4	0.4	0.4	0.3	0.4	0.4	19 (0.3)	Saudi Arabia
0.6	0.7	0.6	0.7	0.7	0.6	0.6	0.6	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	17 (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	15 (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		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	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	43 (0.7)	Basque Country, Spain
1.3	1.3	1.4	1.3	1.3	1.4	1.3	1.3	1.3	1.3	1.4	1.3	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.3	1.3	1.3	1.3	47 (1.3)	Indiana State, US
0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	52 (0.7)	Ontario Province, Can.
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	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	57 (0.9)	Quebec Province, Can.
196	209	197	209	188	174	189	152	209	192	203	199	162	164	207	192	198	184	213	128	151	210	206	195	201	213	Number of Items (Score Points) Identified*

* Of the 194 items in the Mathematics test, some extended-response items were scored on a two-point scale, resulting in 215 total score points. Following item review, response categories were combined for a number of items, resulting in 213 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 – Mathematics

MATHEMATICS 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	Hong Kong, SAR	Japan	Chinese Taipei	Belgium (Flemish)	Netherlands	Lithuania	Latvia	England	Russian Federation	Hungary	United States	Cyprus	Moldova, Rep. of	Italy	Australia	New Zealand	Scotland	Slovenia	Norway	Armenia	Iran, Islamic Rep. of	Philippines	Morocco	Tunisia	Indiana State, US	Ontario Province, Can.	Quebec Province, Can.
Singapore	74 (1.2)	1.2	1.2	1.2	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.2	1.1	1.2	1.1	1.2
Hong Kong, SAR	70 (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	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
Japan	69 (0.4)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.4
Chinese Taipei	69 (0.5)	0.5	0.5	0.5	0.4	0.4	0.5	0.5	0.5	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.5	0.5	0.5	0.5	0.4	0.5	0.5	0.5	0.5	0.4	0.5
Belgium (Flemish)	65 (0.4)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.5	0.5	0.4	0.4	0.4	0.5	0.4	0.5	0.4	0.4	0.4
Netherlands	62 (0.5)	0.5	0.6	0.6	0.6	0.5	0.6	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.5	0.5	0.6	0.6	0.5	0.6	0.6	0.5	0.6
Lithuania	62 (0.6)	0.6	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	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
Latvia	61 (0.7)	0.7	0.7	0.8	0.7	0.7	0.8	0.7	0.7	0.7	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.7	0.8	0.7	0.8	0.7	0.7	0.8
England	61 (0.8)	0.8	0.9	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.9	0.8	0.8	0.9
Russian Federation	60 (1.0)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Hungary	60 (0.7)	0.7	0.7	0.7	0.7	0.7	0.7	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	0.7	0.7	0.7	0.7
United States	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	0.6	0.6	0.6
Cyprus	57 (0.5)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	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
Moldova, Rep. of	54 (1.0)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Italy	54 (0.8)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Australia	53 (0.9)	0.8	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	0.9	0.9	0.9	0.9	0.8	0.9	0.9	0.9	0.9	0.9	0.9
New Zealand	52 (0.5)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Scotland	51 (0.8)	0.8	0.7	0.7	0.7	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	0.7	0.8	0.7	0.8	0.8	0.8	0.8
Slovenia	48 (0.5)	0.5	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6
Norway	43 (0.5)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Armenia	42 (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	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7
Iran, Islamic Rep. of	32 (0.6)	0.6	0.7	0.6	0.7	0.7	0.7	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.7	0.6	0.7	0.6	0.6	0.6	0.6	0.7	0.7	0.6	0.7	0.6	0.7	0.7
Philippines	29 (1.4)	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.4	1.4	1.5
Morocco	25 (0.7)	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.8	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	0.8	0.7	0.7	0.7
Tunisia	24 (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	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.8	0.7	0.7	0.7
International Avg.	53 (0.2)	0.1	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2
Benchmarking Participants																													
Indiana State, US	61 (0.7)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Ontario Province, Can.	56 (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	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Quebec Province, Can.	55 (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	0.7	0.6	0.6	0.6
Number of Items (Score Points) Identified*	166	151	116	131	117	144	138	164	164	161	95	160	164	159	164	138	157	138	139	145	150	164	135	91	152	85	149	136	143

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

* Of the 161 items in the Mathematics test, some extended-response items were scored on a two-point scale, resulting in 169 total score points. Following item review, some items were deleted and response categories were combined for a number of items, resulting in 159 items and 166 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.

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 Korea, Hong Kong SAR, and Chinese Taipei 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 197 score points selected by Cyprus. The students in Cyprus did a little better on these items than on the test as a whole, with 38 percent correct on these items, on average, compared with 37 percent correct on all items. However, most other countries also did better on these particular items, with an international average of 41 percent correct on the items selected by Cyprus. All 31 participants that performed better than Cyprus on the overall test also performed better on the items selected by Cyprus.

The TCMA results provide evidence that the TIMSS 2003 mathematics 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 Mathematics Achievement

Exhibit D.1: **Percentiles of Achievement in Mathematics**

MATHEMATICS Grade 8

Countries	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Armenia	330 (7.5)	423 (5.1)	483 (3.3)	539 (3.2)	605 (3.5)
Australia	368 (10.4)	450 (3.9)	506 (3.7)	561 (5.8)	634 (6.6)
Bahrain	277 (3.2)	347 (1.5)	402 (1.8)	455 (2.2)	525 (1.4)
Belgium (Flemish)	398 (8.9)	495 (3.7)	545 (3.1)	588 (2.8)	643 (3.3)
Botswana	251 (5.1)	316 (3.0)	365 (2.5)	415 (2.7)	487 (5.0)
Bulgaria	333 (7.5)	421 (5.5)	478 (4.6)	535 (4.6)	611 (6.6)
Chile	258 (4.5)	328 (4.8)	382 (3.4)	441 (4.5)	531 (4.9)
Chinese Taipei	407 (6.0)	518 (7.0)	596 (4.6)	657 (5.0)	733 (6.0)
Cyprus	321 (3.8)	405 (3.4)	463 (1.8)	518 (1.5)	586 (1.6)
Egypt	256 (3.0)	341 (6.0)	405 (4.1)	471 (3.7)	560 (3.2)
England	373 (5.3)	445 (5.9)	497 (5.9)	552 (9.2)	627 (5.6)
Estonia	416 (4.8)	484 (3.6)	531 (4.0)	577 (2.7)	645 (4.0)
Ghana	130 (5.8)	213 (4.3)	274 (5.3)	337 (7.3)	430 (9.1)
Hong Kong, SAR	455 (11.9)	546 (4.0)	593 (3.3)	635 (3.0)	691 (4.6)
Hungary	398 (8.1)	476 (2.9)	531 (3.5)	584 (4.1)	656 (4.2)
Indonesia	266 (11.6)	350 (7.9)	411 (6.0)	472 (4.0)	558 (3.6)
Iran, Islamic Rep. of	294 (4.8)	360 (3.5)	408 (3.0)	461 (2.4)	537 (6.2)
Israel	353 (5.9)	438 (4.8)	498 (5.3)	555 (3.5)	630 (5.3)
Italy	355 (6.0)	432 (4.0)	486 (2.9)	537 (3.2)	606 (5.0)
Japan	433 (4.4)	519 (2.0)	572 (2.6)	623 (2.2)	697 (5.1)
Jordan	279 (5.3)	362 (4.1)	427 (4.9)	488 (5.0)	567 (5.2)
Korea, Rep. of	439 (3.1)	537 (3.2)	596 (2.5)	647 (2.5)	715 (3.0)
Latvia	386 (5.2)	458 (5.2)	510 (2.9)	559 (3.5)	625 (5.4)
Lebanon	324 (3.4)	387 (3.9)	432 (3.7)	479 (4.0)	545 (5.8)
Lithuania	370 (4.5)	448 (2.9)	503 (2.4)	557 (4.0)	628 (2.5)
Macedonia, Rep. of	283 (4.8)	376 (5.1)	439 (2.9)	497 (3.4)	574 (4.7)
Malaysia	388 (3.7)	455 (3.9)	507 (5.5)	562 (6.1)	630 (5.3)
Moldova, Rep. of	321 (5.8)	405 (7.3)	464 (4.9)	518 (4.4)	585 (5.1)
Morocco	275 (4.8)	340 (3.0)	387 (3.0)	434 (3.0)	497 (2.8)
Netherlands	417 (8.4)	488 (4.5)	540 (5.8)	587 (4.8)	644 (6.8)
New Zealand	364 (9.9)	441 (5.2)	495 (5.3)	548 (7.1)	623 (12.5)
Norway	340 (5.2)	414 (2.2)	465 (3.3)	511 (1.7)	573 (2.4)
Palestinian Nat'l Auth.	241 (5.2)	326 (3.2)	389 (4.1)	455 (4.2)	542 (5.4)
Philippines	241 (3.6)	316 (5.6)	373 (6.4)	437 (6.5)	527 (8.0)
Romania	321 (7.8)	413 (4.6)	479 (4.9)	540 (4.9)	619 (9.0)
Russian Federation	381 (5.5)	456 (4.2)	509 (4.5)	561 (4.0)	632 (7.5)
Saudi Arabia	204 (10.0)	279 (6.6)	331 (5.1)	385 (4.5)	460 (5.4)
Scotland	368 (8.5)	449 (5.0)	501 (4.3)	550 (3.9)	615 (6.0)
Serbia	326 (6.2)	417 (4.8)	479 (4.0)	540 (3.1)	618 (4.8)
Singapore	455 (6.6)	556 (6.7)	614 (4.0)	662 (3.5)	723 (2.8)
Slovak Republic	371 (6.5)	453 (4.7)	509 (3.9)	564 (4.3)	642 (4.2)
Slovenia	375 (9.3)	445 (2.4)	492 (2.0)	542 (1.6)	610 (3.7)
South Africa	117 (5.2)	191 (3.5)	248 (4.0)	316 (7.5)	484 (20.1)
Sweden	378 (4.0)	452 (4.3)	501 (2.6)	548 (2.9)	614 (6.3)
Tunisia	316 (2.2)	368 (2.4)	407 (2.4)	450 (2.6)	515 (6.2)
United States	369 (4.7)	450 (2.9)	505 (3.0)	560 (3.5)	635 (3.8)
Benchmarking Participants					
Basque Country, Spain	379 (6.0)	444 (4.3)	488 (2.9)	531 (4.2)	591 (3.1)
Indiana State, US	393 (4.2)	461 (5.9)	507 (4.1)	555 (6.7)	625 (6.3)
Ontario Province, Can.	411 (7.1)	476 (3.8)	522 (3.9)	567 (2.9)	628 (4.2)
Quebec Province, Can.	449 (2.4)	503 (3.6)	542 (3.0)	583 (4.3)	640 (4.9)

( ) Standard errors appear in parentheses.

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

Exhibit D.1: **Percentiles of Achievement in Mathematics**

MATHEMATICS Grade 4

Countries	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Armenia	305 (4.7)	400 (4.7)	460 (3.3)	516 (4.5)	594 (5.8)
Australia	359 (5.0)	447 (5.8)	504 (4.4)	553 (4.0)	625 (6.4)
Belgium (Flemish)	451 (4.0)	511 (2.5)	552 (2.9)	592 (2.0)	644 (3.1)
Chinese Taipei	455 (4.0)	525 (1.9)	567 (1.8)	606 (2.2)	663 (2.2)
Cyprus	358 (3.3)	454 (4.4)	516 (2.9)	569 (2.0)	641 (5.7)
England	379 (9.5)	474 (3.6)	536 (5.3)	592 (3.3)	667 (3.7)
Hong Kong, SAR	466 (4.0)	534 (2.9)	578 (3.8)	619 (3.4)	674 (3.6)
Hungary	393 (4.9)	478 (5.0)	534 (3.7)	583 (3.4)	647 (3.1)
Iran, Islamic Rep. of	246 (6.8)	330 (5.3)	390 (5.0)	450 (2.7)	528 (4.3)
Italy	362 (6.6)	450 (4.5)	507 (3.9)	558 (4.6)	632 (11.5)
Japan	437 (3.6)	518 (3.4)	568 (1.7)	615 (1.4)	680 (4.7)
Latvia	407 (7.8)	491 (3.8)	540 (3.3)	587 (2.8)	647 (4.3)
Lithuania	405 (3.6)	487 (4.3)	539 (3.1)	585 (2.3)	648 (4.3)
Moldova, Rep. of	349 (11.5)	449 (6.1)	511 (5.4)	566 (5.2)	634 (7.0)
Morocco	199 (9.7)	283 (5.9)	347 (6.8)	412 (6.3)	493 (2.5)
Netherlands	448 (6.4)	505 (2.3)	542 (2.9)	578 (1.5)	627 (2.8)
New Zealand	346 (4.7)	438 (3.1)	499 (2.9)	553 (2.5)	623 (3.2)
Norway	310 (6.0)	399 (3.1)	456 (1.8)	508 (3.7)	574 (4.4)
Philippines	189 (11.0)	280 (7.3)	352 (6.8)	431 (11.7)	549 (21.6)
Russian Federation	401 (13.7)	479 (7.3)	533 (6.0)	586 (5.7)	658 (6.6)
Scotland	357 (4.7)	441 (3.3)	493 (3.9)	544 (2.9)	610 (5.4)
Singapore	439 (13.4)	546 (9.0)	601 (5.1)	652 (6.9)	721 (7.0)
Slovenia	343 (3.8)	427 (2.7)	485 (4.0)	534 (2.9)	598 (5.0)
Tunisia	176 (7.9)	269 (4.8)	339 (5.0)	409 (5.2)	503 (5.4)
United States	387 (3.3)	467 (2.7)	522 (4.0)	572 (3.1)	639 (3.4)
Benchmarking Participants					
Indiana State, US	421 (6.2)	491 (4.2)	535 (2.2)	577 (3.0)	638 (9.4)
Ontario Province, Can.	391 (4.3)	465 (3.7)	513 (3.7)	559 (5.8)	626 (7.1)
Quebec Province, Can.	393 (3.2)	464 (2.4)	509 (1.9)	551 (3.7)	609 (2.8)

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 Mathematics

MATHEMATICS Grade 8

Countries	Overall		Girls		Boys	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Armenia	478 (3.0)	84 (1.4)	483 (3.3)	81 (1.6)	473 (3.4)	86 (2.0)
Australia	505 (4.6)	82 (3.2)	499 (5.8)	78 (3.0)	511 (5.8)	84 (4.3)
Bahrain	401 (1.7)	76 (0.9)	417 (2.4)	70 (1.3)	385 (2.4)	79 (1.3)
Belgium (Flemish)	537 (2.8)	73 (2.6)	532 (3.5)	72 (3.2)	542 (3.8)	74 (3.0)
Botswana	366 (2.6)	72 (1.5)	368 (2.6)	71 (1.7)	365 (2.9)	72 (1.7)
Bulgaria	476 (4.3)	84 (2.3)	476 (5.5)	84 (3.0)	477 (4.3)	84 (2.5)
Chile	387 (3.3)	83 (1.9)	379 (3.5)	81 (1.9)	394 (4.3)	85 (2.5)
Chinese Taipei	585 (4.6)	100 (2.2)	589 (4.9)	94 (2.1)	582 (5.2)	105 (2.7)
Cyprus	459 (1.7)	81 (1.3)	467 (1.9)	78 (1.7)	452 (2.3)	84 (1.6)
Egypt	406 (3.5)	93 (1.5)	407 (4.4)	90 (1.9)	406 (5.0)	95 (2.0)
England	498 (4.7)	77 (3.1)	499 (5.3)	76 (2.8)	498 (5.8)	78 (4.3)
Estonia	531 (3.0)	69 (1.6)	532 (3.4)	69 (2.1)	530 (3.3)	69 (1.8)
Ghana	276 (4.7)	91 (2.3)	266 (5.1)	89 (2.6)	283 (4.9)	92 (2.6)
Hong Kong, SAR	586 (3.3)	72 (3.2)	587 (3.8)	70 (3.1)	585 (4.6)	74 (3.9)
Hungary	529 (3.2)	80 (2.3)	526 (3.7)	78 (2.6)	533 (3.5)	81 (2.6)
Indonesia	411 (4.8)	89 (2.6)	411 (4.9)	88 (3.2)	410 (5.3)	89 (2.6)
Iran, Islamic Rep. of	411 (2.4)	74 (1.4)	417 (4.3)	71 (1.9)	408 (4.2)	76 (2.6)
Israel	496 (3.4)	85 (1.8)	492 (3.3)	80 (1.8)	500 (4.5)	89 (2.6)
Italy	484 (3.2)	77 (1.8)	481 (3.0)	74 (2.0)	486 (3.9)	79 (2.2)
Japan	570 (2.1)	80 (1.3)	569 (4.0)	76 (3.6)	571 (3.6)	83 (2.2)
Jordan	424 (4.1)	89 (1.8)	438 (4.6)	86 (2.3)	411 (5.8)	90 (2.7)
Korea, Rep. of	589 (2.2)	84 (1.3)	586 (2.7)	82 (1.6)	592 (2.6)	86 (1.4)
Latvia	508 (3.2)	73 (1.4)	511 (3.3)	70 (1.7)	506 (3.7)	76 (1.9)
Lebanon	433 (3.1)	67 (1.6)	429 (3.6)	66 (1.9)	439 (3.9)	67 (2.1)
Lithuania	502 (2.5)	78 (1.3)	503 (2.9)	77 (1.8)	499 (3.0)	82 (1.6)
Macedonia, Rep. of	435 (3.5)	88 (2.3)	439 (4.0)	86 (2.8)	431 (3.9)	90 (2.5)
Malaysia	508 (4.1)	74 (2.2)	512 (4.7)	73 (2.5)	505 (4.5)	76 (2.3)
Moldova, Rep. of	460 (4.0)	81 (1.7)	465 (4.1)	78 (1.8)	455 (4.8)	82 (2.1)
Morocco	387 (2.5)	68 (1.0)	381 (2.8)	68 (1.4)	393 (3.0)	68 (1.3)
Netherlands	536 (3.8)	69 (2.8)	533 (4.1)	69 (3.0)	540 (4.5)	70 (3.0)
New Zealand	494 (5.3)	78 (3.6)	495 (4.8)	75 (3.5)	493 (7.0)	82 (4.2)
Norway	461 (2.5)	71 (1.3)	463 (2.7)	69 (2.0)	460 (3.0)	72 (1.5)
Palestinian Nat'l Auth.	390 (3.1)	92 (1.5)	394 (3.9)	91 (1.9)	386 (4.7)	92 (1.9)
Philippines	378 (5.2)	87 (2.6)	383 (5.2)	86 (2.5)	370 (5.8)	89 (3.3)
Romania	475 (4.8)	90 (1.7)	477 (5.1)	88 (1.7)	473 (5.0)	92 (2.5)
Russian Federation	508 (3.7)	77 (1.4)	510 (3.5)	74 (1.4)	507 (4.4)	79 (2.1)
Saudi Arabia	332 (4.6)	78 (2.6)	326 (7.9)	75 (4.6)	336 (5.5)	81 (2.7)
Scotland	498 (3.7)	75 (2.3)	500 (4.3)	72 (2.7)	495 (3.8)	77 (2.4)
Serbia	477 (2.6)	89 (1.4)	480 (2.9)	86 (1.9)	473 (2.9)	92 (1.8)
Singapore	605 (3.6)	80 (2.4)	611 (3.3)	75 (2.6)	601 (4.3)	84 (2.6)
Slovak Republic	508 (3.3)	82 (1.7)	508 (3.4)	79 (1.9)	508 (4.0)	85 (2.2)
Slovenia	493 (2.2)	71 (1.5)	495 (2.6)	68 (1.6)	491 (2.6)	74 (1.9)
South Africa	264 (5.5)	107 (5.1)	262 (6.2)	105 (6.0)	264 (6.4)	110 (5.8)
Sweden	499 (2.6)	71 (1.7)	499 (3.0)	70 (1.9)	499 (2.7)	72 (2.0)
Tunisia	410 (2.2)	60 (1.3)	399 (2.6)	60 (1.6)	423 (2.2)	58 (1.4)
United States	504 (3.3)	80 (1.8)	502 (3.4)	78 (1.9)	507 (3.5)	82 (2.0)
Benchmarking Participants						
Basque Country, Spain	487 (2.7)	64 (1.3)	490 (2.5)	60 (1.4)	484 (3.7)	68 (2.0)
Indiana State, US	508 (5.2)	70 (3.0)	502 (5.1)	68 (3.2)	514 (5.8)	72 (3.1)
Ontario Province, Can.	521 (3.1)	66 (1.1)	520 (3.4)	65 (1.5)	522 (3.4)	67 (1.4)
Quebec Province, Can.	543 (3.0)	58 (1.8)	540 (3.7)	57 (2.1)	546 (3.3)	59 (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 Mathematics

MATHEMATICS Grade 4

Countries	Overall		Girls		Boys	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Armenia	456 (3.5)	87 (1.9)	462 (3.7)	84 (2.2)	450 (3.8)	89 (1.9)
Australia	499 (3.9)	81 (2.1)	497 (4.5)	79 (2.5)	500 (4.3)	83 (2.6)
Belgium (Flemish)	551 (1.8)	59 (1.1)	549 (1.8)	57 (1.1)	552 (2.5)	60 (1.7)
Chinese Taipei	564 (1.8)	63 (1.1)	564 (1.7)	59 (1.2)	564 (2.1)	66 (1.5)
Cyprus	510 (2.4)	85 (1.3)	505 (2.7)	82 (1.9)	514 (2.9)	88 (1.5)
England	531 (3.7)	87 (1.9)	530 (3.9)	85 (2.1)	532 (4.5)	90 (2.4)
Hong Kong, SAR	575 (3.2)	63 (1.5)	575 (3.4)	60 (1.7)	575 (3.4)	66 (1.7)
Hungary	529 (3.1)	77 (2.0)	527 (3.8)	77 (2.6)	530 (3.3)	78 (2.0)
Iran, Islamic Rep. of	389 (4.2)	86 (2.1)	394 (6.5)	83 (2.9)	386 (5.5)	87 (2.6)
Italy	503 (3.7)	82 (2.2)	498 (4.1)	80 (2.9)	507 (3.7)	83 (2.0)
Japan	565 (1.6)	74 (1.0)	563 (1.8)	69 (1.3)	566 (2.1)	78 (1.4)
Latvia	536 (2.8)	73 (1.5)	536 (2.9)	69 (1.9)	536 (3.5)	75 (2.1)
Lithuania	534 (2.8)	74 (1.7)	535 (3.5)	73 (2.3)	536 (3.2)	76 (1.9)
Moldova, Rep. of	504 (4.9)	87 (3.2)	510 (5.2)	87 (3.9)	499 (5.1)	87 (3.5)
Morocco	347 (5.1)	90 (1.9)	344 (6.1)	91 (2.1)	350 (5.1)	89 (2.5)
Netherlands	540 (2.1)	55 (1.5)	537 (2.7)	55 (2.2)	543 (2.2)	54 (1.6)
New Zealand	493 (2.2)	84 (1.8)	493 (2.7)	82 (2.3)	494 (2.4)	86 (1.8)
Norway	451 (2.3)	80 (1.6)	449 (2.7)	78 (1.8)	454 (2.7)	82 (1.9)
Philippines	358 (7.9)	110 (5.9)	364 (9.2)	111 (6.6)	352 (7.0)	108 (5.3)
Russian Federation	532 (4.7)	78 (2.0)	530 (5.4)	78 (2.3)	534 (4.7)	78 (2.4)
Scotland	490 (3.3)	78 (1.8)	485 (3.2)	74 (1.9)	496 (4.4)	80 (2.8)
Singapore	594 (5.6)	84 (3.2)	599 (5.5)	80 (3.0)	590 (6.2)	88 (3.7)
Slovenia	479 (2.6)	78 (1.3)	477 (3.0)	75 (1.8)	481 (3.5)	81 (1.9)
Tunisia	339 (4.7)	100 (2.5)	342 (5.0)	98 (2.7)	337 (4.9)	101 (2.6)
United States	518 (2.4)	76 (1.0)	514 (2.4)	74 (1.2)	522 (2.7)	78 (1.3)
Benchmarking Participants						
Indiana State, US	533 (2.8)	65 (2.1)	532 (3.1)	62 (2.1)	534 (3.4)	69 (2.5)
Ontario Province, Can.	511 (3.8)	71 (2.0)	505 (3.6)	69 (1.7)	517 (4.7)	72 (2.6)
Quebec Province, Can.	506 (2.4)	65 (1.2)	502 (2.7)	64 (1.5)	509 (2.8)	66 (1.4)

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

( ) Standard errors appear in parentheses.

Appendix E

Descriptions of Mathematics Items at Each Benchmark

Exhibit E.1: **Descriptions of Mathematics Items at Each International Benchmark**

Items at Low International Benchmark (400)

Number

M05_02*	Solves a word problem by adding numbers with up to three decimal places.
M06_07*	Multiplies a two-place decimal by a three-place decimal.
M06_11	Solves a word problem involving a proportion with unit ratio.
M06_11*	Solves a word problem involving a proportion with unit ratio.
M13_08	Selects two-place decimal closest to a given whole number.

Measurement

M10_06	Selects the most appropriate metric unit to measure a large area.

Data

M12_13A	Selects the appropriate line on a graph and reads information from it.

Items at Intermediate International Benchmark (475)

Number

M03_04	Arranges four given digits in descending and ascending order and finds the difference between those two numbers.
M04_05	Solves a word problem involving subtraction of a two-place decimal number from another.
M04_06	Writes a fraction less than a given fraction.
M05_01	Identifies a circular model of a fraction that best approximates a given rectangular model of the same fraction.
M05_02	Solves a word problem by adding numbers with up to three decimal places.
M05_06	Selects the approximate quantity remaining after an amount is decreased by a given percent.
M06_03	Selects the smallest fraction from a set of familiar fractions.
M06_12*	Solves a word problem about distance and time by finding the missing term in a proportion.
M10_01	Solves a word problem involving addition and multiplication of two-digit whole numbers.
M11_01	Identifies the decimal number that is equivalent to the sum of two fractions whose denominators are powers of ten.
M13_01	Uses knowledge of exponential notation to select approximations to two squared whole numbers.
M14_01	Rounds two-place decimals to whole numbers.

Algebra

M01_02	Using properties of a balance, reasons to find an unknown weight (mass).
M01_10	Solves equation for missing number in a proportion.
M02_12	Selects the formula satisfied by the given values of the variables.
M03_01	Solves problem by interpreting information from a graph of two intersecting lines.

* Denotes with calculator available.

Exhibit E.1: **Descriptions of Mathematics Items at Each International Benchmark** *(Continued...)*

MATHEMATICS Grade 8

Items at Intermediate International Benchmark (475) – *Continued*

Algebra – *Continued*

M08_04	Selects the rule expressed in words that generates successive terms in a given number pattern.
M08_05	Solves a linear equation in one variable.
M08_13A	Identifies the straight line graph modeling a situation described in words.
M08_13B	Interprets two straight line graphs and uses their intersection to solve a problem.
M12_04	Knows the meaning of a simple algebraic expression involving multiplication and addition.
M12_05	Identifies the algebraic expression that represents a situation, involving addition and multiplication.
M14_03	Extends number patterns derived from a sequence of geometric shapes.

Measurement

M01_08	Identifies an unlabeled midway point on a number line marked in tenths.
M04_11A	Finds a fraction of a given area of an irregular figure composed of squares of equal sides.
M06_01	Reads the value indicated by an unlabeled tick mark on a circular scale.
M07_05	Solves a word problem by comparing distances on a map drawn to scale with a given distance.

Geometry

M02_03	Identifies corresponding parts of congruent trapezoids.
M05_03	Identifies the diagrammatic representation of a three-dimensional object after rotation.
M08_10	Uses properties of an isosceles triangle to identify the coordinates of a point on a grid.
M09_10	Divides an isosceles triangle in to two congruent triangles.
M09_12	Recognizes a net of a triangular prism.
M09_13	Locates a point with given coordinates in the Cartesian plane.
M11_11	Given a net of three-dimensional object, completes a two-dimensional drawing of it from a specific viewpoint.
M13_04	Uses a concept of line symmetry to complete a tiling pattern.

Data

M01_06	Calculates and compares the averages of two sets of data.
M02_02	Reads and interprets information from a pie graph.
M02_09	Solves a comparison problem by associating elements of a bar graph with a verbal description.
M06_02	Recognizes that the probability of an outcome of a single event is inversely related to the number of elements in the population of events.
M06_08	Given a table of values for two variables, selects the graph that could represent the given data.
M11_13	Constructs and labels a pie chart representing a given situation.

Exhibit E.1: **Descriptions of Mathematics Items at Each International Benchmark** *(...Continued)*

Items at High International Benchmark (550)

Number

M01_01	Finds 4/5 of a region divided into 10 equal parts.
M01_04	Solves a word problem by finding the missing term in a proportion.
M01_11	Selects a fraction representing the comparison of part to whole, given each of two parts in a word-problem setting.
M01_13	Identifies a percent equivalent to a given fraction with a denominator that is a factor of 100.
M01_14	Demonstrates understanding of the effect of operations involving a negative integer by identifying the largest number produced.
M02_10	Selects the statement that describes the effect of adding the same amount to both terms of a ratio.
M02_11	Estimates the product of a multiple of 1000 and a two-digit number in a word problem involving knowledge of units of time.
M03_03	Identifies the fraction of an hour representing a time interval.
M03_10	Rounds a four-place decimal to the nearest hundredth.
M03_15	Solves a one-step word problem involving division of a whole number by a unit fraction.
M04_02	Solves a multi-step word problem involving multiplication of whole numbers by fractions.
M05_09	Adds three fractions with denominators less than 10.
M06_07	Multiplies a two-place decimal by a three-place decimal.
M06_12	Solves a word problem about distance and time by finding the missing term in a proportion.
M06_13	Identifies the number that gives a specified result when divided by a given negative integer.
M06_13*	Identifies the number that gives a specified result when divided by a given negative integer.
M08_01	Solves a word problem by determining a number between two given numbers that is divisible by only one of two other given numbers.
M09_03	Calculates the new price of an item given the percent increase in price.
M09_08	Solves a word problem with decimals involving a proportion.
M12_01	Solves a word problem by using the patterns in a two-column table to determine the number in the second column that would corresponds to a number midway between two entries in the first column.
M13_03	Identifies proportional share of an amount divided into three unequal parts.
M13_09	Determines the simplified ratio of shaded to unshaded parts of a shape.
M14_07	Identifies the prime factor of a given number.

Algebra

M01_12	Finds the value of an algebraic expression involving multiplication of negative integers.
M02_05	Finds a specified term in a sequence given the first three terms pictorially.
M02_07	Subtracts algebraic fractions with the same numeric denominator.
M03_05	Identifies the linear relationship between the first and second terms in a set of ordered pairs.
M03_13	Solves a linear equation involving parentheses.
M04_10A	Given a sequence of diagrams growing in two dimensions and a partially completed table, finds the next two terms in the table.

* Denotes with calculator available.

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

Exhibit E.1: **Descriptions of Mathematics Items at Each International Benchmark** *(Continued...)*

MATHEMATICS Grade 8

Items at High International Benchmark (550) – *Continued*

Algebra – *Continued*

M07_02	Recognizes the product of two algebraic terms in one variable that involve exponents.
M07_10	Identifies the linear equation represented by a set of ordered pairs given in a table.
M10_04	Solves a simultaneous linear equations.
M11_05	Identifies the algebraic expression that represents a situation involving the sum of a constant term and a product.
M11_06	Uses a formula to determine the value of one variable given the value of the other.
M12_12	Identifies the quantity that satisfies two inequalities represented by balances.
M13_05	Extends a geometric tiling pattern to identify the orientation of a tile.
M13_10	Simplifies an algebraic expression combining like terms.
M13_11	Solves a pair of simultaneous linear equations.
M14_09	Given an interval containing a number, determines the interval containing the sum of that number and a whole number.

Measurement

M01_03	Given a length rounded to the nearest centimeter, identifies what the actual length could have been in centimeters to one decimal place.
M02_01	Compares volume by visualizing and counting cubes.
M03_12	Given the start time, and the duration of an event expressed as a fraction of an hour, determines the end time.
M04_07	Finds the area between two rectangles when one is inside the other and their sides are parallel.
M04_11B	Finds the length of a side of a square, given that its area is a square number.
M05_05	Finds the perimeter of a square given that its area is a square number less than 150.
M05_12	Finds the area of a triangle, on the same base and with the same height as a square, when the length of a side of the square is known.
M07_04	Calculates the volume of a rectangular prism by using appropriate measures from its net.
M08_08	Calculates the area of an irregular figure formed by two rectangles.
M09_07A	Solves a word problem to find average speed given distance and time.
M09_09	Given two touching circles of equal radius, finds the area of rectangle that encloses them.
M11_08	Given the area of a square, finds its perimeter.
M11_09	Determines the number of cubes needed to fill a hole in a given shape.
M13_12	Identifies the appropriate unit measure for an area.

Geometry

M01_05	Identifies pairs of congruent triangles.
M01_09	Solves a problem involving adjacent and vertical angles.
M03_02	Uses properties of congruent triangles to find the measure of an angle.

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

Exhibit E.1: **Descriptions of Mathematics Items at Each International Benchmark** *(...Continued)*

Items at High International Benchmark (550) – *Continued*

Geometry – *Continued*

M03_09	Given two parallel lines cut by a transversal, selects a pair of supplementary angles.
M03_14	Selects the center of rotation when shown a diagram of a triangle and its image under a quarter turn.
M06_06	Uses knowledge of a straight angle to find the measure of an angle.
M06_14	Determines the measure of the missing angle in a right triangle.
M06_15	Uses properties of angles to draw and label a figure.
M07_09	Uses the properties of a triangle and regular hexagon to find the measure of an angle.
M09_11	Identifies a triangle similar to a specific triangle given the lengths of all sides.
M11_12	Identifies the transformations used to produce a sequence of figure.
M12_08	Visualizes the unfolded shape of a figure shown on a folded piece of paper and uses property of triangles to identify the shape.

Data

M01_07	Reads data from a frequency table to solve a problem.
M03_11	In a word problem, when given the possible number of outcomes and the probability of successful outcomes, solves for the number of successful outcomes.
M04_09	Given the set of possible outcomes expressed as fractions of all outcomes, recognizes that probability is associated with the size of a fraction.
M05_07	In a word problem, when given the possible number of outcomes and the probability of successful outcomes, solves for the number of successful outcomes.
M07_07C	Draws conclusions from data in a table.
M07_08	Compares and integrates several sets of data to determine which meet given conditions.
M08_13C	Reads values from two straight line graphs to solve a problem.
M09_14	Uses the size of a group with a given characteristic in a sample to estimate the size of group with that characteristic in a population.
M11_14	Identifies the statement that best describes the relative likelihood of two events.
M12_13C	Selects the appropriate line on a graph and determines the interval where the greatest change occurs.
M14_08	Uses percentages given in a pie chart to solve a problem.

Items at Advanced International Benchmark (625)

Number

M02_04	Identifies the pair of numbers satisfying given conditions involving ordering integers, decimals, and common fractions.
M02_13	Orders a set of decimals of up to three decimal places.
M02_14	Multiplies and adds fractions with different denominators in the correct order.
M03_08	Finds the percent change given the original and the new quantities.
M04_12	Solves a word problem involving multiplication and subtraction of decimals.

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

Exhibit E.1: **Descriptions of Mathematics Items at Each International Benchmark** *(Continued...)*

MATHEMATICS Grade 8

Items at Advanced International Benchmark (625) – *Continued*

Number – *Continued*

M05_11B	Given the dimensions of two rectangles, expresses the ratio of their areas.
M06_05	Given the total number and the ratio of the two parts, finds the value of one part.
M06_09	Selects appropriate data to solve a problem involving operations with fractions that have unlike denominators.
M06_10	Solves a word problem involving multiplication of a proper fraction with improper fraction.
M07_01	Identifies equivalent ratios in a problem setting.
M08_02	Identifies a procedure for subtracting fractions with unlike denominators.
M08_03	Given the total number and the ratio of the two parts, finds the value of one part.
M08_12	Given the original and reduced prices, finds the percentage reduction.
M09_01	Solves a word problem involving inverse operations and decimal place value.
M09_02	Solves a multi-step problem involving computing with whole numbers and rounding up.
M10_02	Computes with integers using order of operations.
M11_03	Solves a problem involving a fraction of a whole number of currency units.
M12_02	Converts a mixed number to a decimal rounded to two places.
M13_02	Uses the distributive property to recognize two different representations of a number.
M13_07	Solves a multi-step non-routine problem involving percents.

Algebra

M04_04	Identifies numbers common to two different arithmetic sequences.
M04_10B	Knowing the first five terms of a sequence growing in one dimension, finds the seventh term.
M04_10C	Generalizing from the first several terms of a sequence growing in two dimensions, explains a way to find a specified term, e.g. the 50th.
M05_04	Solves a linear inequality involving a fraction.
M08_06	Identifies an algebraic expression to model a situation.
M09_04	Identifies algebraic expression that represents a situation involving division.
M09_05	Given a linear equation in which y is expressed in terms of x, solves for x.
M09_06	Writes a pair of simultaneous equations in two unknowns to model a situation.
M10_03	Evaluates an algebraic expression by using an equivalent form and substituting given values.
M10_05	Evaluates an algebraic expression by using an equivalent form and substituting given values.
M11_04	Identifies a diagram that models addition of two like algebraic terms.
M12_03	Adds three simple algebraic rational expressions with unlike numerical denominators.
M12_09	Identifies the sum of three consecutive whole numbers given the middle number in general terms.

Exhibit E.1: **Descriptions of Mathematics Items at Each International Benchmark** *(...Continued)*

Items at Advanced International Benchmark (625) – *Continued*

Algebra – *Continued*

M14_04A	Extends number patterns in a table to identify the row whose entries solve the problem.
M14_04B	Extends number patterns in a table to identify the row whose entries solve the problem.
M14_04C	Extends number patterns in a table to identify the row whose entries solve the problem.

Measurement

M02_08	From a set of times expressed variously in days, hours, minutes, and seconds, determines which is least.
M03_06	Identifies the length of a rectangle given its perimeter and width.
M04_03	Applies knowledge of number of milliliters in a liter to solve a word problem.
M04_11C	Finds the perimeter of a figure made up of squares with known length of sides.
M05_11A	Uses computation with fractions to find the length and width of a rectangle and draws and labels that rectangle on a grid.
M09_07B	Solves a multi-step problem involving time, distance, and average speed.
M10_10	Solves a non-routine problem involving the number of spheres that will fit in a rectangular box.
M11_07	Uses information about the lengths of segments on a line to determine the distance between their midpoints.
M12_06	Uses knowledge of time, clocks, and angles to solve a problem.
M12_07	Determines the area of a trapezoid inscribed in a triangle.

Geometry

M01_15	Determines the exterior angle of a regular hexagon.
M02_15	Solves a problem involving measures of overlapping angles.
M04_08	Given only the coordinates of two points on the line, selects the coordinates of a third point on that line.
M05_08	Uses properties of congruent triangles and the sum of the angles of a triangle to find the measure of an angle.
M06_04	Identifies the image of a triangle under a rotation about a point in the plane.
M08_09	Solves a problem involving angle bisectors and angles at a point on a straight line.
M10_11	Recognizes that arcs of equal radius can generate an equilateral triangle.
M11_10	Identifies the justification that a triangle is a right triangle using Pythagorean relationship.
M12_10	Applies properties of interior and exterior angles of a triangle to find an unknown angle in overlapping triangles.
M14_06	Uses knowledge of interior angles of a triangle to determine the angle sum of a given polygon, showing calculations.

Data

M03_07	On a given graph, interpolates to find a value between graduations on one axis matching a given value on the other axis.
M07_07A	Completes a table by interpreting several time tables to identify times that meet a given set of conditions.

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

Exhibit E.1: **Descriptions of Mathematics Items at Each International Benchmark**

MATHEMATICS Grade 8

Items at Advanced International Benchmark (625) – *Continued*

Data – *Continued*

M07_07B	Derives information from given timetables to complete a table for a specified journey and check that it meets given conditions.
M08_11	Uses experimental data and an understanding of probability to draw the spinner that could have produced the data.
M10_07	Interprets data from a table, draws and justifies conclusions.
M12_11	Given a spinner, identifies the frequency of a particular outcome.
M12_13B	Interprets information from a graph to determine an average.

Items Above the Advanced International Benchmark (625)

Number

M07_06	Calculates total costs for each of two groups given different unit costs and discounts.
M11_02	Given two points on a number line representing unspecified fractions, identifies the point that represents their product.

Algebra

M02_06	Selects an algebraic expression to answer a question about a set of linked verbal statements.
M04_01	Identifies what the variable represents in an equation for a given situation.
M07_03	Generalizes a number sequence based on a geometric pattern to find the term which produces given sum of sequence and show calculations.
M14_05	Finds the general term, express algebraically for related number patterns.

Measurement

M05_10	Estimates the total time in minutes for an event made up of a series of events, each given in minutes and seconds.
M08_07	Uses knowledge of area of a circle and of average rate to solve a problem.

Geometry

M13_06	Completes a geometric tiling pattern with two given lines of symmetry using letters to represent the orientation of the tiles.

Data

M10_08	Interprets the data from a table to make calculations to solve a problem.
M10_09	Interprets the data from a table to make calculations to solve a problem.
M14_02	Solves a problem involving extrapolation of the data shown in a double bar graph.

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

Exhibit E.2: **Descriptions of Mathematics Items at Each International Benchmark**

Items at Low International Benchmark (400)

Number

M01_06	Recognizes the hundreds place in a four-digit number.
M01_11	Translates between a numeric and verbal representation of a four-digit number.
M03_04	Translates between standard and expanded notation of three-digit whole numbers.
M04_01	Multiplies a two-digit by a one-digit whole number.
M08_01	Identifies the difference between two fractions with the same denominator.
M11_01	Adds a four-digit and three-digit whole number.
M14_05	Solves a word problem involving addition of three-digit whole numbers.

Patterns and Relationships

M12_04	Finds the missing number in a number sentence involving multiplication of one-digit whole numbers.

Measurement

M02_13	Compares areas by counting squares.
M04_06	Given the base, draws a triangle on a grid whose other two sides are each the same length.

Geometry

M02_03	Identifies two figures that have the same size and shape.
M02_10	Knows that every triangle has three sides.
M05_09	Identifies two triangles with the same size and shape in a complex figure.
M08_10	Recognizes the triangles in a set of polygons.
M10_08B	Draws a line to divide one rectangle into two rectangles.

Data

M01_01	Reads information from a simple bar graph.
M02_01	Reads information from a simple bar graph.

Items at Intermediate International Benchmark (475)

Number

M01_03	Recognizes a familiar fraction represented by a figure with shaded parts (region model).
M01_04	Recognizes multiplication as the appropriate operation in a one-step word problem (single-digit).
M02_04	Subtracts two decimals involving hundredths with regrouping over 0.
M02_08	Translates from a form of expanded notation to a standard notation for a five-digit number.
M02_11	Solves a one-step word problem involving multiplication of a three-digit by a one-digit number requiring regrouping.

Exhibit E.2: **Descriptions of Mathematics Items at Each International Benchmark** *(Continued...)*

Items at Intermediate International Benchmark (475) – *Continued*

Number – *Continued*

M02_12	Recognizes a pictorial representation of ones, tens, and hundreds and can identify the standard numeral.
M03_05	Adds decimal numbers involving tenths.
M03_06	Recognizes one-half of a set of objects.
M03_10	Recognizes inequality symbols and can choose the largest of two three-digit numbers.
M04_02	Identifies the appropriate operation to solve a word problem involving division.
M07_01	Identifies the appropriate operation to solve a word problem involving multiplication.
M09_01	Labels a point associated with a whole number on a number line.
M09_02	Uses knowledge of whole number place value to solve a word problem involving addition of a three-digit and a four-digit number.
M09_03	Identifies the fraction that represents a given part-whole situation.
M10_01	Divides a three digit by a one-digit whole number.
M10_04	Solves a word problem involving multiplication of a two-digit by a one-digit whole number.
M13_03	Solves a word problem involving finding a missing three-digit addend.
M14_01A	Selects appropriate information and uses it to solve a simple proportion problem.

Patterns and Relationships

M03_11	Identifies next terms in an alternating number pattern involving counting forward and backward by ones.
M04_04	Identifies the value that extends a pattern of time.
M04_05	Identifies a number sentence that represents a situation involving subtraction.
M11_05	Selects the expression that represents a situation involving addition.
M12_03	Generalizes from the first several terms of a numeric sequence to select another number that is also in the sequence.
M12_06B	Extends a numeric sequence based on a geometric pattern.

Measurement

M01_05	Counts weeks forward from a given date on a calendar.
M01_10	Selects a reasonable metric weight (mass) for an adult.
M05_08	Solves a measurement word problem involving subtraction of two-digit numbers.
M08_06	Recognizes that area does not change when the parts of a figure are rearranged.
M08_09	Recognizes the inverse relationship between size of a unit shown in the figure and the number of units require to cover an area.

Exhibit E.2: **Descriptions of Mathematics Items at Each International Benchmark** *(...Continued)*

Items at Intermediate International Benchmark (475) – *Continued*

Geometry

M04_08	Draws a line parallel to a given line on a grid.
M04_09	Identifies and names common geometric shapes in a picture.
M10_08A	Draws a line to divide one rectangle into two triangles.
M11_11	Identifies a pattern generated by quarter turns clockwise.
M12_10	Locates a point on an informal coordinate grid and identifies the moves to get there.
M14_06	Identifies a three-dimensional object given the pictorial representation of its faces.

Data

M02_06	Locates data in a two-way table.
M03_01	Solves a comparison problem by associating elements of a bar graph with a verbal description.
M04_10	Completes a bar graph based on the solution of a word problem.
M05_11	Identifies the pie chart that matches the information shown in a table.
M06_10	Completes a two-by-two table to summarize information.
M07_09	Uses information to identify the number of symbols needed to complete a pictograph when the symbol represents more than one.
M08_12	Identifies the pie chart that matches a given bar graph.
M11_12	Completes a bar graph that represents a table of data.

Items at High International Benchmark (550)

Number

M01_07	Rounds a three-digit whole number to the nearest hundred.
M02_05	Recognizes the figure that illustrates a simple ratio.
M02_07	Solves word problem involving 1/2 and 1/4.
M03_03	Selects the number sentence that provides the best estimate of which is closest to the actual product of two two-digit numbers.
M03_07	Solves two-step word problem using doubling and adding.
M03_12	Understands tens place value and can translate between verbal and numeric representations.
M04_03	Solves a word problem by finding a fractional part of a collection of objects.
M05_01	Solves a word problem involving division of a three digit by a one-digit whole number.
M05_02	Determines the missing digit to give a specified difference in a three-digit subtraction problem.
M07_02	Solves a word problem involving division of a three-digit by a one-digit whole number.
M07_07	Solves a multi-step word problem involving addition and multiplication of whole numbers.
M08_03	Selects two-place decimal closest to a given whole number.

Exhibit E.2: **Descriptions of Mathematics Items at Each International Benchmark** *(Continued...)*

MATHEMATICS Grade 4

Items at High International Benchmark (550) – *Continued*

Number – *Continued*

M10_02	Solves a word problem involving simple proportional reasoning.
M10_03	Solves a word problem involving multiplication of a three-digit number by a one-digit number.
M11_09	Identifies the appropriate operation to solve a word problem involving division.
M12_02	Solves a multi-step word problem involving halving, doubling, and adding.
M13_01A	Uses knowledge of place value to arrange three given digits to create a sum closest to a given two-digit number.
M13_01B	Uses knowledge of place value to arrange three given digits to create a sum closest to a given two-digit number.
M13_01C	Uses knowledge of place value to arrange three given digits to create a given sum in two different ways.
M13_02A	Uses knowledge of place value to arrange three given digits to create the largest sum of a two-digit and one-digit number.
M13_02B	Uses knowledge of place value to arrange three given digits to create the largest difference between a two-digit and a one-digit number.
M14_08	Solves a word problem involving measures and proportional reasoning.

Patterns and Relationships

M01_12	Selects the expression that represents a situation involving multiplication.
M06_06	Identifies a number that satisfies a number sentence involving division.
M07_04A	Extends entries in two tables according to numerical rules described in a situation.
M08_04	Identifies the next term in a sequence of whole numbers formed by doubling.
M08_05	Identifies a number sentence that represents a situation involving division.
M09_07	Identifies the result of a specified sequence of operations on a given number.
M10_05	Identifies the missing number in a square whose rows and columns have the same sum.
M12_06C	Generalizes from the first several terms of a numeric sequence to find the tenth term.

Measurement

M01_02	Calculates the volume of a rectangular solid given the volume of one layer and the number of layers.
M02_02	Finds the increase in temperature from a negative to a positive temperature on a thermometer.
M02_09	Selects appropriate metric unit to measure weight (mass).
M05_05	Solves a multi-step word problem involving time and temperature.
M05_06	Solves a multi-step word problem involving duration of time.
M06_07	Determines the number of non-standard units of area needed to cover a figure.
M06_08B	On a map drawn to scale, positions a building within a range of distance from a specified point.

Exhibit E.2: **Descriptions of Mathematics Items at Each International Benchmark** *(...Continued)*

Items at High International Benchmark (550) – *Continued*

Measurement – *Continued*

M08_07	Identifies the value of an unlabelled mark on a circular scale.
M10_07	Selects the attribute that can be measured with a given metric unit.
M11_07	Identifies the value of an unlabelled mark on a circular scale.
M12_08	Solves a word problem involving conversion between hours and minutes.

Geometry

M03_02	Recognizes flat and curved surfaces on solids.
M06_09	Given a figure and the line of symmetry on a grid, draws the reflection.
M07_08	Uses properties of a rectangles and triangles to solve a problem.
M08_11	Recognizes the net of a triangular prism.
M09_05A	Makes and draws one large triangle from two triangle tiles (square tiles divided diagonally into one white and one black triangle).
M09_05B	Makes and draws one square from four triangle tiles (square tiles divided diagonally into one white and one black triangle).
M10_08C	Draws two lines to divide a rectangle into one rectangle and two triangles.
M10_09	Identifies two triangles that have the same shape but different sizes in a complex figure.
M11_10	Orders four angles by size.
M12_11	Identifies the figure in which a line of symmetry is shown.

Data

M04_11	Uses data from a tally chart to solve a problem.
M07_04B	Reads and interprets data from two tables to answer a question.
M07_04C	Draws conclusions from data in two tables.
M10_10	Identifies the label for a column in a bar graph that corresponds to data in a tally chart.
M12_12	Interprets data from a bar graph to solve a problem.

Items at Advanced International Benchmark (625)

Number

M01_08	Identifies the decimal representation for a fraction with a denominator of 10.
M05_03	Selects the appropriate information to solve a multi-step word problem involving whole numbers.
M06_01	Solves a multi-step word problem involving divisibility.
M06_02	Solves a problem involving proportional reasons.
M09_05C	Determines the fraction of a figure that is shaded.
M09_06A	Uses appropriate tiles to represent one-half.

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

Exhibit E.2: **Descriptions of Mathematics Items at Each International Benchmark** *(Continued...)*

Items at Advanced International Benchmark (625) – *Continued*

Number – *Continued*

M11_02	Identifies all the numbers in a given interval ending in a given string of digits.
M11_03	Halves the amounts in a recipe involving whole numbers and fractions.
M12_01	Given a fraction, identifies a larger fraction with a different denominator.
M14_01B	Selects appropriate information and uses it to solve a proportion problem.
M14_01C	Selects appropriate information and uses it to solve a multi-step problem involving proportions.
M14_02	Selects appropriate information and uses it to solve a proportion problem.

Patterns and Relationships

M06_04	Writes a rule for a multiplicative relationship between first and second numbers in a set of ordered pairs of numbers.
M06_05	Identifies the two-step rule used to describe the relationship between adjacent terms in a sequence of numbers.
M11_06	Identifies the two-step rule for a linear relationship between first and second numbers in a set of ordered pairs of numbers.
M12_05	Identifies the number that satisfies a number sentence involving addition of two terms on each side.

Measurement

M01_09	Estimates the distance on a map given scale (in cm = km).
M03_09	Identifies the numerical expression that gives the distance around a rectangle, given its length and width.
M04_07	Completes an irregular figure on a grid so that it has a given area.
M05_07	Solves a word problem involving conversion of metric units of capacity.
M06_03	Solves a multi-step measurement problem involving multiplication and subtraction.
M06_08A	On a map drawn to scale, positions a park at a given distance from a specified point.
M06_08C	On a map drawn to scale, positions a building half-way between two specified points.
M07_06	Recognizes that the area does not change when a figure is cut into parts and rearranged.
M08_08	Solves a multi-step problem involving conversion between hours and minutes.
M11_08	Determines the area of a figure made up of squares and half squares on a grid.
M12_07	Estimates the length of a curved line next to the middle of ruler.
M13_04	Identifies the operation that solves a word problem involving distance, time, and speed.
M13_05	Solves a multi-step problem involving conversion between hours and minutes.

Geometry

M12_09	Draws an angle greater than 90°.
M14_07	Identifies the position of a shape after a half-turn rotation.

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

Exhibit E.2: **Descriptions of Mathematics Items at Each International Benchmark** *(...Continued)*

Items at Advanced International Benchmark (625) – *Continued*

Data

M05_10 Organizes data and completes a tally chart to represent it.

M13_06 Reads, relates, and interprets values from two sets of data from graph to solve a problem.

Items Above Advanced International Benchmark (625)

Number

M08_02 Subtracts a one-place decimal from a two-place decimal presented horizontally.

M09_06B Selects the appropriate tiles from a restricted set and uses them to represent a given fraction.

M13_02C Uses knowledge of place value to arrange three given digits to create the largest product of a two-digit and one-digit number.

M14_03 Selects appropriate information and uses it to solve a multi-step problem involving two proportions.

Patterns and Relationships

M05_04 Writes two-step rule for a linear relationship between pairs of numbers.

M07_03 Identifies the number that satisfies a number sentence involving division of two terms on each side.

M07_05 Solves a multi-step problem to find one of the two unknown values.

M09_04 Uses understanding of equality to evaluate an expression.

Measurement

M10_06 Identifies a time in minutes in an interval given in hours and half hours.

Geometry

M03_08 Recognizes the equivalent of a three-dimensional figure when it is rotated to a different orientation.

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

Appendix F

Syrian Arab Republic and Yemen - Mathematics Achievement

Exhibit F.1: Syrian Arab Republic – Selected Mathematics Achievement Results

Distribution of Mathematics 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)
358 (3.7)	8	14	232 (3.7)	303 (3.1)	356 (4.2)	410 (3.9)	491 (7.4)

Gender Difference in Mathematics Achievement		
Mathematics Achievement	Girls' Mean	Boys' Mean
358 (3.7)	352 (3.6)	355 (6.1)

▲ Significantly higher than other gender

Average Achievement in Mathematics Content Areas by Gender			
Content Area	Girls' Mean	Boys' Mean	Overall Mean
Number	363 (4.2)	365 (5.3)	368 (4.0)
Algebra	373 (2.8) ▲	361 (4.9)	371 (3.1)
Measurement	369 (3.6)	383 (4.9) ▲	381 (3.3)
Geometry	397 (4.2)	397 (6.1)	400 (3.3)
Data	362 (4.0)	370 (4.5)	369 (3.2)

▲ Significantly higher than other gender

Percentages of Students Reaching International Benchmarks in Mathematics			
Advanced International Benchmark (625)	High International Benchmark (550)	Intermediate International Benchmark (475)	Low International Benchmark (400)
0 (0.0)	1 (0.3)	7 (0.9)	29 (1.6)

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

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

Exhibit F.2: Yemen – Selected Mathematics Achievement Results

MATHEMATICS Grade 4

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

Distribution of Mathematics 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)
278 (7.4)	4	11	99 (5.9)	196 (7.0)	273 (6.9)	355 (10.2)	473 (12.4)

Gender Difference in Mathematics Achievement		
Mathematics Achievement	Girls' Mean	Boys' Mean
278 (7.4)	275 (8.7)	282 (8.7)

▲ Significantly higher than other gender

Average Achievement in Mathematics Content Areas by Gender			
Content Area	Girls' Mean	Boys' Mean	Overall Mean
Number	294 (8.3)	303 (8.2)	299 (6.8)
Patterns and Relationships	283 (8.1)	304 (8.5)	296 (6.0)
Measurement	249 (10.4)	263 (8.7)	256 (7.5)
Geometry	284 (8.8)	269 (8.5)	274 (6.9)
Data	284 (6.7)	289 (7.4)	286 (6.0)

▲ Significantly higher than other gender

Percentages of Students Reaching International Benchmarks in Mathematics			
Advanced International Benchmark (625)	High International Benchmark (550)	Intermediate International Benchmark (475)	Low International Benchmark (400)
0 (0.1)	1 (0.4)	5 (1.1)	15 (1.9)

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

Appendix G

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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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