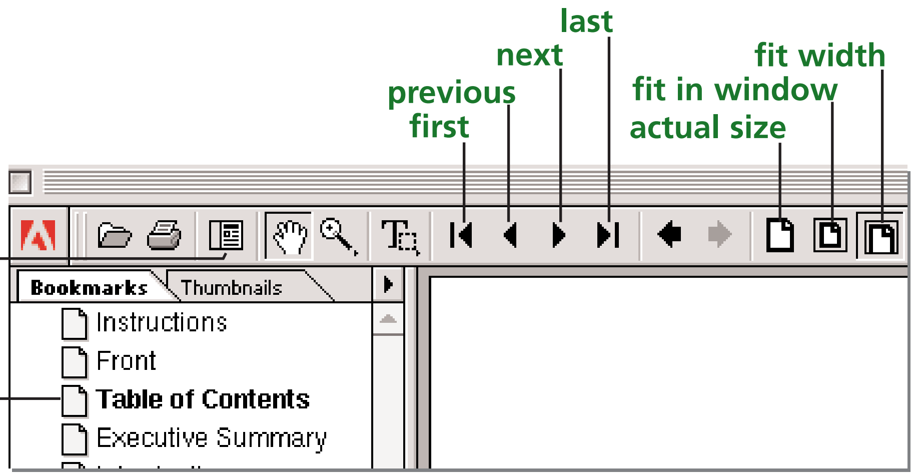
How to Navigate This Book



click icon to display or hide navigation panel

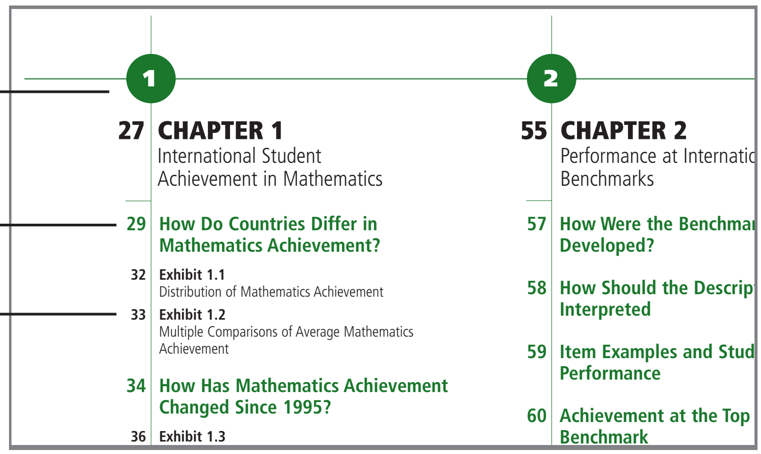
click on section icon in navigation panel to display section

Contents Pages

click on chapter number to display chapter

click on section title to display section

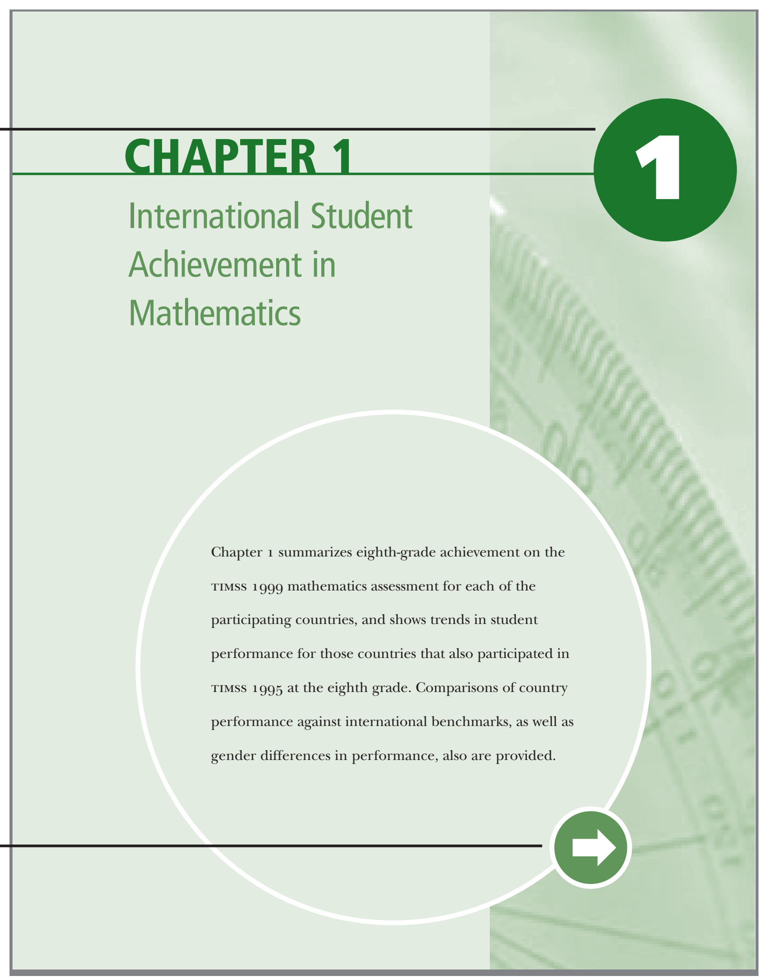
click on exhibit number to display exhibit



Cover Pages

click on chapter number to return to the table of contents

click on arrow to jump to the next page of text



next

Text Pages

click on section title to return to table of contents

click on icon to jump to exhibit

click on arrow to jump to indicated page of text

click on number to jump to another chapter

click here to return to the table of contents

Achievement at the Top 10% Benchmark

2.1 Exhibit 2.1 describes performance at the Top 10% Benchmark. Students reaching this benchmark demonstrated the ability to organize information in problem-solving situations and to apply their understanding of mathematical relationships. They typically demonstrated success on the knowledge and skills represented by this benchmark, as well as those demonstrated at the Upper Quarter, Median, and Lower Quarter benchmarks.

2.2 Example Item 1 in Exhibit 2.2 illustrates the type of measurement item a student performing at the Top 10% Benchmark generally answered correctly. As can be seen, students had to apply their knowledge of the area of rectangles and inscribed shapes to solve a two-step problem about the area of a garden path. The international average for this item was 42 percent correct. Nevertheless, more than two-thirds of the students answered the item correctly in Hong Kong, Singapore, Japan, Chinese Taipei, and Korea. On average internationally, more than 20 percent of students chose Option A, solving for the area of the larger rectangle rather than that of the path. Option C was an equally popular distracter, with more than 20 percent of students internationally selecting this response.

2.3 Unlike students performing at lower benchmarks, students reaching the Top 10% Benchmark typically could correctly answer multi-step word problems. Example Item 2 in Exhibit 2.3 requires students to select relevant information from two advertisements to solve a complex multi-step word problem involving decimals. Given the price for each issue of a magazine and a certain number of free issues, students were asked to calculate which of the two magazine subscriptions was the less expensive for 24 issues. Students received full credit if they showed correct calculations for at least one of the subscriptions, identified the less expensive magazine, and calculated the difference between the two subscriptions. With an international average of 24 percent correct (for full credit), this item was among the most difficult in TIMSS 1999. Singapore, Korea, and Chinese Taipei were the only countries where the majority of the students answered the item correctly.

2.4 Students reaching the Top 10% Benchmark exhibited an understanding of the properties of similar triangles, as shown by Example Item 3 (see Exhibit 2.4). Given two angle measurements, the length of a side of a triangle, and the dimensions of a second similar triangle, students needed to find the length of an unlabeled side of the first triangle. Internationally, most eighth-grade students had not mastered the concept of proportionality of corresponding sides, or could not solve the resulting

text continued page 62

Exhibit Pages

click on exhibit number to jump to text discussion of that exhibit

Exhibit 1.6 Percentages of Students Reaching TIMSS 1999 International Benchmarks of Mathematics Achievement

TIMSS 1999 8th grade Mathematics

Country	Top 10%	Upper Quarter	Median	Lower Quarter
Singapore	46 (3.5)	75 (2.7)	93 (1.3)	99 (0.3)
Chinese Taipei	41 (1.7)	66 (1.5)	85 (1.0)	95 (0.6)
Korea, Rep. of	37 (1.0)	68 (0.9)	91 (0.5)	99 (0.2)
Hong Kong, SAR †	33 (2.3)	68 (2.4)	92 (1.5)	99 (0.6)
Japan	33 (1.1)	64 (0.9)	89 (0.5)	98 (0.3)
Belgium (Flemish) †	23 (1.4)	54 (1.7)	85 (1.4)	98 (0.7)
Hungary	16 (1.2)	41 (1.9)	74 (1.6)	94 (1.0)
Slovenia	15 (1.2)	39 (1.4)	74 (1.4)	95 (0.7)
Russian Federation	15 (1.8)	37 (2.8)	72 (2.7)	94 (1.2)
Netherlands †	14 (2.3)	45 (4.1)	81 (3.5)	96 (1.3)
Slovak Republic	14 (1.4)	40 (2.3)	78 (1.8)	96 (0.6)
Canada	12 (1.1)	38 (1.5)	77 (1.3)	96 (0.6)
Australia	12 (1.8)	37 (2.7)	73 (2.4)	94 (0.8)
Malaysia	12 (1.4)	34 (2.4)	69 (2.2)	94 (0.8)
Czech Republic	11 (1.4)	33 (2.1)	69 (2.3)	94 (1.1)
Bulgaria	11 (2.3)	30 (3.0)	66 (2.6)	91 (1.3)
United States	9 (1.0)	28 (1.6)	61 (1.9)	88 (1.0)
New Zealand	8 (1.2)	25 (2.4)	56 (2.5)	85 (1.5)
Latvia (LSS) 1	7 (0.9)	26 (1.8)	63 (2.0)	92 (1.0)
England †	7 (0.9)	24 (1.9)	58 (2.1)	89 (1.3)
Finland	6 (0.9)	31 (1.7)	75 (1.5)	96 (0.5)
Italy	5 (0.7)	20 (1.4)	52 (2.1)	83 (1.4)
Romania	5 (1.1)	19 (1.9)	49 (2.6)	80 (2.1)
Israel 2	5 (0.6)	18 (1.3)	47 (1.8)	77 (1.9)
Lithuania 1‡	4 (0.7)	17 (2.0)	52 (2.4)	86 (1.8)
Moldova	4 (0.7)	16 (1.5)	45 (2.2)	81 (1.7)
Thailand	4 (0.8)	16 (1.8)	44 (2.6)	81 (1.6)
Cyprus	3 (0.4)	17 (0.8)	51 (1.1)	84 (0.8)
Macedonia, Rep. of	3 (0.4)	12 (1.0)	38 (1.9)	72 (1.8)
Jordan	3 (0.5)	11 (0.9)	32 (1.5)	62 (1.4)
Indonesia	2 (0.4)	7 (0.9)	22 (1.4)	52 (2.2)
Turkey	1 (0.3)	7 (1.0)	27 (1.9)	65 (2.0)
Iran, Islamic Rep.	1 (0.2)	5 (0.8)	25 (1.7)	63 (1.5)
Chile	1 (0.5)	3 (1.1)	15 (1.8)	48 (2.0)
Tunisia	0 (0.1)	4 (0.5)	32 (1.6)	80 (1.3)
Philippines	0 (0.1)	1 (0.5)	8 (1.4)	31 (2.5)
South Africa	0 (0.2)	1 (0.4)	5 (1.0)	14 (2.0)
Morocco	0 (0.0)	0 (0.2)	5 (0.4)	27 (1.1)

Top 10% Benchmark (90th Percentile) = 616
Upper Quarter Benchmark (75th Percentile) = 555
Median Benchmark (50th Percentile) = 479
Lower Quarter Benchmark (25th Percentile) = 391

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

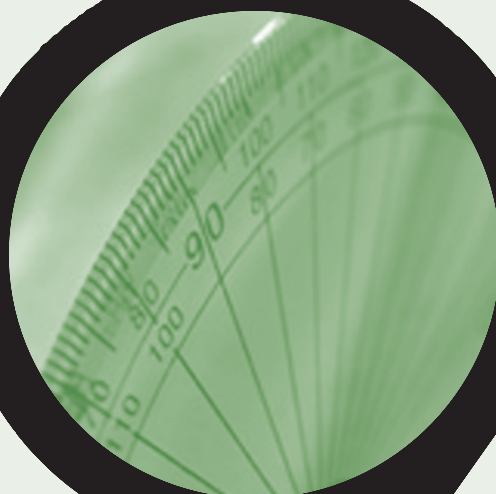
begin book

Book Navigation Instructions

TIMSS 1999

International Mathematics Report

Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade



Ina V.S. Mullis
Michael O. Martin
Eugenio J. Gonzalez
Kelvin D. Gregory
Robert A. Garden
Kathleen M. O'Connor
Steven J. Chrostowski
Teresa A. Smith

The International Study Center
Boston College
Lynch School of Education

The International Association for the Evaluation of Educational Achievement

December 2000

CONTENTS

TIMSS 1999 International Mathematics Report / by Ina V.S. Mullis, Michael O. Martin, Eugenio J. Gonzalez, Kelvin D. Gregory, Robert A. Garden, Kathleen M. O'Connor, Steven J. Chrostowski, Teresa A. Smith

Publisher: International Study Center
Lynch School of Education
Boston College

Library of Congress Catalog Card Number: 00-110266

ISBN 1-889938-15-7

For more information about TIMSS contact:

The International Study Center
Lynch School of Education
Campion Hall 332
Boston College
Chestnut Hill, MA 02467
United States

For information on ordering this report, write to the above address or call +1-617-552-1600

This report also is available on the World Wide Web: http://www.timss.org

Funding for the international coordination of TIMSS 1999 was provided by the National Center for Education Statistics of the U.S. Department of Education, the U.S. National Science Foundation, the World Bank, and participating countries. Each participating country was responsible for funding national project costs and implementing TIMSS 1999 in accordance with the international procedures.

Printed and bound in the United States

CONTENTS

6

CONTENTS

CONTENTS

EXECUTIVE SUMMARY

S

TIMSS 1999
International
Mathematics
Report

Executive Summary

In 1999, the Third International Mathematics and Science Study (TIMSS) was replicated at the eighth grade. Involving 41 countries and testing at five grade levels, TIMSS was originally conducted in 1995 to provide a base from which policy makers, curriculum specialists, and researchers could better understand the performance of their educational systems. Conducted under the auspices of the International Association for the Evaluation of Educational Achievement (IEA), TIMSS was the first step in a long-term strategy, with further assessments in mathematics and science planned for 1999, 2003, and beyond.

TIMSS 1999, also known as TIMSS-Repeat or TIMSS-R, was designed to provide trends in eighth-grade mathematics and science achievement in an international context. Thirty-eight countries participated in TIMSS 1999. Of these, 26 countries also participated in TIMSS 1995 at the eighth grade and have trend data included in this report. Also, 1999 represents four years since the first TIMSS, and the population of students originally assessed as fourth-graders had advanced to the eighth grade. Thus, for 17 of the 26 countries that participated in TIMSS 1995 at the fourth grade, TIMSS 1999 also provides information about whether the relative performance of these students has changed in the intervening years.

Five content areas were covered in the TIMSS 1999 mathematics test: fractions and number sense; measurement; data representation, analysis, and probability; geometry; and algebra. About one-fourth of the questions were in the free-response format, requiring students to generate and write their answers. (See Chapter 2 for example items illustrating the range of mathematics concepts and processes covered in the TIMSS 1999 tests.) The achievement data are accompanied by extensive questionnaire data about the home, classroom, school, and national contexts within which mathematics learning takes place.

Because a valid and efficient sample in each country is crucial to the quality and integrity of the study, TIMSS developed procedures and standards regarding coverage of the target population, participation, and the age and years of schooling of students. For 1999, all countries met the guidelines, and any variations that occurred are annotated. Indeed, TIMSS 1999 was conducted with rigorous attention to attaining high quality in all aspects of the project.

Students' Mathematics Achievement

- Singapore, the Republic of Korea, Chinese Taipei, and Hong Kong SAR had the highest average performance, with Singapore and Korea having significantly higher achievement than all other participating countries. Japan also performed very well as did Belgium (Flemish) (see Exhibits 1.1 and 1.2).
- Countries that showed an increase in average mathematics achievement between 1995 and 1999 were Latvia (LSS)[1], Canada, and Cyprus. Only the Czech Republic showed a decrease.
- The difference in average achievement for boys and girls was negligible in most countries, except Israel, the Czech Republic, Tunisia, and the Islamic Republic of Iran. The gender differences among high-performing students, although small, were statistically significant, with 27 percent of boys on average across countries in the top achievement quarter, compared with 23 percent of girls. Since boys and girls showed similar increases across countries from 1995 to 1999, the average gender difference remained essentially the same. Korea was the one country that narrowed the gender gap in average mathematics achievement.

1 Because coverage of the target population falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

Students' Home Environment and Attitudes Towards Mathematics

- On average internationally, students from homes with a high level of educational resources (more than 100 books; all three study aids: computer, study desk, and dictionary; and at least one parent finished university) had higher mathematics achievement than students from homes with fewer resources.
- Eighth-grade students internationally had high expectations for further education. On average across countries, more than half the students reported that they expected to finish university. In almost every country there was a positive association between educational expectations and mathematics achievement.
- Internationally on average, about 15 percent of the eighth-grade students seem to be convinced that they just cannot do mathematics. In each country, a more positive self-concept in mathematics was associated with higher average achievement. Interestingly, however, several countries with low percentages of students reporting a strong self-concept had high average mathematics achievement, including the five Asian Pacific countries (Singapore, Hong Kong, Chinese Taipei, Korea, and Japan).
- Across the participating countries, eighth-grade students generally had positive attitudes towards mathematics. More boys than girls reported high levels of positive attitudes towards mathematics internationally and in a number of countries. There was little change overall in students' attitudes between 1995 and 1999.

The Mathematics Curriculum

- In 35 of the 38 countries, specifications for students' curricular goals in mathematics were developed as national curricula. The exceptions were Australia, Canada, and the United States.
- Testing and assessment were widely used methods to support curriculum implementation. Belgium (Flemish) was the one country that reported having no public examinations in mathematics to certify students or select them for university or academic tracks. Approximately two-thirds of the countries conduct system-wide assessments at two or three grades, primarily to inform policy makers about achievement of the intended curriculum.
- On average across countries, the percentage of instructional time designated in official curricula for mathematics instruction remains about the same from grade 4 to grade 6 but then decreases by grade 8 (17, 16, and 13 percent, respectively). In contrast, the instructional time specified for science increases from grade 4 to grade 8 (from 11 to 16 percent).
- Across countries, the official curricula for eighth grade most commonly placed major emphasis on mastering basic skills and understanding mathematical concepts. Moderate to major emphasis was placed on assessing student learning, "real-life" applications of mathematics, and communicating mathematically. Thirty-three countries reported at least moderate emphasis on solving non-routine problems, but working on mathematics projects was given minor or no emphasis in the intended curriculum of most countries.
- According to their teachers, internationally 55 percent of the eighth-grade students were receiving mathematics instruction emphasizing a combination of algebra, geometry, and number sense; about 27 percent instruction emphasizing algebra or algebra combined with geometry; and 14 percent instruction in mainly number. Very few students were given an emphasis in only geometry (three percent).

Instructional Contexts and Practices

- Internationally, 60 percent of eighth-grade students were taught mathematics by females and 40 percent by males, and similar percentages were found in a number of countries.
- Teachers' undergraduate and graduate studies provide some indication of their preparation to teach mathematics. Internationally, 84 percent of students were taught by teachers having mathematics and/or mathematics education as a major area of study.
- The TIMSS 1999 results show higher achievement is related to higher levels of teachers' confidence in their preparation to teach mathematics. Internationally, teachers reported relatively high degrees of confidence, with 63 percent of students taught by teachers who believed they were very well prepared.
- The percentage of instructional time at the eighth grade that was devoted to mathematics ranged from 9 to 17 percent. For the most part, the percentages reported by teachers corresponded with the percentages targeted in the intended curriculum.
- In 1999, teachers reported that approximately half the students were in mathematics classes that met between about two and three and a half hours per week, and another third were in classes meeting about three and a half to five hours. Compared with 1995, this represents a slight increase (five percentage points) for the shorter time period and a commensurate decrease for the longer time period.
- Videotapes of mathematics classes in the United States and Japan in TIMSS 1995 revealed that outside interruptions can affect the flow of the lesson and detract from instructional time. Internationally in 1999, about one-fifth of the students reported that their mathematics classes were interrupted pretty often or almost always, and 28 percent reported that their classes were never interrupted. In comparison, more than half the students in Japan, Korea, and Tunisia were in classes with no interruptions.
- Across the participating countries, teachers reported that the two most predominant activities encountered in mathematics class are teacher lecture and teacher-guided student practice, accounting for nearly half of class time.

- Students in classes emphasizing reasoning and problem-solving had higher achievement than those in classes with a low emphasis on these activities. In Japan, nearly half the students were in classes involving reasoning and problem-solving activities in most lessons. Across countries, however, the majority of students were asked to do such activities in some but not most lessons. There was some evidence of increased emphasis on problem-solving activities between 1995 and 1999. However, the percentage of students asked to practice their computational skills in most or every lesson also increased significantly between 1995 and 1999.

- In the Netherlands, Singapore, and Australia, more than four-fifths of the students and their teachers reported at least weekly calculator use. From about two-thirds to four-fifths in England, Canada, New Zealand, Hong Kong, Israel, and the United States reported this level of calculator use. Calculators were used most frequently to check answers, perform routine computations, and solve complex problems. At the other end of the spectrum, a majority of students and their teachers reported using calculators infrequently or never in a number of countries, including Chinese Taipei, Iran, Japan, Korea, Malaysia, the Philippines, Romania, Thailand, and Turkey.

- Across countries, the vast majority of students (80 percent) reported never using computers in mathematics class. The trend data from 1995 to 1999, however, show a small but statistically significant shift from the "never" to the "once in while" category. Although there was great variation across countries, about a quarter of the students internationally reported Internet access at school. Despite this access, only 10 percent on average used the Internet to obtain information for mathematics projects on even a monthly basis.

School Factors

- Students in schools that reported being well resourced generally had higher average mathematics achievement than those in schools where across-the-board shortages affected instructional capacity in mathematics some or a lot. According to their principals, nearly half the students were in schools where instruction was negatively affected by shortages or inadequacies in instructional materials, budget for supplies, school buildings, instructional space, audio-visual resources, and library materials relevant to mathematics instruction. More than half the students were in schools where shortages or inadequacies in computers and computer software affected the capacity to provide mathematics instruction. Countries seemed to have computers either in nearly all of their schools or in only a fraction of them.

- Clearly schools around the world expect help from parents. Internationally, 85 percent of students attended schools expecting parents to ensure that their children complete their homework, 79 percent attended schools expecting parents to volunteer for school projects or field trips, and about half attended schools expecting parents to help raise funds and to serve on committees.

- Internationally, one-fifth of the students attended schools where principals reported that attendance was not a problem. However, 60 percent were in schools where principals reported moderate attendance problems, and 19 percent were in schools with some serious attendance problems.

- Generally, the overwhelming majority of eighth-grade students attended schools judged by principals to have few serious problems threatening an orderly or safe school environment.

INTRODUCTION

I

TIMSS 1999 International Mathematics Report

In 1999, the Third International Mathematics and Science Study (TIMSS) was replicated at the eighth grade. Thirty-eight countries participated in this mathematics and science assessment, known as TIMSS-R or TIMSS 1999. The mathematics results are presented in this report for the 38 countries that participated in TIMSS in 1999. Trend data also are included for 26 countries that participated in TIMSS in 1995.

What is TIMSS?

Originally conducted in 1994-1995, the Third International Mathematics and Science Study (TIMSS) was the largest and most comprehensive comparative international study of education ever undertaken. Designed to provide a base from which policy makers, curriculum specialists, and researchers could better understand the performance of their educational systems, TIMSS compared the mathematics and science achievement of students in 41 countries at five grade levels. Using questionnaires, videotapes, and analyses of curriculum materials, TIMSS also investigated the contexts for learning mathematics and science in the participating countries. Information was collected about educational systems, curriculum, teacher and school characteristics, and instructional practices, providing an extremely rich source of valuable insights into mathematics teaching and learning.

TIMSS results, which were first reported in 1996, have stirred debate, spurred reform efforts, and provided important information to academics, researchers, and decision makers around the world.[1] Since that time most of the participating countries have published one or more national reports, analyzing the findings from their own perspective. In addition, at least 12 book-length international reports have been published, along with hundreds of articles and comments in newsletters, newspapers, and magazines.

What is TIMSS 1999?

TIMSS was the first step in a long-term strategy, with further assessments in mathematics and science planned for 1999, 2003, and beyond. TIMSS 1999, also known as TIMSS-Repeat or TIMSS-R, is a replication of TIMSS at the lower-secondary or middle-school level – the eighth grade in most countries. As a follow-up to the earlier study, TIMSS 1999 adds to the richness of the TIMSS data and their potential to have an impact on policy and practice.

Administered during the 1998-99 school year, TIMSS 1999 was designed to provide trends in eighth-grade mathematics and science achievement in an international context. Also, 1999 represents 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 provides information about whether the relative performance of

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.

these students has changed in the intervening years. As in the original 1995 study, TIMSS 1999 included a full range of context questionnaires and the TIMSS-R Videotape Classroom Study examining mathematics and science instructional practices in seven nations.[2]

In countries new to the study as well as those that participated in 1995, the data from TIMSS 1999 can help policy makers and practitioners assess their comparative standing and gauge the rigor and effectiveness of their mathematics and science programs. The aim is to improve the teaching and learning of mathematics and science for students everywhere by providing data about what types of curricula, instructional practices, and school environments result in higher student achievement.

Who Conducted TIMSS 1999?

The original TIMSS and TIMSS 1999 were conducted by the International Association for the Evaluation of Educational Achievement (IEA). With a permanent secretariat based in Amsterdam, the Netherlands, the IEA is an independent international cooperative of national research institutions and governmental research agencies. Its primary purpose is to conduct large-scale comparative studies of educational achievement to gain a deeper understanding of the effects of policies and practices within and across systems of education.

Four IEA studies in the areas of mathematics and science preceded TIMSS. These were the First International Mathematics Study, 1959-1967; the First International Science Study, 1966-1973; the Second International Mathematics Study, 1976-1987; and the Second International Science Study, 1980-1989. During the same period, the IEA conducted a number of studies that focused on other areas of schooling, including reading literacy, civics, computer applications, and early childhood education.

Funding for TIMSS 1999 was provided by the United States, the World Bank, and the participating countries. Within the United States, funding agencies include the National Center for Education Statistics of the U.S. Department of Education, the National Science Foundation, and the Department of Education's Office of Educational Research and Improvement.

The IEA delegated responsibility for the overall direction and management of the project to the International Study Center in the Lynch School of Education at Boston College, headed by Michael O. Martin

2 Sponsored by the United States, the TIMSS-R Videotape Classroom Study builds on the work of the first TIMSS videotape study of mathematics (Stigler, J.W., Gonzales, P., Kawanaka, T., Knoll S., and Serrano, A. (1999), *The TIMSS Videotape Classroom Study: Methods and Findings from an Exploratory Research Project on Eighth-Grade Mathematics Instruction in Germany, Japan, and the United States*, NCES 1999-074, Washington, DC: National Center for Education Statistics). The first data from the Videotape Classroom Study are anticipated in late 2001.

and Ina V.S. Mullis. In carrying out the project, the International Study Center worked closely with the IEA Secretariat in Amsterdam, Statistics Canada in Ottawa, the IEA Data Processing Center in Hamburg, and Educational Testing Service in Princeton, New Jersey.

Which Countries Participated?

Exhibit 1 shows the 38 countries that participated in TIMSS 1999. The decision to participate in any IEA study is coordinated through the secretariat in Amsterdam and made solely by each member country according to its own data needs and resources. Exhibit 1 shows that 26 countries also participated in TIMSS 1995.[3] For these, trend data are included in this report, while for 12 of the participants data are included only for TIMSS 1999.[4] Seventeen of the 26 countries that participated in TIMSS 1995 also have data at the fourth grade.[5] A list of the countries participating in TIMSS 1995 at grades 4 and 8 can be found in Exhibit A.1 in the appendix.

Each participating country designated a national center to conduct the activities of the study and a National Research Coordinator (NRC) to implement it in accordance with international procedures – a considerable responsibility given the complexity of the data collection and the measurement instruments. The quality of the study depends on the work of the NRCs and their colleagues, and all those involved deserve deep appreciation for their continued commitment to the project.[6]

For the sake of comparability across countries and across assessments, all testing was conducted at the end of the school year, except in Lithuania. As noted in the exhibits in this report, Lithuania tested the same cohort of students as other countries, but later in 1999, at the beginning of the next school year. The six countries on a Southern Hemisphere school schedule (Australia, Chile, Malaysia, New Zealand, Singapore and South Africa) tested in October through December of 1998, which was the end of the school year there. The remaining countries tested at the end of the 1998-1999 school year, most often in May and June of 1999.

3 Hong Kong became a Special Administrative Region of the People's Republic of China in 1999, and is labeled "Hong Kong, SAR" in the exhibits in this report.

4 Italy was unable to complete the steps necessary to have its data available for reporting in 1996, but all scoring and database tasks were completed subsequently. Indonesia and the Philippines participated in 1995, but were unable to complete the steps necessary for their 1995 data to be reported comparably to those of other countries.

5 Israel and Thailand also participated at the fourth grade in 1995, but did not satisfy guidelines for sampling procedures at the classroom level and were not included in the comparisons for fourth and eighth grade.

6 Please see Appendix E for a list of the TIMSS 1999 National Research Coordinators and the TIMSS 1999 advisory committees.

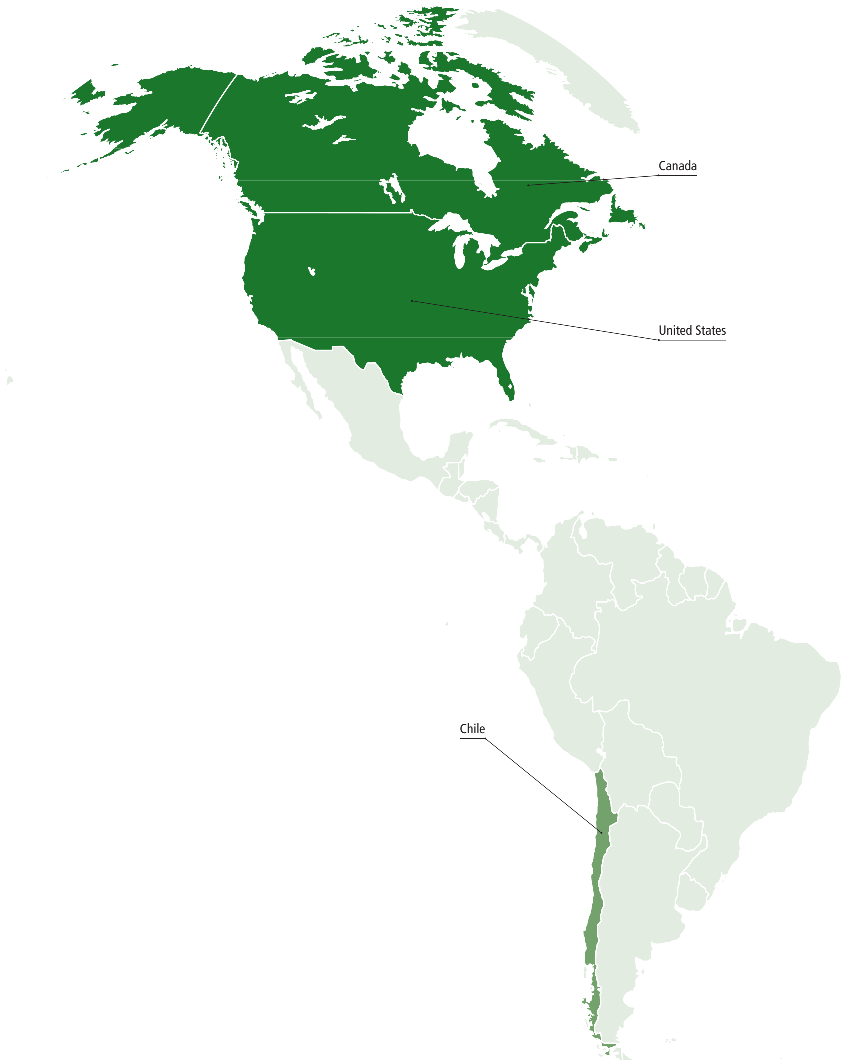
Exhibit 1 Countries Participating in TIMSS 1999

Countries with Data from 1995 and 1999

Australia
Belgium (Flemish)
Bulgaria
Canada
Cyprus
Czech Republic
England
Hong Kong, SAR*
Hungary
Iran, Islamic Republic
Israel
Italy
Japan
Korea, Republic of
Latvia (LSS)
Lithuania
Netherlands
New Zealand
Romania
Russian Federation
Singapore
Slovak Republic
Slovenia
South Africa
Thailand
United States

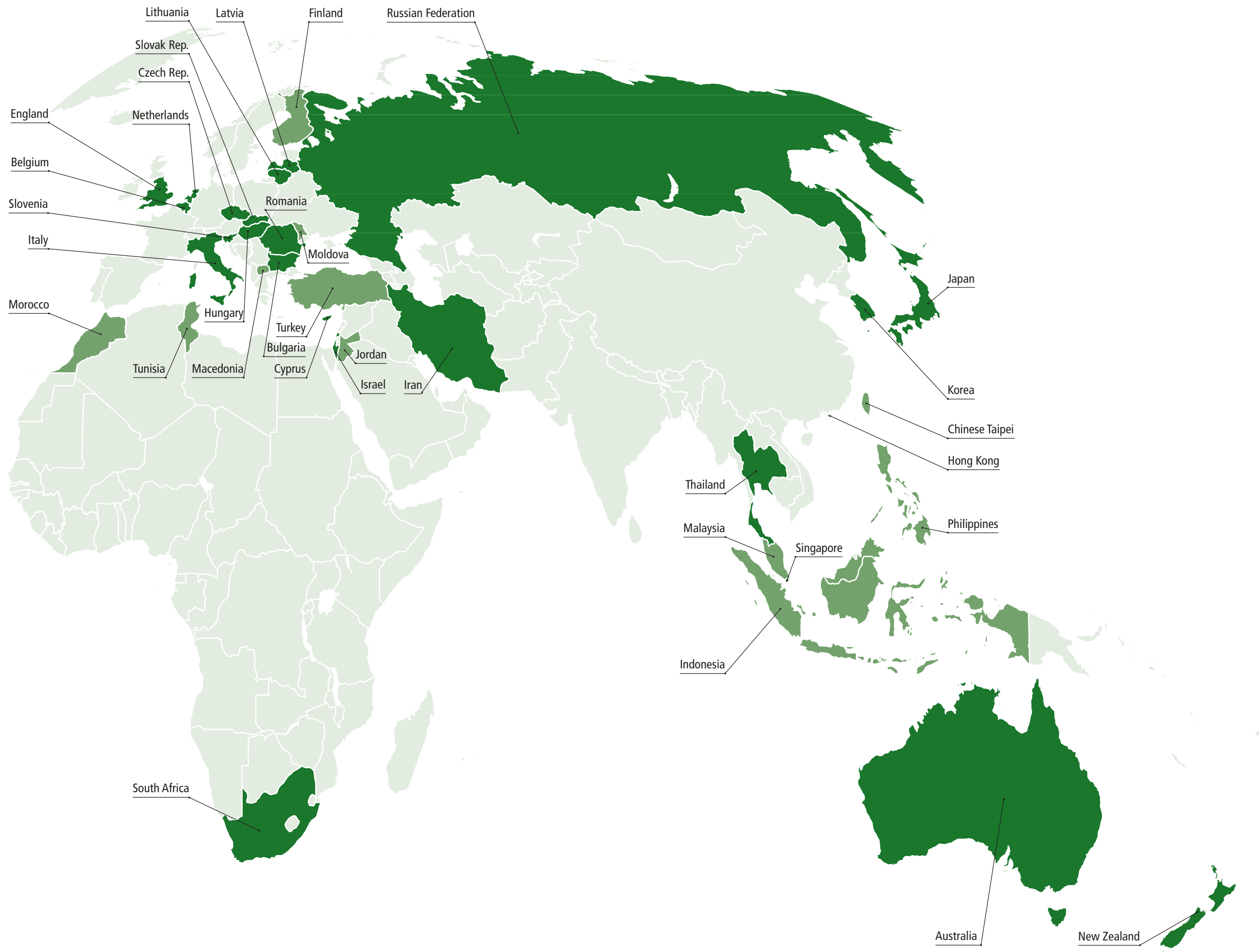
Countries with Data from 1999 Only

Chile
Chinese Taipei
Finland
Indonesia
Jordan
Macedonia, Republic of
Malaysia
Moldova
Morocco
Philippines
Tunisia
Turkey



Countries Participa

* For 1995, Hong Kong. It became a Special Administrative Region of the People's Republic of China in 1999.



SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

ting in TIMSS 1999

What is the Comparability Across the Grades and Ages Tested?

2 Exhibit 2 shows information about the grade tested in each country for TIMSS 1999, including each country's name for the grade and the years of formal schooling students in the grade had completed when they were tested. Based on reassessing the same target population as originally defined for TIMSS in 1995, all countries that participated in TIMSS 1999 were to test students in the upper of the two grades with the largest proportion of 13-year-olds. Although in 1995 TIMSS tested students in the two grades with the largest proportion of 13-year-olds, the 1999 replication was carried out at only the upper of the two middle-school grades tested in 1995.

Exhibit 2 reveals that for most but not all countries, the grade tested represented the eighth year of formal schooling. Thus, solely for convenience, the report usually refers to the grade tested as the eighth grade.

It should be noted that students in Finland, in particular, had one year less of formal schooling and were about half a year younger, on average, than were the students tested internationally. Students in Morocco and the Philippines also had only seven years of formal schooling, as did some students in the Russian Federation. Students in the Czech Republic, England, and Moldova, as well as some in Australia and New Zealand, had nine years of formal schooling, yet the average age of the students was at or below the international average. Two countries, Romania and Slovenia, had students somewhat older than the international average, and a third, South Africa, had students about one year older, though these students had eight years of formal schooling. These countries, however, assessed the same grade as in 1995 in order to measure trends.

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, participation rates, and the age of students. 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 annotated in the exhibits in this report.[7]

[7] The TIMSS 1999 sampling requirements and the outcomes of the sampling procedures are described in Appendix A.

Exhibit 2 Information About the Students Tested in TIMSS 1999

TIMSS 1999 8th grade Mathematics

	Country's Name for Grade Tested	Years of Formal Schooling[1]	Average Age of Students Tested
Australia	8 or 9	8 or 9	14.3
Belgium (Flemish)	2A & 2P	8	14.1
Bulgaria	8	8	14.8
Canada	8	8	14.0
Chile	8	8	14.4
Chinese Taipei	2nd Grade Junior High School	8	14.2
Cyprus	8	8	13.8
Czech Republic	8	8	14.4
England	Year 9	9	14.2
Finland	7	7	13.8
Hong Kong, SAR	Secondary 2	8	14.2
Hungary	8	8	14.4
Indonesia	2nd Grade Junior Secondary	8	14.6
Iran, Islamic Rep.	8	8	14.6
Israel	8	8	14.1
Italy	3rd Grade Middle School	8	14.0
Japan	2nd Grade Lower Secondary	8	14.4
Jordan	8	8	14.0
Korea, Rep. of	2nd Grade Middle School	8	14.4
Latvia (LSS)	8	8	14.5
Lithuania ‡	9	8.5	15.2
Macedonia, Rep. of	8	8	14.6
Malaysia	Form 2	8	14.4
Moldova	8	9	14.4
Morocco	7	7	14.2
Netherlands	Secondary 2	8	14.2
New Zealand [2]	Year 9	8.5 to 9.5	14.0
Philippines	1st Year High School	7	14.1
Romania	8	8	14.8
Russian Federation	8	7 or 8	14.1
Singapore	Secondary 2	8	14.4
Slovak Republic	8	8	14.3
Slovenia	8	8	14.8
South Africa	8	8	15.5
Thailand	Secondary 2	8	14.5
Tunisia	8	8	14.8
Turkey	8	8	14.2
United States	8	8	14.2
		International Avg.	14.4

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, at the beginning of the next school year.

1 Years of schooling based on the number of years children in the grade level have been in formal schooling, beginning with primary education (International Standard Classification of Education Level1). Does not include pre-primary education.

2 The official nomenclature used in New Zealand since 1996 refers to students' years of schooling rather than to a class/grade level. Year 9 students are found in a class level equivalent to grade 8.

What Was the Nature of the Mathematics Test?

Together with the quality of the samples, the quality of the test also receives considerable scrutiny in any comparative study. Developing the 1995 TIMSS tests was a cooperative venture involving all of the NRCs during the entire process. Through a series of efforts, countries submitted items that were reviewed by mathematics subject-matter specialists, and additional items were written to ensure that the desired mathematics topics were covered adequately. Items were pilot tested, the results were reviewed, and new items were written and piloted. As part of the TIMSS dissemination strategy, approximately two-thirds of the 1995 items were released for public use. For TIMSS 1999, these items were replaced with items similar in content, format, and difficulty level.[8] All of the potential replacement items were reviewed thoroughly by subject-matter experts and field tested. Nearly all the TIMSS 1999 countries participated in field testing the replacement items with nationally representative samples, and all the NRCs had several opportunities to review the items and scoring criteria. The resulting TIMSS 1999 mathematics test contained 162 items representing a range of mathematics topics and skills.

The TIMSS curriculum frameworks developed for 1995 were also used for 1999. They describe the content dimensions for the TIMSS tests as well as the performance expectations (behaviors that might be expected of students in school mathematics).[9] Five content areas are covered in the TIMSS 1999 mathematics test. These areas and the percentage of the test items devoted to each are fractions and number sense (38 percent), measurement (15 percent), data representation, analysis, and probability (13 percent), geometry (13 percent), and algebra (22 percent). The performance expectations include knowing (19 percent), using routine procedures (23 percent), using complex procedures (24 percent), investigating and solving problems (31 percent), and communicating and reasoning (two percent).

About one-fourth of the questions were in the free-response format, requiring students to generate and write their answers. These questions, some of which required extended responses, were allotted about one-third of the testing time. Responses to the free-response questions were evaluated to capture diagnostic information, and some were scored using procedures that permitted partial credit. Chapter 2 of this report contains 16 example items illustrating the range of mathematics concepts and processes covered in the TIMSS 1999 tests.

8 The TIMSS 1999 item replacement procedures are described in Appendix A.

9 Robitaille, 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.

The TIMSS 1999 tests were prepared in English and translated into 33 languages. A series of verification checks were conducted to ensure the comparability of the translations.[10]

Testing was designed so that no one student took all the items, which would have required more than three hours. Instead, exactly as in 1995, the test was assembled in eight booklets, each requiring 90 minutes to complete. Each student took only one booklet, and the items were rotated through the booklets so that each item was answered by a representative sample of students.

TIMSS conducted a Test-Curriculum Matching Analysis in which countries examined the TIMSS 1999 test to identify items measuring topics not covered in their curricula. The analysis showed that omitting such items for each country had little effect on the overall pattern of achievement results across all countries.[11]

10 See Appendix A for more information about the translation procedures.

11 Results of the Test-Curriculum Matching Analysis are presented in Appendix C.

How Do Country Characteristics Differ?

International studies of student achievement provide valuable comparative information about student performance, instructional practice, and curriculum. Accompanying the benefits of international studies, though, are challenges associated with comparing achievement across countries, cultures, and languages. In both the 1995 and 1999 studies, extensive efforts were made to attend to these issues through careful planning and documentation, cooperation among the participating countries, standardized procedures, and rigorous attention to quality control throughout.[12]

Beyond ensuring the integrity of the study procedures and collecting information about system-wide factors that influence students' opportunity to learn,[13] the results from comparative studies such as TIMSS also need to be considered in light of country-wide demographic and economic factors. Some selected demographic characteristics of the TIMSS 1999 coun-
3 tries are presented in Exhibit 3. Countries range widely in population size, from almost 270 million in the United States to less than one million in Cyprus, and in size, from almost 17 million square kilometers in the Russian Federation to less than one thousand in Hong Kong SAR and Singapore. Countries also vary widely on indicators of health, such as life expectancy at birth and infant mortality rate, and of literacy, including
4 adult literacy rate and daily newspaper circulation. Exhibit 4 shows information for selected economic indicators, such as gross national product (GNP) per capita, expenditure on education and research and development as a percentage of GNP, unemployment rate, and amount of development aid. The data reveal that there is great disparity in the economic resources available to countries. Together the indicators in these two exhibits highlight the diversity of the TIMSS 1999 countries, and although the factors they reflect do not necessarily determine high or low performance in mathematics, they do provide a context for considering the challenges involved in the educational task from country to country.

12 Appendix A contains an overview of the procedures used. More detailed information is provided in Martin, M.O., Gregory, K.A., and Stemler, S.E., eds., (2000), *TIMSS 1999 Technical Report*, Chestnut Hill, MA: Boston College.

13 See Chapter 5 for information about the official mathematics curriculum for each country participating in TIMSS 1999.

Exhibits 3 and 4 Overleaf

Exhibit 3 Selected Characteristics of TIMSS 1999 Countries

	Population Size (in millions)[1]	Area of Country (1000 square kilometers)[2]	Life Expectancy at Birth[3]	Infant Mortality Rate (per 1000 live births)[4]	Adult Literacy Rate (%)[5]	Daily Newspaper Circulation (per 1000)[6]
Australia	18.5	7682	78	5	99.0	296
Belgium (Flemish) [7]	10.2	33	77	6	99.0	161
Bulgaria	8.3	111	71	18	98.2	254
Canada	30.3	9221	79	6	99.0	158
Chile	14.6	749	75	11	95.2	98
Chinese Taipei [8]	22.1	36	75	8	–	–
Cyprus [9]	0.8	9	–	6	95.9	111
Czech Republic	10.3	77	74	6	99.0	254
England [10]	50.0	130	–	–	99.0	–
Finland	5.1	305	77	4	99.0	455
Hong Kong	6.5	1	79	5	92.4	786
Hungary	10.2	92	71	10	99.0	186
Indonesia	200.4	1812	65	47	85.0	23
Iran, Islamic Rep.	60.9	1622	69	32	73.3	26
Israel [11]	6.1	21	78	7	95.4	288
Italy	57.5	294	78	5	98.3	104
Japan	126.1	377	80	4	99.0	578
Jordan	4.4	89	71	29	87.2	42
Korea, Rep.	46.0	99	72	9	97.2	394
Latvia	2.5	62	69	15	99.0	247
Lithuania	3.7	65	71	10	99.0	93
Macedonia	2.0	25	72	16	94.0	21
Malaysia	21.7	329	72	11	85.7	163
Moldova	4.3	33	67	20	98.3	60
Morocco [12]	27.3	711	67	51	45.9	27
Netherlands	15.6	34	78	5	99.0	306
New Zealand	3.8	268	77	7	99.0	216
Philippines	73.5	298	68	35	94.6	82
Romania	22.6	230	69	22	97.8	298
Russian Federation	147.3	16889	67	17	99.0	105
Singapore	3.1	1	76	4	91.4	324
Slovak Republic	5.4	48	73	9	99.0	184
Slovenia	2.0	20	75	5	99.0	199
South Africa	40.6	1221	65	48	84.0	34
Thailand	60.6	511	69	33	94.7	64
Tunisia	9.2	155	70	30	67.0	31
Turkey [13]	62.5	815	69	40	83.2	110
United States	267.6	9159	76	7	99.0	212

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

1 Estimates for 1997 based, in most cases, on a de facto definition. Refugees not permanently settled in the country of asylum are generally considered to be part of their country of origin. World Bank (1999) World Development Indicators, p. 42-44.

2 Area is the total surface area in square kilometers, comprising all land area and inland waters. World Bank (1999) World Development Indicators, p. 120-122.

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 (1999) World Development Indicators, p. 110-112.

4 Infant mortality rate is the number of deaths of infants under one year of age during 1997 per 1,000 live births in the same year. World Bank (1999) World Development Indicators, p.16-18.

5 Population aged 15 years and over. UNDP (1999) Human Development Report 1999 (134-137).

6 A newspaper issued at least four times a week is considered to be a daily newspaper. Circulation figures show the average circulation. UNESCO (1999) Statistical Yearbook, IV (106-133).

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

8 Data provided by Department of Statistics, Ministry of Interior, Republic of China.

9 Data for population, area, and infant mortality provided by Cypriot Government Statistics Department.

10 The Statesman's Yearbook, 1998-99. Edited by Barry Turner, p.1411.

11 Data provided by Israel's Central Bureau of Statistics, publication no. 1133.

12 Data provided by Ministere du plan et de l'initiation economique: Annuaire de Maroc, 1999.

13 Data provided by Turkey's State Institute of Statistics.

A dash (–) indicates data are not available.

Exhibit 4 Selected Economic Indicators of TIMSS 1999 Countries

TIMSS1999 8th grade Mathematics

	Gross National Product per Capita (in US dollars)[1]	GNP per Capita (Purchasing Power Parity)[2]	Expenditure on Education as % of Gross National Product[3]	Expenditure on Research and Development as % of Gross National Product[4]	Total Unemployment (% of total labor force)[5]	Aid per Capita[6]
Australia	20650	19510	5.5	1.8	8.4	–
Belgium (Flemish) [7]	26730	23090	3.1	1.6	12.7	–
Bulgaria	1170	3870	3.2	0.6	11.1	25
Canada	19640	21750	6.9	1.7	9.4	0
Chile	4820	12240	3.6	0.6	5.3	9
Chinese Taipei [8]	13235	–	4.9	2.0	2.9	–
Cyprus	–	–	4.5	0.2	–	–
Czech Republic	5240	10380	5.1	1.2	3.1	10
England	–	–	–	–	–	–
Finland	24790	19660	7.5	2.8	14.7	–
Hong Kong	25200	24350	2.9	0.3	2.2	–
Hungary	4510	6970	4.6	0.7	10.5	16
Indonesia	1110	3390	1.4	0.1	–	4
Iran, Islamic Rep.	1780	5690	4.0	0.5	–	3
Israel [9]	16180	17680	10.1	2.4	7.7	204
Italy	20170	20100	4.9	2.2	12.1	–
Japan	38160	24400	3.6	2.8	3.2	–
Jordan	1520	3350	7.9	0.3	–	104
Korea, Rep.	10550	13430	3.7	2.8	2.7	-3
Latvia	2430	3970	6.3	0.4	7.0	33
Lithuania	2260	4140	5.5	0.7	7.1	27
Macedonia	1100	3180	5.1	–	38.8	75
Malaysia	4530	7730	4.9	0.2	2.5	-11
Moldova	460	1450	10.6	0.9	1.6	15
Morocco	1260	3210	5.3	–	17.8	17
Netherlands	25830	21300	5.1	2.1	6.2	–
New Zealand	15830	15780	7.3	1.0	6.0	–
Philippines	1200	3670	3.4	0.2	7.9	9
Romania	1410	4270	3.6	0.7	6.3	9
Russian Federation	2680	4280	3.5	0.9	3.4	5
Singapore	32810	29230	3.0	1.1	2.4	0
Slovak Republic	3680	7860	5.0	1.1	12.6	13
Slovenia	9840	11880	5.7	1.5	13.9	49
South Africa	3210	7190	8.0	0.7	–	12
Thailand	2740	6490	4.8	0.1	0.9	10
Tunisia	2110	5050	7.7	0.3	–	21
Turkey	3130	6470	2.2	0.5	6.6	0
United States	29080	29080	5.4	2.6	5.0	–

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

1 World Bank (1999) World Development Indicators, p. 12-14.

2 An international dollar has the same purchasing power over GNP as a U.S. dollar in the United States. World Bank (1999) World Development Indicators, p. 12-14.

3 UNESCO (1999) Statistical Yearbook, p.II-(490-513); Belgium figure is for the Flemish community only; Cyprus is for Greek section only.

4 UNESCO (1999) Statistical Yearbook, p.III-(6-17); Belgium figure is for the Flemish community only; Cyprus is for Greek section only.

5 Unemployment is the share of the labor force that is without work but available for and seeking employment. Definitions of labor force and unemployment differ by country. World Bank (1999) World Development Indicators, p. 58-60.

6 World Bank (1999) World Development Indicators, p. 352-355. Aid per capita includes official development assistance, which consists of disbursement of loans and grants, and official aid, which consists of capital projects, budget and balance of payments support, food and other commodity services, technical co-operation and emergency relief. A negative value indicates repayments exceed aid payments.

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

8 Data provided by Department of Statistics, Ministry of Interior, Republic of China.

9 Data Provided by Israel's Central Bureau of Statistics, publication no. 1133.

A dash (–) indicates data are not available or that aggregates cannot be calculated because of missing data in year shown.

CHAPTER 1

1

International Student Achievement in Mathematics

Chapter 1 summarizes eighth-grade achievement on the TIMSS 1999 mathematics assessment for each of the participating countries, and shows trends in student performance for those countries that also participated in TIMSS 1995 at the eighth grade. Comparisons of country performance against international benchmarks, as well as gender differences in performance, also are provided.

1

How Do Countries Differ in Mathematics Achievement?

Exhibit 1.1 presents the distribution of student achievement for the 38 countries that participated in TIMSS 1999.[1] Countries are shown in decreasing order of average (mean) scale score, together with an indication of whether the country average is significantly higher or lower than the international average. The international average of 487 was obtained by averaging across the mean scores for each of the 38 participating countries. The results reveal substantial differences in mathematics achievement between the high- and low-performing countries, from an average of 604 for Singapore to 275 for South Africa. Nineteen countries had average mathematics achievement that was significantly above the international average, including three countries that are participating in TIMSS for the first time – Chinese Taipei, Finland, and Malaysia.[2] Fourteen countries had average achievement below the international average, including seven countries new to TIMSS – Moldova, Tunisia, the Republic of Macedonia, Turkey, Jordan, Chile, and Morocco. 1.1

The broad range of achievement both within and across countries is illustrated in Exhibit 1.1 by a graphical representation of the distribution of student performance within each country. Achievement for each country is shown for the 25th and 75th percentiles as well as for the 5th and 95th percentiles.[3] Each percentile point indicates the percentages of students performing below and above that point on the scale. For example, 25 percent of the eighth-grade students in each country performed below the 25th percentile for that country, and 75 percent performed above the 25th percentile. The range between the 25th and 75th percentiles represents performance by the middle half of the students. In most countries, the range of performance for the middle group was between 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 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.[4]

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' performance to be summarized on a common metric even though individual students responded to different items in the mathematics test. For more detailed information, see the "IRT Scaling and Data Analysis" section of Appendix A.

2 The significance tests in Exhibits 1.1 and 1.2 are based on a Bonferroni procedure for multiple comparisons that holds to 5 percent the probability of erroneously stating the mean of one country to be different from that of another country.

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

4 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.

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 38 countries was very large. For example, average performance in Singapore was comparable to or even exceeded performance at the 95th percentile in the lower-performing countries such as Chile, the Philippines, Morocco, and South Africa. 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. Most notably, students in Finland, Morocco, the Philippines, and parts of the Russian Federation had fewer years of formal schooling than their counterparts in other countries, while those in the Czech Republic, England, Moldova, and parts of Australia and New Zealand had more years of schooling. The average age of students ranged from 13.8 years in Cyprus and Finland to 15.5 years in South Africa.

1.2

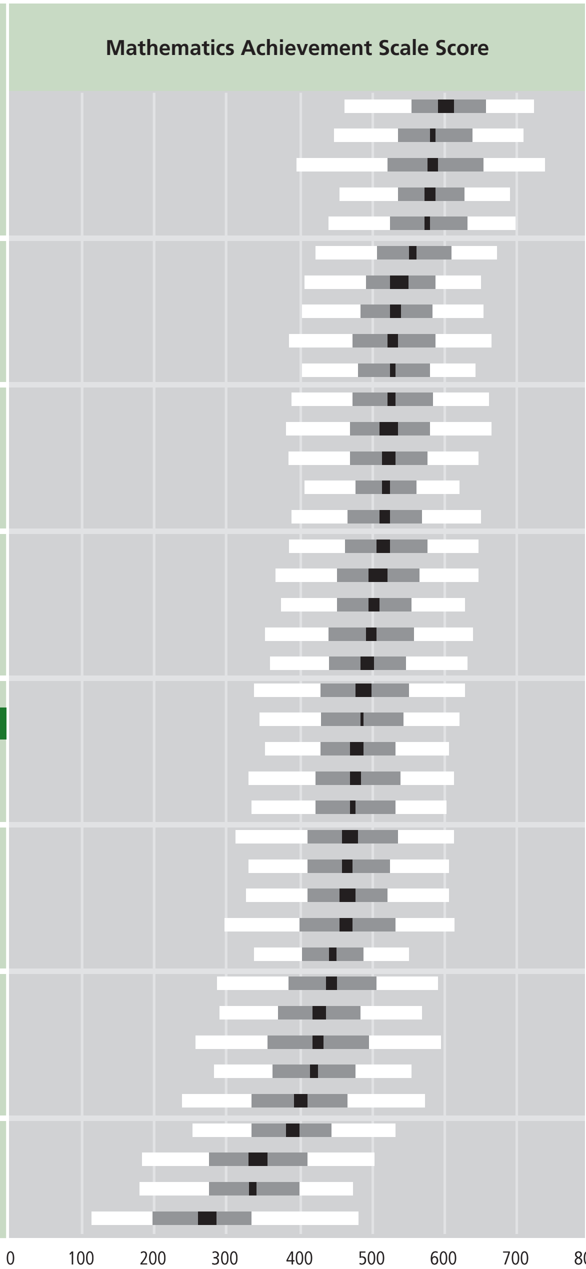
Exhibit 1.2 compares overall mean achievement among individual countries. This figure shows whether or not the differences in average achievement between pairs of countries are statistically significant. Selecting a country of interest and reading across the table, a triangle pointing up indicates significantly higher performance than the comparison country listed across the top; a circle indicates no significant difference in performance; and a 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.

Singapore, the Republic of Korea, Chinese Taipei, and Hong Kong SAR had the highest average performance, with Singapore and Korea having significantly higher mean achievement than the rest of the other participating countries, and Chinese Taipei and Hong Kong significantly better than all the other countries except Japan. Japan also performed very well, with significantly higher achievement than most other participating countries, as did Belgium (Flemish).[5] Interestingly, the Netherlands, the Slovak Republic, Hungary, Canada, Slovenia, the Russian Federation, Australia, Finland, the Czech Republic, Malaysia, and Bulgaria all performed very similarly. In fact, the difference in performance from one country to the next was often negligible.

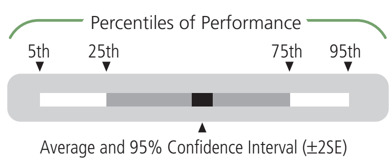
5 Average achievement in Belgium (Flemish) was 558 compared to 579 in Japan and 540 in the Netherlands. Even though the differences are comparable, the latter difference was not statistically significant because the Netherlands had a larger than usual standard error.

Exhibit 1.1 Distribution of Mathematics Achievement



Country		Average Scale Score	Years of Formal Schooling	Average Age
Singapore	▲	604 (6.3)	8	14.4
Korea, Rep. of	▲	587 (2.0)	8	14.4
Chinese Taipei	▲	585 (4.0)	8	14.2
Hong Kong, SAR †	▲	582 (4.3)	8	14.2
Japan	▲	579 (1.7)	8	14.4
Belgium (Flemish) †	▲	558 (3.3)	8	14.1
Netherlands †	▲	540 (7.1)	8	14.2
Slovak Republic	▲	534 (4.0)	8	14.3
Hungary	▲	532 (3.7)	8	14.4
Canada	▲	531 (2.5)	8	14.0
Slovenia	▲	530 (2.8)	8	14.8
Russian Federation	▲	526 (5.9)	7 or 8	14.1
Australia	▲	525 (4.8)	8 or 9	14.3
Finland	▲	520 (2.7)	7	13.8
Czech Republic	▲	520 (4.2)	9	14.4
Malaysia	▲	519 (4.4)	8	14.4
Bulgaria	▲	511 (5.8)	8	14.8
Latvia (LSS) [1]	▲	505 (3.4)	8	14.5
United States	▲	502 (4.0)	8	14.2
England †	●	496 (4.1)	9	14.2
New Zealand	●	491 (5.2)	8.5 to 9.5	14.0
International Avg.		487 (0.7)		14.4
Lithuania [1]‡	●	482 (4.3)	8.5	15.2
Italy	●	479 (3.8)	8	14.0
Cyprus	▼	476 (1.8)	8	13.8
Romania	●	472 (5.8)	8	14.8
Moldova	▼	469 (3.9)	9	14.4
Thailand	▼	467 (5.1)	8	14.5
Israel [2]	▼	466 (3.9)	8	14.1
Tunisia	▼	448 (2.4)	8	14.8
Macedonia, Rep. of	▼	447 (4.2)	8	14.6
Turkey	▼	429 (4.3)	8	14.2
Jordan	▼	428 (3.6)	8	14.0
Iran, Islamic Rep.	▼	422 (3.4)	8	14.6
Indonesia	▼	403 (4.9)	8	14.6
Chile	▼	392 (4.4)	8	14.4
Philippines	▼	345 (6.0)	7	14.1
Morocco	▼	337 (2.6)	7	14.2
South Africa	▼	275 (6.8)	8	15.5

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.



▲ Country average significantly higher than international average

● No statistically significant difference between country average and international average

▼ Country average significantly lower than international average

Significance tests adjusted for multiple comparisons

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 1.2 Multiple Comparisons of Average Mathematics Achievement

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

	Singapore	Korea, Rep. of	Chinese Taipei	Hong Kong, SAR	Japan	Belgium (Flemish)	Netherlands	Slovak Republic	Hungary	Canada	Slovenia	Russian Federation	Australia	Finland	Czech Republic	Malaysia	Bulgaria	Latvia (LSS)	United States	England	New Zealand	Lithuania	Italy	Cyprus	Romania	Moldova	Thailand	Israel	Tunisia	Macedonia, Rep. of	Turkey	Jordan	Iran, Islamic Rep.	Indonesia	Chile	Philippines	Morocco	South Africa
Singapore		●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Korea, Rep. of	●		●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei	●	●		●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong, SAR	●	●	●		●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan	▼	▼	●	●		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Belgium (Flemish)	▼	▼	▼	▼	▼		●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Netherlands	▼	▼	▼	▼	▼	●		●	●	●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovak Republic	▼	▼	▼	▼	▼	▼	●		●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hungary	▼	▼	▼	▼	▼	▼	●	●		●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Canada	▼	▼	▼	▼	▼	▼	●	●	●		●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovenia	▼	▼	▼	▼	▼	▼	●	●	●	●		●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Russian Federation	▼	▼	▼	▼	▼	▼	●	●	●	●	●		●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Australia	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●		●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Finland	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●		●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Czech Republic	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●		●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Malaysia	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●	●		●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Bulgaria	▼	▼	▼	▼	▼	▼	●	▼	●	●	●	●	●	●	●	●		●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Latvia (LSS)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	▼	▼	●	●	●		●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
United States	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●		●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
England	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●		●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
New Zealand	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●		●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Lithuania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●		●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Italy	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●		●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●		●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Romania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●		●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Moldova	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●		●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Thailand	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●		●	▲	●	▲	▲	▲	▲	▲	▲	▲	▲
Israel	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		●	▲	▲	▲	▲	▲	▲	▲	▲
Macedonia, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	▼	●		●	▲	▲	▲	▲	▲	▲	▲
Turkey	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●		●	●	▲	▲	▲	▲	▲
Jordan	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●		●	▲	▲	▲	▲	▲
Iran, Islamic Rep.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●		●	▲	▲	▲	▲
Indonesia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●		●	▲	▲	▲
Chile	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●		▲	▲	▲
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		●	▲
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●		▲
South Africa	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ Average achievement significantly higher than comparison country

● No statistically significant difference from comparison country

▼ Average achievement significantly lower than comparison country

Significance tests adjusted for multiple comparisons

How Has Mathematics Achievement Changed Since 1995?

Twenty-six countries took part in the TIMSS eighth-grade assessments in both 1995 and 1999. For these countries, Exhibit 1.3 shows the results and the differences in average achievement between the two years.[6] Average mathematics achievement across these 26 countries increased slightly, from a scale score of 519 in 1995 to 521 in 1999. However, this increase was not statistically significant.

1.3

In some countries, average mathematics achievement increased considerably between 1995 and 1999. The greatest increase was in Latvia (LSS)[7], with an increase of 17 scale-score points. Canada and Cyprus also had statistically significant gains in average mathematics achievement between 1995 and 1999. Hong Kong, the Netherlands, and Lithuania also had increases of 10 or more scale-score points, although the somewhat larger estimates of measurement error for these countries meant that the differences were not statistically significant. The Lithuanian results should be interpreted with additional caution, since Lithuania conducted the assessment six months later than other participants, when the students were beginning ninth grade rather than finishing eighth grade.

Several countries showed a small decrease in average achievement from 1995 to 1999, but only in the case of the Czech Republic was it statistically significant. Israel, South Africa, and Thailand are shown in a separate panel in Exhibit 1.3 because they used unapproved sampling procedures at the classroom level in 1995. Israel and Thailand showed large decreases since 1995, which could indicate an upward bias in the 1995 results due to their sampling problems in the original TIMSS rather than actual decreases.

TIMSS in 1995 assessed both fourth- and eighth-grade students. This allowed participants to compare their performance relative to each other at the fourth and eighth grades, and gave a cross-sectional perspective on how relative performance changed between grades.[8] For example, as shown in Exhibit 1.4, Singapore, Korea, Japan, and Hong Kong performed significantly above the international average at the fourth grade in 1995 and again at the eighth grade in 1999. In contrast, the Netherlands and the Czech Republic were significantly above the international average at the fourth grade in 1995, but only similar to it four years later at the eighth grade. Canada had mathematics performance

1.4

6 TIMSS used IRT methods to place the eighth-grade results from 1995 and 1999 on the same scale. See Appendix A for more detailed information.

7 Because coverage of its eighth-grade population falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

8 The mathematics achievement scale for fourth grade is not comparable to that for eighth grade, and so results for fourth grade and eighth grade may be compared only in relative terms, for example with reference to the international average for countries that participated in 1995 at both the fourth and eighth grades.

significantly below the international average at the fourth grade in 1995, but similar to it at the eighth grade in 1999. In contrast, the United States and Italy moved from being similar to the international average at the fourth grade in 1995 to significantly below it at the eighth grade in 1999.

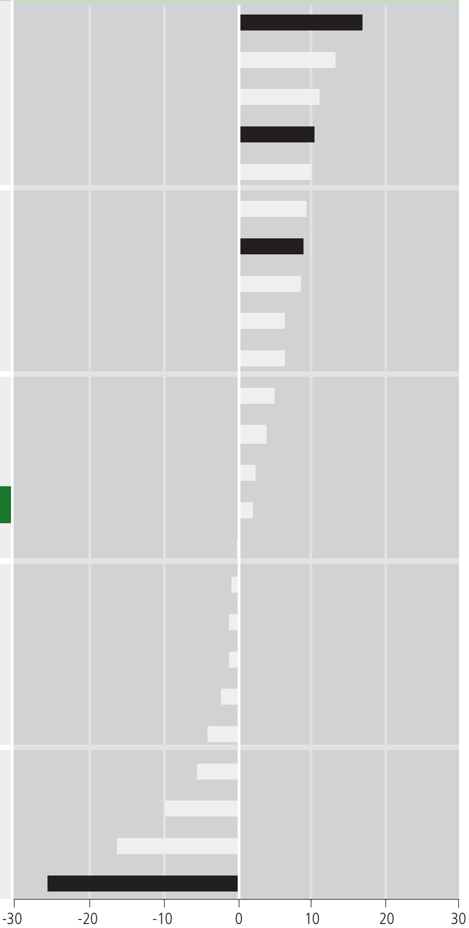
It has been argued, at least in the United States, that recent reforms in education had their greatest impact in the earlier grades, and that a second TIMSS assessment could show better results for the eighth grade in 1999 than in 1995. Despite a modest, non-statistically significant gain at the eighth grade (see Exhibit 1.3), however, the data show that the relative position of the U.S. at grade 8 was below the international average in 1999 just as it was in 1995.

Exhibit 1.3 Trends in Mathematics Achievement

TIMSS 1999 8th grade Mathematics

	1995 Average Scale Score	1999 Average Scale Score	1995-1999 Difference
Latvia (LSS)	488 (3.6)	505 (3.4)	17 (5.0)
Hong Kong, SAR	569 (6.1)	582 (4.3)	13 (7.5)
Netherlands	529 (6.1)	540 (7.1)	11 (9.5)
Canada	521 (2.2)	531 (2.5)	10 (3.2)
Lithuania	472 (4.1)	482 (4.3)	10 (6.1)
United States	492 (4.7)	502 (4.0)	9 (6.2)
Cyprus	468 (2.2)	476 (1.8)	9 (2.9)
Belgium (Flemish)	550 (5.9)	558 (3.3)	8 (6.8)
Korea, Rep. of	581 (2.0)	587 (2.0)	6 (2.8)
Australia	519 (3.8)	525 (4.8)	6 (6.1)
Hungary	527 (3.2)	532 (3.7)	5 (4.9)
Iran, Islamic Rep.	418 (3.9)	422 (3.4)	4 (5.2)
Russian Federation	524 (5.3)	526 (5.9)	2 (8.0)
International Avg. §	**519 (0.9)**	**521 (0.9)**	**2 (1.3)**
Slovak Republic	534 (3.1)	534 (4.0)	0 (4.9)
Slovenia	531 (2.8)	530 (2.8)	-1 (3.9)
Romania	474 (4.6)	472 (5.8)	-1 (7.4)
England	498 (3.0)	496 (4.1)	-1 (5.2)
Japan	581 (1.6)	579 (1.7)	-2 (2.2)
Singapore	609 (4.0)	604 (6.3)	-4 (7.4)
Italy	491 (3.4)	485 (4.8)	-6 (6.0)
New Zealand	501 (4.7)	491 (5.2)	-10 (7.1)
Bulgaria	527 (5.8)	511 (5.8)	-16 (8.2)
Czech Republic	546 (4.5)	520 (4.2)	-26 (6.1)

Difference in Average Achievement Between 1995 and 1999



Countries with Unapproved Sampling Procedures at the Classroom Level in 1995

	1995 Average Scale Score	1999 Average Scale Score	1995-1999 Difference
Israel	513 (6.2)	482 (4.7)	-32 (7.8)
South Africa	278 (9.2)	275 (6.8)	-3 (11.5)
Thailand	516 (6.0)	467 (5.1)	-49 (7.9)

Difference statistically significant

Difference not statistically significant

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian-Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

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

TIMSS 1999 8th grade Mathematics

Exhibit 1.4 Mathematics Achievement for TIMSS 1999 Countries That Participated in 1995 at Both the Fourth and Eighth Grades in Relation to the Average Across These Countries

1995

Eighth Grade Difference From Average Across Countries§

Singapore	87 (3.8)
Japan	59 (1.8)
Korea, Rep. of	59 (2.1)
Hong Kong, SAR	47 (5.8)
Czech Republic	24 (4.3)
Slovenia	9 (2.8)
Netherlands	7 (5.8)
Hungary	5 (3.1)
Canada	-1 (2.2)
Australia	-3 (3.7)
New Zealand	-21 (4.5)
England	-24 (2.9)
United States	-29 (4.6)
Italy	-31 (3.3)
Latvia (LSS)	-33 (3.5)
Cyprus	-54 (2.3)
Iran, Islamic Rep.	-103 (3.8)
Avg. Across Countries §	**522 (0.9)**

Fourth Grade Difference From Average Across Countries§

Singapore	73 (4.3)
Korea, Rep. of	63 (1.9)
Japan	50 (2.0)
Hong Kong, SAR	40 (3.8)
Netherlands	32 (2.9)
Czech Republic	23 (3.0)
Slovenia	8 (3.1)
Hungary	4 (3.5)
United States	0 (2.9)
Australia	0 (3.0)
Italy	-7 (4.5)
Canada	-12 (3.3)
Latvia (LSS)	-18 (4.4)
England	-33 (3.2)
Cyprus	-42 (3.1)
New Zealand	-48 (4.2)
Iran, Islamic Rep.	-130 (4.8)
Avg. Across Countries §	**517 (0.9)**

1999

Eighth Grade Difference From Average Across Countries§

Singapore	80 (5.9)
Korea, Rep. of	63 (2.0)
Hong Kong, SAR	58 (4.2)
Japan	55 (1.8)
Netherlands	16 (6.8)
Hungary	8 (3.6)
Canada	7 (2.7)
Slovenia	6 (2.8)
Australia	1 (4.7)
Czech Republic	-4 (4.1)
Latvia (LSS)	-19 (3.3)
United States	-22 (3.8)
England	-28 (4.0)
New Zealand	-33 (4.9)
Italy	-39 (4.6)
Cyprus	-48 (1.9)
Iran, Islamic Rep.	-102 (3.3)
Avg. Across Countries §	**524 (1.0)**

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Country average significantly higher than average across countries

Country average not significantly different from average across countries

Country average significantly lower than average across countries

Significance tests adjusted for multiple comparisons

§ Average across the subset of TIMSS 1999 countries that participated and met sampling guidelines in 1995 at both the fourth and eighth grades.

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

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, and conducted an ambitious scale-anchoring exercise to describe performance at these benchmarks.
1.5 Exhibit 1.5 shows the four international benchmarks of mathematics achievement and briefly describes what students scoring at these benchmarks typically know and can do. More detailed descriptions appear in Chapter 2, together with example test items illustrating performance at each benchmark.

The Top 10% Benchmark is defined at the 90th percentile on the TIMSS mathematics scale, taking into account the performance of all students in all countries participating in 1999. This point on the scale, which corresponds to a scale score of 616, is the point above which the top 10 percent of the students in the TIMSS 1999 assessment scored. Students performing at this level demonstrated that they could organize information, make generalizations, and explain solution strategies in non-routine problem solving situations.

The Upper Quarter Benchmark is the 75th percentile on the mathematics scale. This point, corresponding to a scale score of 555, is the point above which the top 25 percent of students scored. Students scoring at this benchmark demonstrated that they could apply their mathematical understanding and knowledge in a wide variety of relatively complex situations involving fractions, decimals, geometric properties, and algebraic expressions.

The Median Benchmark, with a score of 479, corresponds to the 50th percentile, or median. This is the point above which the top half of the students scored on the TIMSS 1999 assessment. Students performing at this level showed they could apply basic mathematical knowledge in straightforward situations, such as one-step word problems involving addition and subtraction or computational problems based on basic properties of geometric figures and simple algebraic relationships.

The Lower Quarter Benchmark is the 25th percentile and corresponds to a scale score of 396. This score point was reached by the top 75 percent of students, and may be used as a benchmark of performance for lower-achieving students. Students scoring at this level typically demonstrated computational facility with whole numbers.

Exhibit 1.6 displays the percentage of students in each participating country that reached each international benchmark, in decreasing order by percentage reaching the Top 10% Benchmark. If student achievement in mathematics were distributed in the same way in every country, then each country would be expected to have approximately 10 percent of its students reaching the Top 10% Benchmark, 25 percent the Upper Quarter Benchmark, 50 percent the Median Benchmark, and 75 percent the Lower Quarter Benchmark. Although New Zealand came fairly close, no country followed this pattern exactly. Instead, the high-performing countries generally had greater percentages of students reaching each benchmark, and the low-performing countries had lesser percentages. Among the high performers, for example, Singapore, Chinese Taipei, Korea, Hong Kong, and Japan had one-third or more of their students reaching the Top 10% Benchmark, about two-thirds or more reaching the Upper Quarter Benchmark, around 90 percent reaching the Median Benchmark, and almost all (95 to 99 percent) reaching the Lower Quarter Benchmark. In contrast, low-performing countries such as South Africa, the Philippines, and Morocco had almost no students reaching the Top 10% Benchmark, no more than one percent reaching the Upper Quarter Benchmark, less than 10 percent reaching the Median Benchmark, and no more than 31 percent reaching the Lower Quarter Benchmark. 1.6

Although Exhibit 1.6 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, Canada, Australia, and Malaysia had 12 percent of their students reaching the Top 10% Benchmark, as might be expected, but 94 to 96 percent (rather than 75 percent) reaching the Lower Quarter Benchmark.

Exhibits 1.7 through 1.10 provide more information on the change in student performance from 1995 to 1999 by showing the percentages reaching each international benchmark (Top 10%, Upper Quarter, Median, and Lower Quarter) in each of the years for the 26 countries that participated in both assessments.[9] In general, there were very few changes at any of the benchmarks, but these exhibits do provide fur- 1.7–1.10

9 For Exhibits 1.7 through 1.10 the benchmarks were those computed from the 1999 data.

ther detail about the countries that showed increases or decreases in Exhibit 1.3 in average mathematics achievement from 1995 to 1999. For example, the decrease in performance in the Czech Republic is also apparent at the Upper Quarter, Median, and Lower Quarter benchmarks, implying a decrease at most levels of the proficiency distribution. In contrast, the increase for Latvia (LSS) appears mainly at the Median benchmark, and for Cyprus at the Lower Quarter benchmark.

Exhibits 1.5 – 1.10 Overleaf

Exhibit 1.5 TIMSS 1999 International Benchmarks of Mathematics Achievement

• Top 10% Benchmark

Students can organize information, make generalizations, and explain solution strategies in non-routine problem solving situations. They can organize information and make generalizations to solve problems; apply knowledge of numeric, geometric, and algebraic relationships to solve problems (e.g., among fractions, decimals, and percents; geometric properties; and algebraic rules); and find the equivalent forms of algebraic expressions.

90th Percentile: 616

• Upper Quarter Benchmark

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; solve multi-step word problems involving proportions with whole numbers; solve probability problems; use knowledge of geometric properties to solve problems; identify and evaluate algebraic expressions and solve equations with one variable.

75th Percentile: 555

• Median Benchmark

Students can apply basic mathematical knowledge in straightforward situations. They can add or subtract to solve one-step word problems involving whole numbers and decimals; identify representations of common fractions and relative sizes of fractions; solve for missing terms in proportions; recognize basic notions of percents and probability; use basic properties of geometric figures; read and interpret graphs, tables, and scales; and understand simple algebraic relationships.

50th Percentile: 479

• Lower Quarter Benchmark

Students can do basic computations with whole numbers. The few items that anchor at this level provide some evidence that students can add, subtract, and round with whole numbers. When there are the same number of decimal places, they can subtract with multiple regrouping. Students can round whole numbers to the nearest hundred. They recognize some basic notation and terminology.

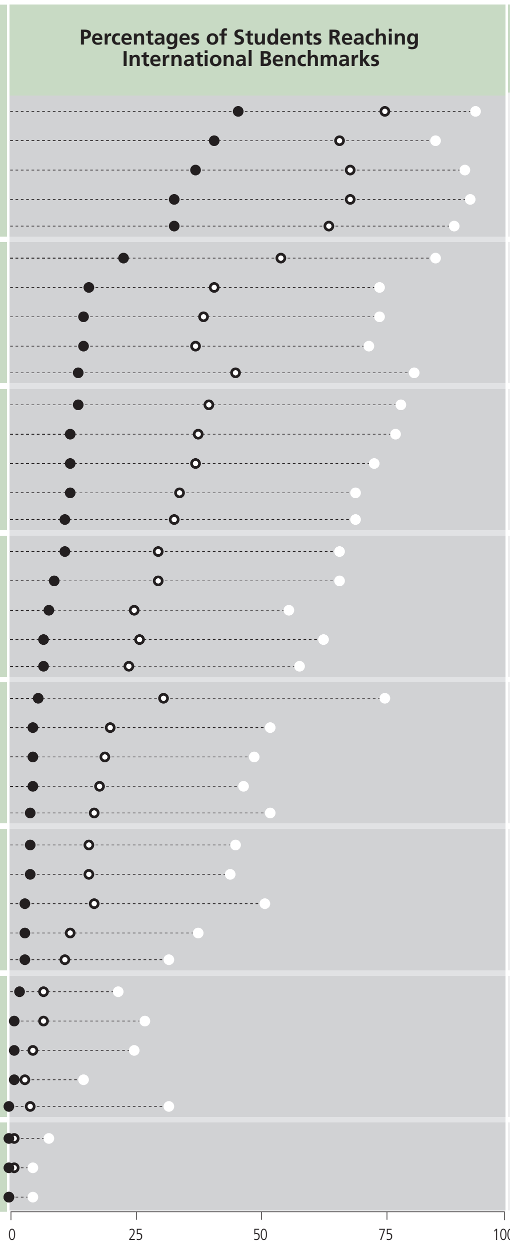
25th Percentile: 396

The international benchmarks are based on the combined data from the countries participating in 1999.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

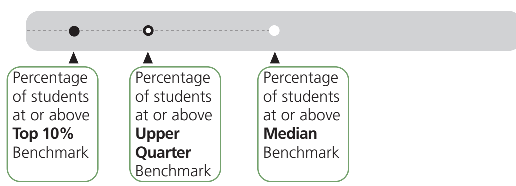
Exhibit 1.6 Percentages of Students Reaching TIMSS 1999 International Benchmarks of Mathematics Achievement

TIMSS 1999 8th grade Mathematics



Country	Top 10%	Upper Quarter	Median	Lower Quarter
Singapore	46 (3.5)	75 (2.7)	93 (1.3)	99 (0.3)
Chinese Taipei	41 (1.7)	66 (1.5)	85 (1.0)	95 (0.6)
Korea, Rep. of	37 (1.0)	68 (0.9)	91 (0.5)	99 (0.2)
Hong Kong, SAR †	33 (2.3)	68 (2.4)	92 (1.5)	99 (0.6)
Japan	33 (1.1)	64 (0.9)	89 (0.5)	98 (0.3)
Belgium (Flemish) †	23 (1.5)	54 (1.7)	85 (1.2)	98 (0.6)
Hungary	16 (1.2)	41 (1.9)	74 (1.6)	94 (1.0)
Slovenia	15 (1.2)	39 (1.4)	74 (1.4)	95 (0.7)
Russian Federation	15 (1.8)	37 (2.8)	72 (2.7)	94 (1.2)
Netherlands †	14 (2.3)	45 (4.1)	81 (3.5)	96 (1.3)
Slovak Republic	14 (1.4)	40 (2.3)	78 (1.8)	96 (0.6)
Canada	12 (1.1)	38 (1.5)	77 (1.3)	96 (0.6)
Australia	12 (1.8)	37 (2.7)	73 (2.4)	94 (0.8)
Malaysia	12 (1.4)	34 (2.4)	69 (2.2)	94 (0.8)
Czech Republic	11 (1.4)	33 (2.1)	69 (2.3)	94 (1.1)
Bulgaria	11 (2.3)	30 (3.0)	66 (2.6)	91 (1.3)
United States	9 (1.0)	28 (1.6)	61 (1.9)	88 (1.0)
New Zealand	8 (1.2)	25 (2.4)	56 (2.5)	85 (1.5)
Latvia (LSS) 1	7 (0.9)	26 (1.8)	63 (2.0)	92 (1.0)
England †	7 (0.9)	24 (1.9)	58 (2.1)	89 (1.3)
Finland	6 (0.9)	31 (1.7)	75 (1.5)	96 (0.5)
Italy	5 (0.7)	20 (1.4)	52 (2.1)	83 (1.4)
Romania	5 (1.1)	19 (1.9)	49 (2.6)	80 (2.1)
Israel 2	5 (0.6)	18 (1.3)	47 (1.8)	77 (1.9)
Lithuania 1‡	4 (0.7)	17 (2.0)	52 (2.4)	86 (1.8)
Moldova	4 (0.7)	16 (1.5)	45 (2.2)	81 (1.7)
Thailand	4 (0.8)	16 (1.8)	44 (2.6)	81 (1.6)
Cyprus	3 (0.4)	17 (0.8)	51 (1.1)	84 (0.8)
Macedonia, Rep. of	3 (0.4)	12 (1.0)	38 (1.9)	72 (1.8)
Jordan	3 (0.5)	11 (0.9)	32 (1.5)	62 (1.4)
Indonesia	2 (0.4)	7 (0.9)	22 (1.4)	52 (2.2)
Turkey	1 (0.3)	7 (1.0)	27 (1.9)	65 (2.0)
Iran, Islamic Rep.	1 (0.2)	5 (0.8)	25 (1.7)	63 (1.5)
Chile	1 (0.5)	3 (1.1)	15 (1.8)	48 (2.0)
Tunisia	0 (0.1)	4 (0.5)	32 (1.6)	80 (1.3)
Philippines	0 (0.1)	1 (0.5)	8 (1.4)	31 (2.5)
South Africa	0 (0.2)	1 (0.4)	5 (1.0)	14 (2.0)
Morocco	0 (0.0)	0 (0.2)	5 (0.4)	27 (1.1)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.



Top 10% Benchmark (90th Percentile) = 616
Upper Quarter Benchmark (75th Percentile) = 555
Median Benchmark (50th Percentile) = 479
Lower Quarter Benchmark (25th Percentile) = 396

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

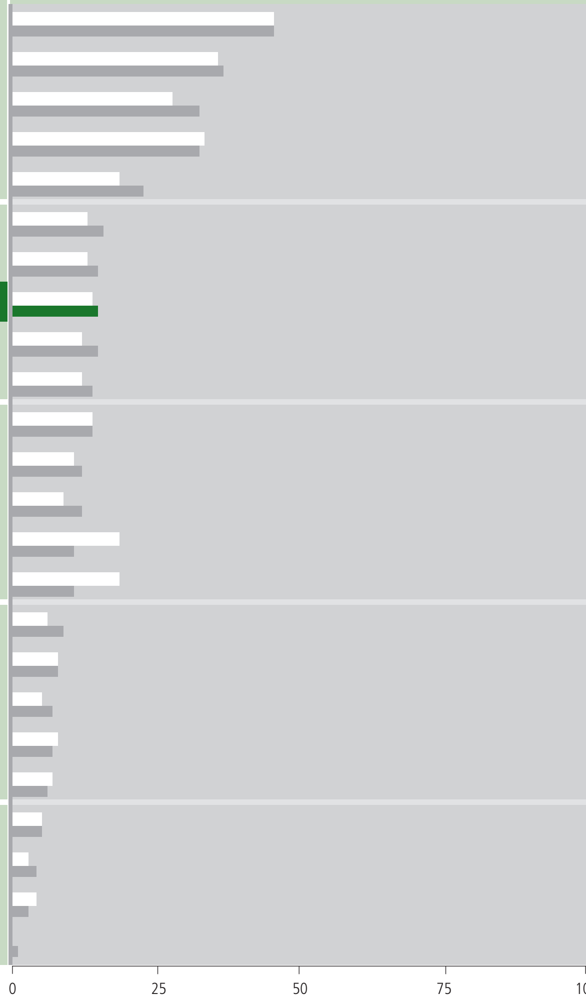
‡ Lithuania tested the same cohort of students as other countries, but later in 1999, at the beginning of the next school year.

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

Exhibit 1.7 Trends in Percentages of Students Reaching the TIMSS 1999 Top 10% International Benchmark of Mathematics Achievement

TIMSS 1999 8th grade Mathematics

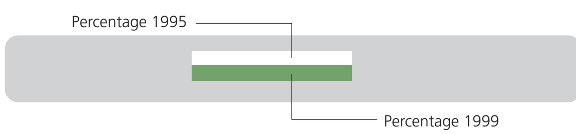
Percentages of Students At or Above the Top 10% International Benchmark in 1995 and 1999



Country	1995 Percentage of Students	1999 Percentage of Students	1995-1999 Difference
Singapore	46 (3.0)	46 (3.5)	0 (4.7)
Korea, Rep. of	36 (1.2)	37 (1.0)	2 (1.4)
Hong Kong, SAR	28 (2.6)	33 (2.3)	5 (3.4)
Japan	34 (1.0)	33 (1.1)	0 (1.5)
Belgium (Flemish)	19 (1.6)	23 (1.4)	4 (2.2)
Hungary	13 (1.1)	16 (1.2)	3 (1.6)
Slovenia	13 (1.1)	15 (1.2)	2 (1.5)
International Avg. §	**14 (0.4)**	**15 (0.3)**	**1 (0.4)**
Russian Federation	12 (1.4)	15 (1.8)	2 (2.2)
Netherlands	12 (2.1)	14 (2.3)	3 (3.1)
Slovak Republic	14 (1.2)	14 (1.4)	-1 (1.8)
Australia	11 (1.2)	12 (1.8)	1 (2.2)
Canada	9 (0.9)	12 (1.1)	3 (1.4)
Czech Republic	19 (2.1)	11 (1.4)	-8 (2.5)
Bulgaria	19 (2.0)	11 (2.3)	-8 (3.0)
United States	6 (0.9)	9 (1.0)	3 (1.4)
New Zealand	8 (1.2)	8 (1.2)	0 (1.7)
Latvia (LSS)	5 (0.8)	7 (0.9)	3 (1.2)
England	8 (1.2)	7 (0.9)	0 (1.6)
Italy	7 (0.8)	6 (1.0)	-1 (1.2)
Romania	5 (0.8)	5 (1.1)	0 (1.3)
Lithuania	3 (0.5)	4 (0.7)	1 (0.9)
Cyprus	4 (0.4)	3 (0.4)	-1 (0.6)
Iran, Islamic Rep.	0 (0.3)	1 (0.2)	0 (0.4)

Countries with Unapproved Sampling Procedures at the Classroom Level in 1995

Country	1995 Percentage of Students	1999 Percentage of Students	1995-1999 Difference
Israel	8 (1.5)	6 (0.7)	-3 (1.6)
South Africa	0 (0.2)	0 (0.2)	0 (0.3)
Thailand	10 (2.1)	4 (0.8)	-5 (2.3)



1999 significantly higher than 1995 ▲

No significant difference between 1995 and 1999 ●

1999 significantly lower than 1995 ▼

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

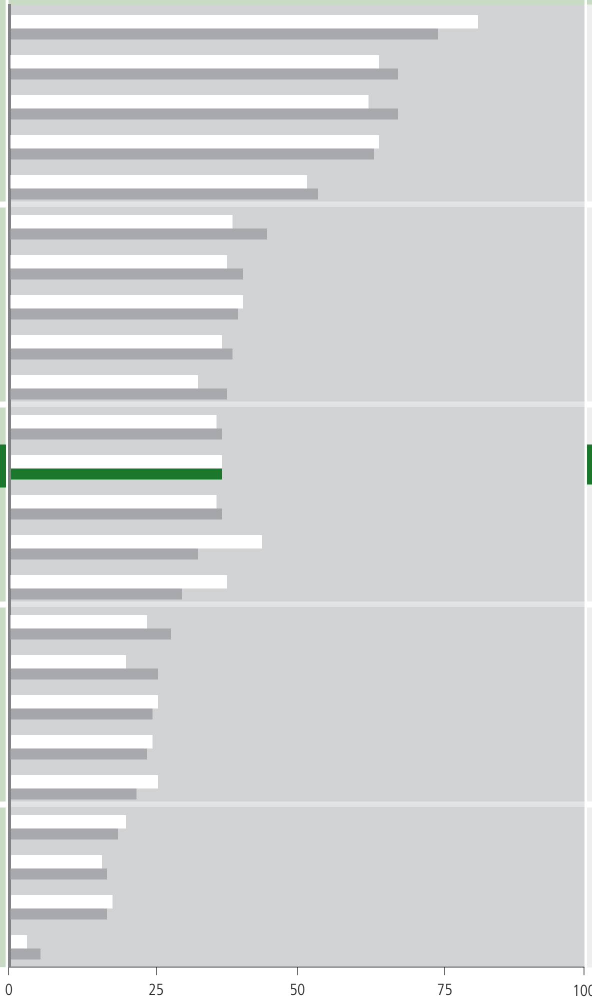
§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

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

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian-Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

Exhibit 1.8 Trends in Percentages of Students Reaching the TIMSS 1999 Upper Quarter International Benchmark of Mathematics Achievement

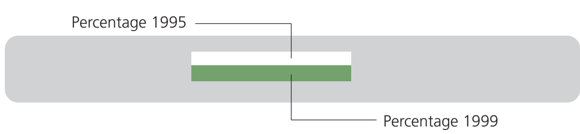
TIMSS 1999 8th grade Mathematics



Country	1995 Percentage of Students	1999 Percentage of Students	1995-1999 Difference	
Singapore	82 (1.9)	75 (2.7)	-7 (3.4)	●
Korea, Rep. of	65 (1.0)	68 (0.9)	3 (1.4)	●
Hong Kong, SAR	63 (3.2)	68 (2.4)	5 (4.0)	●
Japan	65 (0.9)	64 (0.9)	-1 (1.4)	●
Belgium (Flemish)	52 (2.8)	54 (1.7)	3 (3.2)	●
Netherlands	39 (3.0)	45 (4.1)	6 (5.2)	●
Hungary	38 (1.6)	41 (1.9)	3 (2.6)	●
Slovak Republic	41 (1.6)	40 (2.3)	-1 (2.7)	●
Slovenia	37 (1.6)	39 (1.4)	2 (2.1)	●
Canada	33 (1.3)	38 (1.5)	5 (1.9)	●
Australia	36 (1.9)	37 (2.7)	1 (3.3)	●
International Avg. §	**37 (0.5)**	**37 (0.5)**	**0 (0.6)**	●
Russian Federation	36 (3.1)	37 (2.8)	0 (4.1)	●
Czech Republic	44 (2.5)	33 (2.1)	-12 (3.3)	▼
Bulgaria	38 (2.7)	30 (3.0)	-8 (4.1)	●
United States	24 (1.9)	28 (1.6)	4 (2.5)	●
Latvia (LSS)	20 (1.5)	26 (1.8)	6 (2.2)	●
New Zealand	26 (2.1)	25 (2.4)	-1 (3.2)	●
England	25 (1.5)	24 (1.9)	-2 (2.4)	●
Italy	26 (1.6)	22 (1.8)	-4 (2.4)	●
Romania	20 (1.6)	19 (1.9)	-1 (2.4)	●
Lithuania	16 (1.4)	17 (2.0)	1 (2.6)	●
Cyprus	18 (0.9)	17 (0.8)	-1 (1.3)	●
Iran, Islamic Rep.	3 (0.6)	5 (0.8)	2 (1.0)	●

Countries with Unapproved Sampling Procedures at the Classroom Level in 1995

Country	1995 Percentage of Students	1999 Percentage of Students	1995-1999 Difference	
Israel	31 (2.9)	21 (1.6)	-10 (3.3)	●
South Africa	2 (0.8)	1 (0.4)	-1 (0.9)	●
Thailand	31 (3.3)	16 (1.8)	-16 (3.7)	▼



1999 significantly higher than 1995 ▲

No significant difference between 1995 and 1999 ●

1999 significantly lower than 1995 ▼

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

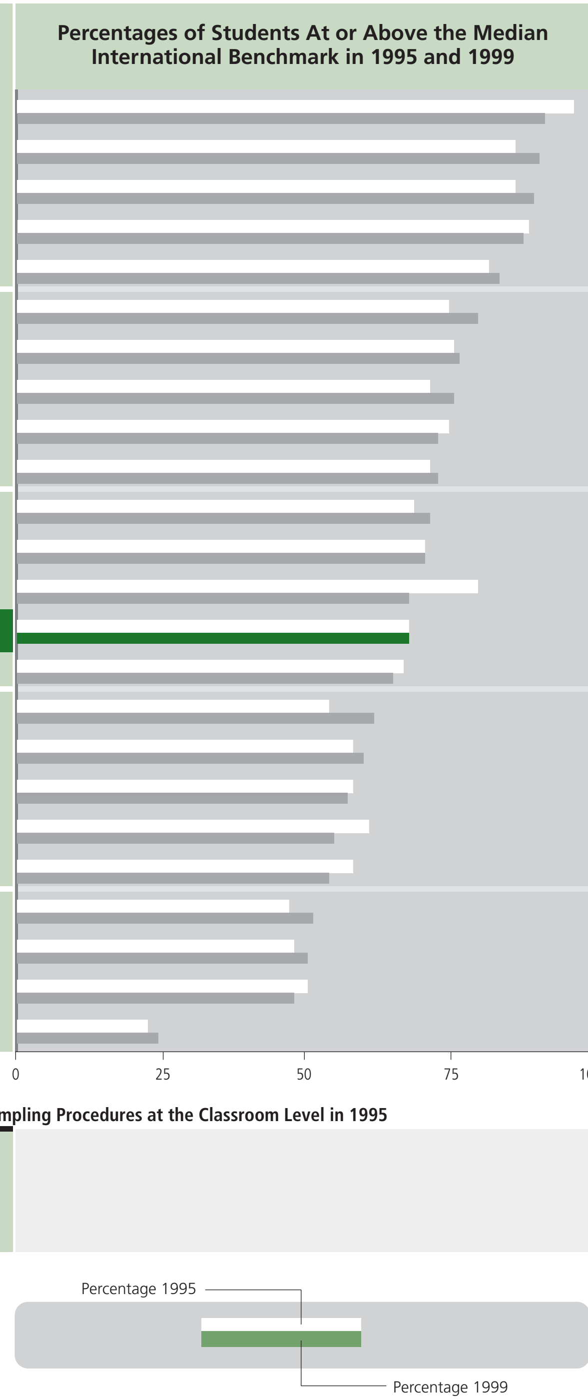
§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian-Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

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

Exhibit 1.9 Trends in Percentages of Students Reaching the TIMSS 1999 Median International Benchmark of Mathematics Achievement

TIMSS 1999 8th grade Mathematics



Country	1995 Percentage of Students	1999 Percentage of Students	1995-1999 Difference
Singapore	98 (0.4)	93 (1.3)	-5 (1.3) ▼
Hong Kong, SAR	88 (2.2)	92 (1.5)	4 (2.6) ●
Korea, Rep. of	88 (0.7)	91 (0.5)	3 (0.9) ●
Japan	90 (0.5)	89 (0.5)	-1 (0.7) ●
Belgium (Flemish)	83 (2.6)	85 (1.4)	2 (3.0) ●
Netherlands	76 (2.9)	81 (3.5)	4 (4.6) ●
Slovak Republic	77 (1.4)	78 (1.8)	1 (2.2) ●
Canada	73 (1.2)	77 (1.3)	4 (1.5) ●
Slovenia	76 (1.4)	74 (1.4)	-2 (2.0) ●
Hungary	73 (1.6)	74 (1.6)	1 (2.2) ●
Australia	70 (1.7)	73 (2.4)	3 (2.9) ●
Russian Federation	72 (2.5)	72 (2.7)	0 (3.8) ●
Czech Republic	81 (1.5)	69 (2.3)	-11 (2.7) ▼
International Avg. §	**69 (0.4)**	**69 (0.5)**	**0 (0.6) ●**
Bulgaria	68 (2.5)	66 (2.6)	-2 (3.6) ●
Latvia (LSS)	55 (1.8)	63 (2.0)	8 (2.6) ▲
United States	59 (2.4)	61 (1.9)	2 (3.0) ●
England	59 (1.4)	58 (2.1)	-1 (2.6) ●
New Zealand	62 (2.3)	56 (2.5)	-6 (3.4) ●
Italy	59 (1.8)	55 (2.5)	-4 (3.0) ●
Lithuania	48 (2.3)	52 (2.4)	4 (3.2) ●
Cyprus	49 (1.3)	51 (1.1)	2 (1.7) ●
Romania	51 (2.2)	49 (2.6)	-2 (3.4) ●
Iran, Islamic Rep.	23 (1.7)	25 (1.7)	2 (2.2) ●

Countries with Unapproved Sampling Procedures at the Classroom Level in 1995

Country	1995 Percentage of Students	1999 Percentage of Students	1995-1999 Difference
Israel	71 (2.8)	54 (2.2)	-17 (3.6) ▼
South Africa	7 (2.1)	5 (1.0)	-2 (2.4) ●
Thailand	69 (2.5)	44 (2.6)	-25 (3.6) ▼

▲ 1999 significantly higher than 1995
● No significant difference between 1995 and 1999
▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

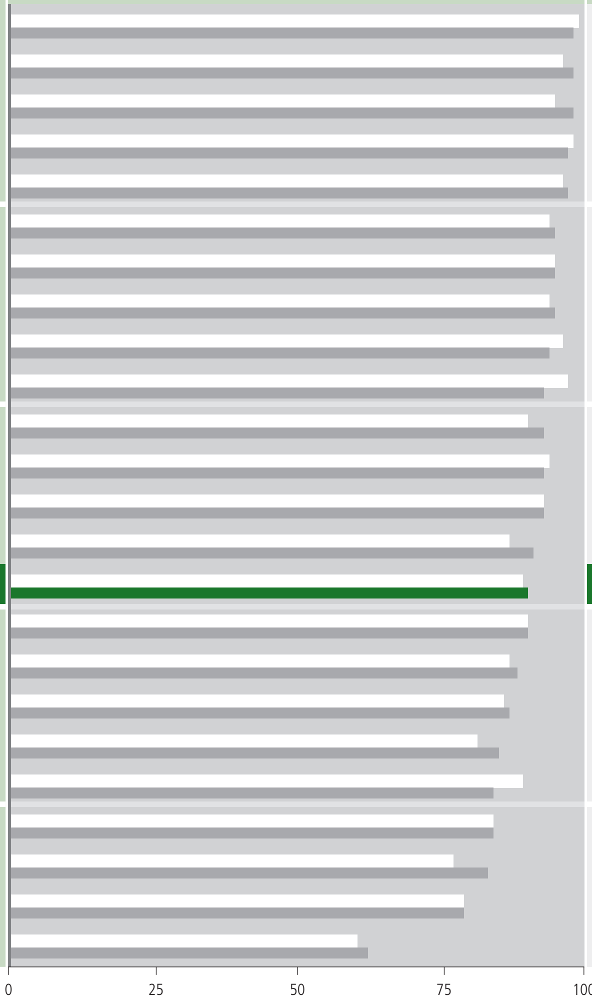
Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian-Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

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

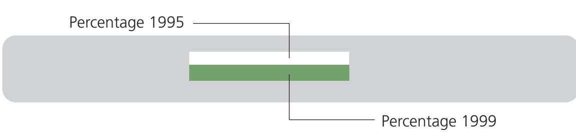
Exhibit 1.10 Trends in Percentages of Students Reaching the TIMSS 1999 Lower Quarter International Benchmark of Mathematics Achievement

TIMSS 1999 8th grade Mathematics

Percentages of Students At or Above the Lower Quarter International Benchmark in 1995 and 1999



Country	1995 Percentage of Students	1999 Percentage of Students	1995-1999 Difference	
Singapore	100 (0.0)	99 (0.3)	-1 (0.3)	●
Korea, Rep. of	97 (0.4)	99 (0.2)	1 (0.5)	●
Hong Kong, SAR	96 (1.1)	99 (0.6)	2 (1.2)	●
Japan	99 (0.2)	98 (0.3)	0 (0.3)	●
Belgium (Flemish)	97 (1.1)	98 (0.7)	1 (1.3)	●
Netherlands	95 (1.6)	96 (1.3)	1 (2.0)	●
Slovak Republic	96 (0.5)	96 (0.6)	0 (0.7)	●
Canada	95 (0.5)	96 (0.6)	1 (0.8)	●
Slovenia	97 (0.6)	95 (0.7)	-3 (0.9)	●
Czech Republic	98 (0.4)	94 (1.1)	-4 (1.1)	▼
Australia	91 (0.9)	94 (0.8)	3 (1.2)	●
Hungary	95 (0.8)	94 (1.0)	-1 (1.2)	●
Russian Federation	94 (1.1)	94 (1.2)	0 (1.7)	●
Latvia (LSS)	88 (1.4)	92 (1.0)	4 (1.6)	●
International Avg. §	**90 (0.3)**	**91 (0.3)**	**1 (0.4)**	●
Bulgaria	91 (1.0)	91 (1.3)	0 (1.6)	●
England	88 (1.1)	89 (1.3)	1 (1.6)	●
United States	87 (1.5)	88 (1.0)	1 (1.8)	●
Lithuania	82 (1.7)	86 (1.8)	4 (2.5)	●
New Zealand	90 (1.3)	85 (1.5)	-4 (2.0)	●
Italy	85 (1.2)	85 (1.9)	0 (2.4)	●
Cyprus	78 (1.1)	84 (0.8)	6 (1.4)	▲
Romania	80 (1.6)	80 (2.1)	0 (2.7)	●
Iran, Islamic Rep.	61 (2.0)	63 (1.5)	1 (2.5)	●
Countries with Unapproved Sampling Procedures at the Classroom Level in 1995				
Israel	92 (1.4)	82 (2.1)	-10 (2.6)	▼
South Africa	15 (3.0)	14 (2.0)	-1 (3.6)	●
Thailand	93 (0.9)	81 (1.6)	-13 (1.9)	▼



1999 significantly higher than 1995 ▲

No significant difference between 1995 and 1999 ●

1999 significantly lower than 1995 ▼

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian-Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

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

What Are the Gender Differences in Mathematics Achievement?

1.11 Exhibits 1.11 through 1.14 show gender differences in eighth-grade mathematics achievement in 1999, and also changes since 1995. Exhibit 1.11 presents average achievement separately for girls and boys for each of the TIMSS 1999 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 a modest but significant difference favoring boys, although the situation varied considerably from country to country. In most countries the gender difference was negligible. The only countries with differences large enough to be statistically significant were Israel, the Czech Republic, the Islamic Republic of Iran, and Tunisia. The countries with the greatest differences were Iran and Tunisia, where the mean for boys exceeded the mean for girls by 24 to 25 scale-score points.

1.12 Exhibit 1.12 provides information on gender differences in mathematics achievement among students with high performance compared to those in the middle of the achievement distribution. For each country, score levels were computed for the highest-scoring 25 percent of students, called the upper quarter level, and for the top-scoring 50 percent of students, called the median level. The percentages of girls and boys in each country reaching each of the two levels were computed. For equitable performance, 25 percent each of girls and boys should have reached the upper quarter level, and 50 percent each the median level.

On average across countries, 23 percent of girls compared with 27 percent of boys reached the upper quarter level, and 49 percent of girls compared with 51 percent of boys reached the median level. These gender differences favoring boys, although small, were statistically significant. Despite this, in nearly all participating countries the percentages of girls and boys reaching the upper quarter and median levels were equivalent. In all but four countries, the percentages reaching the upper quarter and median levels were not significantly different, indicating that gender equity exists in most countries at these levels. However, in Israel, Tunisia, and the United States, the percentages of boys reaching the upper quarter level were significantly greater than the percentages of girls reaching this level. In Tunisia, the percentage of boys reaching the median level was also significantly greater than the percentage of girls, whereas in the Philippines, the percentage of girls reaching level was greater (53 percent for girls vs. 46 percent for boys).

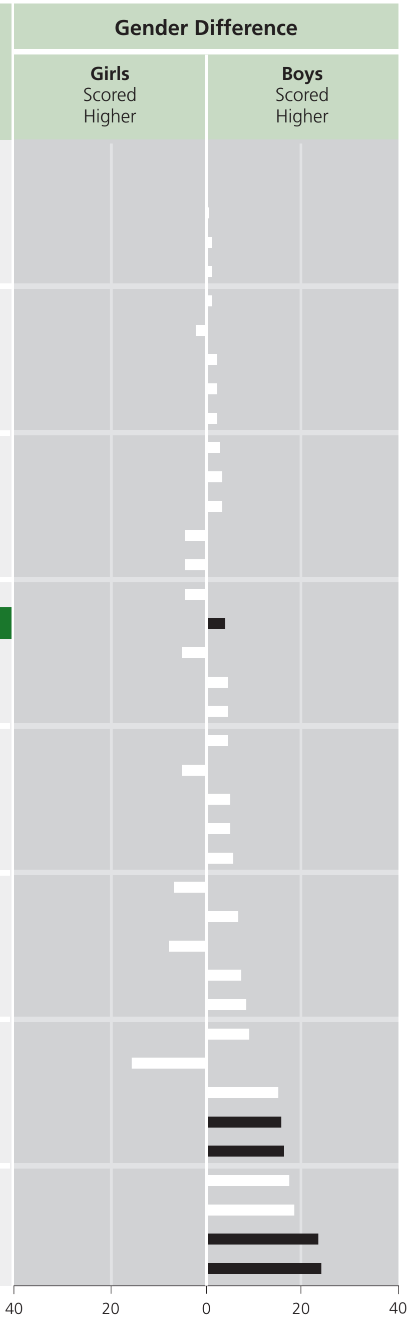
Achievement differences from 1995 to 1999 are presented separately for girls and for boys in Exhibit 1.13. Average mathematics achievement across countries for girls increased significantly in Korea only. Achievement for both girls and boys decreased significantly in the Czech Republic, Israel, and Thailand. 1.13

Taking the study of trends in gender differences one step further, Exhibit 1.14 presents the difference in average mathematics achievement between boys and girls in 1995 and in 1999, and shows whether the difference has changed. Korea is the one country showing a significant decrease in the gender difference, from 17 to 5 scale-score points favoring boys. Fortunately, no country showed a significant increase in gender differences in mathematics performance. 1.14

Exhibit 1.11 Average Mathematics Achievement by Gender

TIMSS 1999 8th grade Mathematics

	Girls Average Scale Score	Boys Average Scale Score	Difference (Absolute Value)
Bulgaria	510 (5.9)	511 (6.9)	0 (5.5)
Macedonia, Rep. of	446 (5.3)	447 (4.3)	0 (4.5)
Russian Federation	526 (6.0)	526 (6.4)	1 (3.3)
Slovenia	529 (3.0)	531 (3.6)	1 (3.6)
Turkey	428 (4.7)	429 (4.4)	2 (2.8)
Australia	524 (5.7)	526 (5.7)	2 (6.0)
Hong Kong, SAR †	583 (4.7)	581 (5.9)	2 (6.5)
Singapore	603 (6.1)	606 (7.5)	2 (5.7)
Lithuania 1‡	480 (4.7)	483 (4.8)	3 (4.0)
Moldova	468 (4.1)	471 (4.7)	3 (4.1)
Canada	529 (2.5)	533 (3.2)	3 (2.9)
Finland	519 (3.0)	522 (3.5)	3 (3.6)
Chinese Taipei	583 (3.9)	587 (5.3)	4 (4.6)
Thailand	469 (5.7)	465 (5.5)	4 (4.9)
Belgium (Flemish) †	560 (7.2)	556 (8.3)	4 (14.2)
Cyprus	479 (2.1)	474 (2.7)	4 (3.3)
International Avg.	485 (0.8)	489 (0.9)	4 (1.1)
Malaysia	521 (4.7)	517 (6.0)	5 (6.1)
Indonesia	401 (5.4)	405 (5.0)	5 (3.3)
Slovak Republic	532 (4.2)	536 (4.5)	5 (3.6)
Netherlands †	538 (7.6)	542 (7.0)	5 (3.0)
Romania	475 (6.3)	470 (6.2)	5 (4.7)
Korea, Rep. of	585 (3.1)	590 (2.2)	5 (3.7)
Latvia (LSS) 1	502 (3.8)	508 (4.4)	5 (4.5)
Hungary	529 (4.0)	535 (4.3)	6 (3.7)
Jordan	431 (4.7)	425 (5.9)	7 (8.1)
United States	498 (3.9)	505 (4.8)	7 (3.4)
New Zealand	495 (5.5)	487 (7.6)	7 (8.3)
Japan	575 (2.4)	582 (2.3)	8 (3.3)
Chile	388 (4.3)	397 (5.8)	9 (5.5)
Italy	475 (4.5)	484 (4.3)	9 (4.2)
Philippines	352 (6.9)	337 (6.5)	15 (6.1)
South Africa	267 (7.5)	283 (7.3)	16 (5.9)
Israel 2	459 (4.2)	474 (4.8)	16 (4.6)
Czech Republic	512 (4.0)	528 (5.8)	17 (5.0)
Morocco	326 (5.3)	344 (4.1)	17 (7.7)
England †	487 (5.4)	505 (5.0)	19 (6.5)
Iran, Islamic Rep.	408 (4.2)	432 (4.8)	24 (6.5)
Tunisia	436 (2.4)	460 (2.9)	25 (2.2)



Gender difference statistically significant

Gender difference not statistically significant

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 1.12 Percentages of Girls and Boys Reaching Each Country's Own Upper Quarter and Median Levels of Mathematics Achievement

TIMSS 1999 8th grade Mathematics

	Upper Quarter		Median	
	Percent of Girls	Percent of Boys	Percent of Girls	Percent of Boys
Australia	24 (2.8)	26 (2.6)	49 (3.2)	51 (3.0)
Belgium (Flemish) †	25 (2.5)	25 (2.5)	50 (3.1)	50 (3.5)
Bulgaria	24 (3.1)	26 (3.5)	51 (3.0)	49 (3.2)
Canada	24 (1.2)	26 (1.4)	49 (1.3)	51 (1.9)
Chile	23 (1.9)	27 (2.6)	48 (2.2)	52 (2.4)
Chinese Taipei	22 (1.5)	28 (1.9)	49 (1.9)	51 (2.1)
Cyprus	24 (1.4)	26 (1.4)	50 (1.4)	50 (1.5)
Czech Republic	22 (1.6)	28 (2.5)	46 (2.4)	54 (2.9)
England †	20 (2.7)	30 (2.4)	46 (3.0)	54 (2.7)
Finland	23 (1.8)	27 (2.2)	49 (1.9)	51 (2.2)
Hong Kong, SAR †	24 (2.5)	26 (2.4)	50 (2.9)	50 (3.1)
Hungary	24 (1.9)	26 (1.8)	48 (2.2)	52 (2.1)
Indonesia	25 (1.6)	25 (1.7)	49 (2.1)	52 (2.1)
Iran, Islamic Rep.	19 (2.0)	29 (2.2)	43 (2.5)	55 (2.5)
Israel 2	21 (1.5)	29 (1.7) ▲	47 (2.0)	53 (2.2)
Italy	23 (1.8)	28 (1.7)	47 (2.2)	53 (2.2)
Japan	23 (1.3)	27 (1.1)	47 (1.5)	53 (1.3)
Jordan	24 (1.7)	26 (2.1)	51 (2.0)	49 (2.2)
Korea, Rep. of	24 (1.1)	26 (1.0)	48 (1.5)	52 (1.3)
Latvia (LSS) 1	24 (1.9)	27 (2.1)	49 (2.2)	52 (2.2)
Lithuania 1‡	24 (2.5)	26 (2.3)	50 (2.5)	50 (2.5)
Macedonia, Rep. of	26 (1.8)	24 (1.6)	51 (2.4)	49 (2.0)
Malaysia	26 (2.3)	24 (2.9)	52 (2.6)	48 (3.4)
Moldova	24 (1.6)	27 (2.1)	50 (2.1)	51 (2.2)
Morocco	21 (1.7)	28 (1.5)	45 (2.2)	54 (1.7)
Netherlands †	24 (3.6)	26 (3.2)	48 (4.2)	52 (4.4)
New Zealand	26 (2.6)	24 (3.5)	52 (3.0)	48 (3.5)
Philippines	27 (2.7)	23 (2.5)	53 (2.7) ▲	46 (2.5)
Romania	25 (2.3)	25 (2.4)	51 (2.8)	49 (2.8)
Russian Federation	24 (2.4)	26 (2.5)	49 (2.9)	51 (3.2)
Singapore	23 (3.1)	26 (3.4)	49 (3.6)	51 (4.2)
Slovak Republic	23 (2.0)	27 (2.2)	48 (2.6)	52 (2.7)
Slovenia	24 (1.6)	26 (1.5)	49 (1.7)	51 (2.0)
South Africa	23 (2.7)	27 (2.3)	47 (2.5)	53 (2.1)
Thailand	25 (2.6)	24 (2.4)	50 (2.9)	50 (2.7)
Tunisia	19 (1.4)	31 (1.6) ▲	42 (1.7)	59 (1.6) ▲
Turkey	25 (1.8)	25 (1.9)	50 (2.2)	50 (1.8)
United States	23 (1.3)	27 (1.9) ▲	49 (2.0)	51 (2.3)
International Avg.	23 (0.4)	27 (0.4) ▲	49 (0.4)	51 (0.4) ▲

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ Significantly greater percentage than other gender

Significance tests adjusted for multiple comparisons

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 1.13 Trends in Average Mathematics Achievement by Gender

Girls

	1995 Average Scale Score	1999 Average Scale Score	1995-1999 Difference	
Hong Kong, SAR	559 (7.0)	583 (4.7)	24 (8.4)	●
Latvia (LSS)	486 (4.0)	502 (3.8)	16 (5.4)	●
Netherlands	522 (6.6)	538 (7.6)	15 (10.2)	●
Korea, Rep. of	571 (3.0)	585 (3.1)	13 (4.3)	▲
United States	490 (4.7)	498 (3.9)	8 (6.1)	●
Lithuania	472 (4.6)	480 (4.7)	8 (6.7)	●
Cyprus	471 (2.6)	479 (2.1)	7 (3.3)	●
Belgium (Flemish)	553 (8.1)	560 (7.2)	7 (10.9)	●
Canada	522 (2.4)	529 (2.5)	7 (3.3)	●
Australia	520 (4.3)	524 (5.7)	4 (7.0)	●
International Avg. §	516 (1.0)	520 (1.0)	3 (1.5)	●
Iran, Islamic Rep.	405 (6.1)	408 (4.2)	3 (7.3)	●
Romania	473 (4.4)	475 (6.3)	2 (7.7)	●
Slovenia	527 (3.2)	529 (3.0)	2 (4.4)	●
Hungary	527 (3.6)	529 (4.0)	2 (5.4)	●
Russian Federation	524 (5.0)	526 (6.0)	2 (7.8)	●
Slovak Republic	532 (3.1)	532 (4.2)	-1 (5.3)	●
New Zealand	497 (5.3)	495 (5.5)	-2 (7.6)	●
Japan	577 (1.9)	575 (2.4)	-2 (3.0)	●
Italy	488 (4.5)	483 (5.5)	-5 (7.1)	●
Singapore	610 (4.9)	603 (6.1)	-7 (7.8)	●
England	495 (4.0)	487 (5.4)	-8 (6.8)	●
Czech Republic	539 (5.4)	512 (4.0)	-27 (6.6)	▼
Countries with Unapproved Sampling Procedures at the Classroom Level in 1995				
Israel	500 (7.0)	473 (5.1)	-27 (8.7)	▼
South Africa	264 (8.4)	267 (7.5)	4 (11.3)	●
Thailand	520 (7.4)	469 (5.7)	-51 (9.4)	▼

Boys

	1995 Average Scale Score	1999 Average Scale Score	1995-1999 Difference	
Latvia (LSS)	490 (4.2)	508 (4.4)	17 (6.2)	●
Canada	520 (3.0)	533 (3.2)	12 (4.5)	●
Lithuania	472 (4.6)	483 (4.8)	11 (6.7)	●
United States	495 (5.2)	505 (4.8)	10 (7.0)	●
Cyprus	465 (3.3)	474 (2.7)	10 (4.2)	●
Belgium (Flemish)	547 (8.7)	556 (8.3)	9 (12.0)	●
Australia	517 (5.0)	526 (5.7)	9 (7.5)	●
Hungary	527 (3.6)	535 (4.3)	8 (5.5)	●
Netherlands	534 (6.6)	542 (7.0)	8 (9.6)	●
England	500 (5.5)	505 (5.0)	5 (7.5)	●
Hong Kong, SAR	577 (7.2)	581 (5.9)	4 (9.4)	●
Russian Federation	523 (6.2)	526 (6.4)	3 (8.9)	●
Iran, Islamic Rep.	429 (4.7)	432 (4.8)	3 (6.6)	●
International Avg. §	522 (1.1)	524 (1.2)	2 (1.6)	●
Korea, Rep. of	588 (2.7)	590 (2.2)	1 (3.5)	●
Slovak Republic	536 (3.7)	536 (4.5)	1 (5.7)	●
Singapore	608 (4.7)	606 (7.5)	-2 (8.9)	●
Japan	585 (2.2)	582 (2.3)	-3 (3.0)	●
Slovenia	535 (3.1)	531 (3.6)	-4 (4.7)	●
Romania	475 (5.3)	470 (6.2)	-5 (8.2)	●
Italy	494 (3.7)	488 (5.4)	-6 (6.5)	●
New Zealand	505 (6.1)	487 (7.6)	-18 (9.9)	●
Czech Republic	552 (4.6)	528 (5.8)	-24 (7.4)	▼
Countries with Unapproved Sampling Procedures at the Classroom Level in 1995				
Israel	530 (6.9)	490 (5.3)	-40 (8.7)	▼
South Africa	293 (12.7)	283 (7.3)	-10 (14.6)	●
Thailand	511 (6.1)	465 (5.5)	-46 (8.3)	▼

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian-Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations. Trends in gender data for Bulgaria are unavailable.

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

Exhibit 1.14 Trends in Gender Differences in Average Mathematics Achievement

TIMSS 1999 8th grade Mathematics

	1995			1999			Change in Gender Difference*
	Girls Average Scale Score	Boys Average Scale Score	Difference (Absolute Value)	Girls Average Scale Score	Boys Average Scale Score	Difference (Absolute Value)	
Australia	520 (4.3)	517 (5.0)	3 (5.3)	524 (5.7)	526 (5.7)	2 (6.0)	↔
Belgium (Flemish)	553 (8.1)	547 (8.7)	6 (12.2)	560 (7.2)	556 (8.3)	4 (14.2)	↔
Canada	522 (2.4)	520 (3.0)	2 (3.2)	529 (2.5)	533 (3.2)	3 (2.9)	↔
Cyprus	471 (2.6)	465 (3.3)	7 (3.9)	479 (2.1)	474 (2.7)	4 (3.3)	↔
Czech Republic	539 (5.4)	552 (4.6) ▲	14 (3.9)	512 (4.0)	528 (5.8) ▲	17 (5.0)	↔
England	495 (4.0)	500 (5.5)	6 (7.7)	487 (5.4)	505 (5.0)	19 (6.5)	↔
Hong Kong, SAR	559 (7.0)	577 (7.2)	17 (7.7)	583 (4.7)	581 (5.9)	2 (6.5)	↔
Hungary	527 (3.6)	527 (3.6)	0 (3.5)	529 (4.0)	535 (4.3)	6 (3.7)	↔
Iran, Islamic Rep.	405 (6.1)	429 (4.7) ▲	24 (7.8)	408 (4.2)	432 (4.8) ▲	24 (6.5)	↔
Italy	488 (4.5)	494 (3.7)	5 (4.8)	483 (5.5)	488 (5.4)	5 (4.8)	↔
Japan	577 (1.9)	585 (2.2) ▲	8 (2.7)	575 (2.4)	582 (2.3)	8 (3.3)	↔
Korea, Rep. of	571 (3.0)	588 (2.7) ▲	17 (4.2)	585 (3.1)	590 (2.2)	5 (3.7)	↘
Latvia (LSS)	486 (4.0)	490 (4.2)	4 (4.0)	502 (3.8)	508 (4.4)	5 (4.5)	↔
Lithuania	472 (4.6)	472 (4.6)	0 (4.1)	480 (4.7)	483 (4.8)	3 (4.0)	↔
Netherlands	522 (6.6)	534 (6.6) ▲	12 (3.9)	538 (7.6)	542 (7.0)	5 (3.0)	↔
New Zealand	497 (5.3)	505 (6.1)	8 (6.6)	495 (5.5)	487 (7.6)	7 (8.3)	↔
Romania	473 (4.4)	475 (5.3)	2 (3.4)	475 (6.3)	470 (6.2)	5 (4.7)	↔
Russian Federation	524 (5.0)	523 (6.2)	1 (3.5)	526 (6.0)	526 (6.4)	1 (3.3)	↔
Singapore	610 (4.9)	608 (4.7)	2 (5.3)	603 (6.1)	606 (7.5)	2 (5.7)	↔
Slovak Republic	532 (3.1)	536 (3.7)	3 (3.1)	532 (4.2)	536 (4.5)	5 (3.6)	↔
Slovenia	527 (3.2)	535 (3.1)	8 (3.0)	529 (3.0)	531 (3.6)	1 (3.6)	↔
United States	490 (4.7)	495 (5.2)	5 (3.1)	498 (3.9)	505 (4.8)	7 (3.4)	↔
International Avg. §	516 (1.0)	522 (1.1) ▲	6 (1.1)	520 (1.0)	524 (1.1) ▲	5 (1.2)	↔
Countries with Unapproved Sampling Procedures at the Classroom Level in 1995							
Israel	500 (7.0)	530 (6.9) ▲	29 (5.8)	473 (5.1)	490 (5.3) ▲	17 (4.7)	↔
South Africa	264 (8.4)	293 (12.7)	29 (10.9)	267 (7.5)	283 (7.3)	16 (5.9)	↔
Thailand	520 (7.4)	511 (6.1)	9 (7.0)	469 (5.7)	465 (5.5)	4 (4.9)	↔

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ Significantly higher than other gender

Significance tests adjusted for multiple comparisons

↗ Increased
↘ Decreased
↔ No change

* Indicates whether 1999 gender difference is significantly different than 1995 gender difference.

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian-Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations. Trends in gender data for Bulgaria are unavailable.

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

CHAPTER 2

2

Performance at International Benchmarks

The TIMSS 1999 international benchmarks delineate performance of the top 10 percent, top quarter, top half, and lower quarter of students in the countries participating in the study. To help interpret the achievement results, Chapter 2 describes eighth-grade mathematics achievement at each of these benchmarks together with examples of the types of items typically answered correctly by students performing at the benchmark.

2

As countries around the world spend their time and energy on improving mathematics education, it is important that educators, curriculum developers, and policy makers understand what students know and can do in mathematics and what areas, concepts, and topics need more focus and effort. To help interpret the overall achievement results presented in Chapter 1, this chapter describes eighth-grade mathematics achievement at each of the TIMSS 1999 international benchmarks together with examples of the types of items typically answered correctly by students performing at the benchmark.

Exhibit 1.6, presented previously in Chapter 1, shows the percentages of students in each country reaching each international benchmark – Top 10%, Upper Quarter, Median, and Lower Quarter. The benchmarks delineate performance of the top 10 percent, top quarter, top half, and lower quarter of students in the countries participating in TIMSS 1999 (90th, 75th, 50th, and 25th international percentiles, respectively). 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 1999 international benchmarks, the International Study Center used the scale anchoring method. Scale anchoring is a way of describing students' performance at different points on the TIMSS 1999 achievement scale in terms of the types of items they answer 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 1999 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 1999 achievement scale results to identify the sets of items that students reaching each international benchmark were likely to answer correctly and that those at the next lower benchmark were unlikely to answer correctly.[1] 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 great majority of eighth-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 1999 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.

1 For example, for the Top 10% 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 Upper Quarter Benchmark answered it correctly. Similarly, for the Upper Quarter 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 Median Benchmark answered it correctly.

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

Please note that 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, 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 performance expectations – recall, ability to carry out routine procedures, and ability to solve routine and non-routine problems. The TIMSS 1999 results support the premise that successful problem solving is grounded in mastery of more fundamental knowledge and skills.

Item Examples and Student Performance

The remainder of this chapter describes each benchmark and presents three to five example items illustrating what students know and can do at that level. For each example item, the percent correct for each of the TIMSS 1999 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.

Achievement at the Top 10% Benchmark

2.1 Exhibit 2.1 describes performance at the Top 10% Benchmark. Students reaching this benchmark demonstrated the ability to organize information in problem-solving situations and to apply their understanding of mathematical relationships. They typically demonstrated success on the knowledge and skills represented by this benchmark, as well as those demonstrated at the Upper Quarter, Median, and Lower Quarter benchmarks.

2.2 Example Item 1 in Exhibit 2.2 illustrates the type of measurement item a student performing at the Top 10% Benchmark generally answered correctly. As can be seen, students had to apply their knowledge of the area of rectangles and inscribed shapes to solve a two-step problem about the area of a garden path. The international average for this item was 42 percent correct. Nevertheless, more than two-thirds of the students answered the item correctly in Hong Kong, Singapore, Japan, Chinese Taipei, and Korea. On average internationally, more than 20 percent of students chose Option A, solving for the area of the larger rectangle rather than that of the path. Option C was an equally popular distracter, with more than 20 percent of students internationally selecting this response.

Unlike students performing at lower benchmarks, students reaching the Top 10% Benchmark typically could correctly answer multi-step word
2.3 problems. Example Item 2 in Exhibit 2.3 requires students to select relevant information from two advertisements to solve a complex multi-step word problem involving decimals. Given the price for each issue of a magazine and a certain number of free issues, students were asked to calculate which of the two magazine subscriptions was the less expensive for 24 issues. Students received full credit if they showed correct calculations for at least one of the subscriptions, identified the less expensive magazine, and calculated the difference between the two subscriptions. With an international average of 24 percent correct (for full credit), this item was among the most difficult in TIMSS 1999. Singapore, Korea, and Chinese Taipei were the only countries where the majority of the students answered the item correctly.

Students reaching the Top 10% Benchmark exhibited an understanding of the properties of similar triangles, as shown by Example Item 3 (see
2.4 Exhibit 2.4). Given two angle measurements, the length of a side of a triangle, and the dimensions of a second similar triangle, students needed to find the length of an unlabeled side of the first triangle. Internationally, most eighth-grade students had not mastered the concept of proportionality of corresponding sides, or could not solve the resulting

text continued page 62

Exhibit 2.1 Description of Top 10% TIMSS International Benchmark of Mathematics Achievement

TIMSS 1999 8th grade Mathematics

• Top 10% Benchmark

Summary

Students can organize information, make generalizations, and explain solution strategies in non-routine problem solving situations. They can organize information and make generalizations to solve problems; apply knowledge of numeric, geometric, and algebraic relationships to solve problems (e.g., among fractions, decimals, and percents; geometric properties; and algebraic rules); and find the equivalent forms of algebraic expressions.

Students can organize information in problem-solving situations. They can select and organize information from two sources to solve a complex word problem involving decimals and organize information to solve a multi-step word problem involving whole numbers.

Students can correctly order the four basic operations in computing with decimals and fractions. Students use their understanding of fractions and decimals in multi-step problem situations. They can solve a problem involving both addition and subtraction of simple common fractions and a problem involving multiplication and subtraction of decimals. They can solve word problems involving fractions and decimals which require analysis of the verbal relations described. They can order a set of decimal fractions of up to three decimal places and can identify the pair of numbers satisfying given conditions involving ordering integers, decimals, and fractions. They can solve a time-distance-rate problem involving decimals and the conversion of minutes to seconds. They can work with part-whole ratios and can solve word problems to find the percent change.

Students can apply their knowledge of measurement in more complex problem situations. They can solve problems involving area and perimeter of rectangles and area of inscribed triangles. They apply knowledge of properties of squares to solve multi-step word problems and draw a new rectangle based on a given rectangle and express the ratio of their areas. They can relate different units of time and apply their knowledge of the number of milliliters in a liter to solve a word problem. They recognize that precision of measurement is related to the size of the unit of measurement.

Students can use their knowledge of angles – overlapping and measures of angles in quadrilaterals – to solve problems. They can use their knowledge of congruent and similar triangles to solve problems concerning corresponding parts. They can identify the coordinates of a point on a line given the coordinates of two other points on the line and locate a point on a number line given its distance from two other points on the line. They can identify the image of a triangle under a rotation in a plane.

Students can use proportion to find missing values in a table. Students can identify an equivalent form of a linear inequality involving a fraction. Students can recognize properties of number operations represented in symbolic form. They can solve a multi-step word problem in which there are two unknowns.

Given the first several terms in pictorial form, that grow in either one or two dimensions, students can make generalizations to find terms in the sequences (e.g. 51st), and they can explain the process used to find those terms.

90th Percentile: 616

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

continued from page 60

equation, with only 37 percent, on average, answering the question correctly. In comparison, top-performing Korea had 70 percent correct responses. Only in Korea, Japan, Singapore, Hong Kong, Chinese Taipei, and Belgium (Flemish) did at least half the students provide the correct solution.

The eighth-grade students reaching the Top 10% Benchmark typically were able to apply a generalization in order to solve a sequence problem like the one shown in Exhibit 2.5. In this algebra problem, given the initial terms in a sequence and the 50th term of that sequence, they generalized to find the 51st term. This problem was presented in three parts, A, B, and C. For parts A and B, students were asked to indicate how many circles would be in the 5th and 7th figures, respectively, if the pattern were extended. On average internationally, 65 percent of the students answered Part A correctly and 54 percent successfully extended the sequence to the 7th figure in Part B.

2.5

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 circles for the 51st figure. Internationally, on average, 30 percent of the students received full credit for their responses. Most of them added the sequence number to the number of circles in the preceding figure: 1275 + 51 = 1326. Less than three percent of the students internationally calculated the answer by a general expression: n(n+1)/2 or 51(52)/2. About 13 percent of the students in the Netherlands and Moldova received full credit by calculating their answer using the latter method. In 10 countries, 15 percent or less of the students answered Part C of the item correctly. Still, about two-thirds of the students in Korea, Chinese Taipei, Japan, and Singapore received full credit for their responses. It seems worthwhile to note that many students internationally (33 percent) left the item blank, whereas in the four top-performing countries on this item only six to 12 percent of the students did not attempt the item.

Exhibits 2.2–2.5 Overleaf

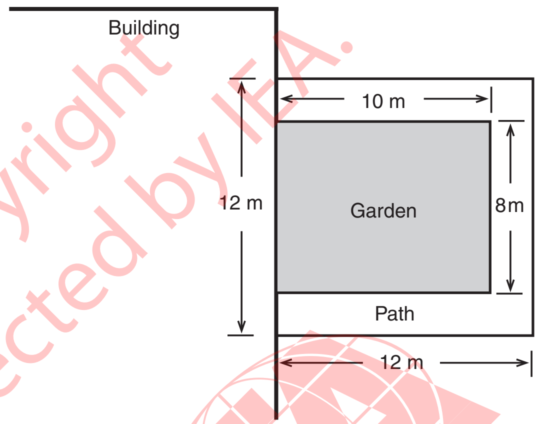
Exhibit 2.2 Top 10% TIMSS International Benchmark – Example Item 1

An Item That Students Reaching the Top 10% International Benchmark Are Likely to Answer Correctly*

Content Area: Measurement

Description: Finds the area between two rectangles when one is inside the other and their sides are parallel.

A rectangular garden that is next to a building has a path around the other three sides, as shown.



What is the area of the path?

A. 144 m^2

B. 64 m^2

C. 44 m^2

D. 16 m^2

Country	Overall Percent Correct	
Hong Kong, SAR †	79 (2.0)	▲
Singapore	78 (2.6)	▲
Japan	74 (1.9)	▲
Chinese Taipei	73 (2.1)	▲
Korea, Rep. of	67 (1.7)	▲
Netherlands †	57 (4.4)	▲
Australia	52 (2.6)	▲
Malaysia	52 (2.1)	▲
Slovak Republic	51 (3.3)	●
Canada	51 (3.0)	●
Belgium (Flemish) †	51 (2.2)	▲
Finland	46 (3.0)	●
Hungary	46 (2.7)	●
Slovenia	46 (3.2)	●
Cyprus	45 (3.0)	●
Italy	45 (2.7)	●
Bulgaria	42 (3.4)	●
International Avg.	42 (0.4)	
Czech Republic	40 (3.5)	●
England †	40 (3.3)	●
New Zealand	40 (2.6)	●
Tunisia	38 (2.0)	●
Russian Federation	38 (3.2)	●
Thailand	35 (2.1)	●
Moldova	34 (2.7)	●
United States	33 (1.6)	▼
Morocco	31 (2.1)	▼
Lithuania 1‡	31 (3.0)	▼
Macedonia, Rep. of	30 (2.5)	▼
Romania	29 (2.6)	▼
Jordan	29 (2.3)	▼
Israel 2	28 (2.1)	▼
Latvia (LSS) 1	28 (2.5)	▼
Iran, Islamic Rep.	26 (2.1)	▼
Indonesia	25 (2.0)	▼
Turkey	22 (1.6)	▼
Chile	18 (1.6)	▼
Philippines	15 (1.2)	▼
South Africa	15 (1.2)	▼

▲ Country average significantly higher than international average

● No statistically significant difference between country average and international average

▼ Country average significantly lower than international average

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

* 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.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 2.3 Top 10% TIMSS International Benchmark – Example Item 2

An Item That Students Reaching the Top 10% International Benchmark Are Likely to Answer Correctly*

Content Area: Data Representation, Analysis and Probability

Description: Selects relevant information from two advertisements to solve a complex word problem involving decimals.

Chris plans to order 24 issues of a magazine. He reads the following advertisements for two magazines. *Ceds* are the units of currency in Chris' country.

Teen Life Magazine

24 issues
First four issues FREE
The rest
3 *ceds* each.

Teen News Magazine

24 issues
First six issues FREE
The rest
3.5 *ceds* each.

Which magazine is the least expensive for 24 issues? How much less expensive? Show your work.

Teen Life = 20
× 3
60 ceds
24 = 60 ceds

Teen News = 18
×3.5
90
540
63.0 ceds
24 = 63 ceds

Teen Life is less expensive by 3 ceds.

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

Country	Overall Percent Correct	
Singapore	57 (2.1)	▲
Korea, Rep. of	52 (1.5)	▲
Chinese Taipei	50 (1.8)	▲
Belgium (Flemish) †	42 (1.7)	▲
Japan	39 (1.5)	▲
Slovak Republic	36 (2.3)	▲
Slovenia	36 (2.1)	▲
Hungary	35 (2.1)	▲
Latvia (LSS) 1	35 (2.1)	▲
Hong Kong, SAR †	34 (1.8)	▲
Czech Republic	34 (2.5)	▲
Canada	32 (1.8)	▲
Russian Federation	30 (2.4)	●
Australia	29 (2.0)	●
Finland	28 (2.0)	●
Italy	27 (1.7)	●
United States	26 (1.4)	●
Netherlands †	25 (2.7)	●
Lithuania †‡	25 (2.0)	●
International Avg.	24 (0.3)	
Bulgaria	22 (2.6)	●
Thailand	21 (1.8)	●
Cyprus	21 (1.8)	●
Romania	20 (2.2)	●
Malaysia	19 (1.4)	▼
Israel 2	19 (1.5)	▼
New Zealand	18 (1.7)	▼
Macedonia, Rep. of	17 (1.3)	▼
England †	17 (1.9)	▼
Moldova	16 (1.8)	▼
Jordan	12 (1.1)	▼
Turkey	10 (1.3)	▼
Tunisia	9 (0.8)	▼
Iran, Islamic Rep.	9 (0.7)	▼
Chile	5 (1.0)	▼
Indonesia	5 (0.5)	▼
Philippines	3 (0.7)	▼
Morocco	2 (0.4)	▼
South Africa	1 (0.3)	▼

▲ Country average significantly higher than international average

● No statistically significant difference between country average and international average

▼ Country average significantly lower than international average

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

* 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.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 2.4 Top 10% TIMSS International Benchmark – Example Item 3

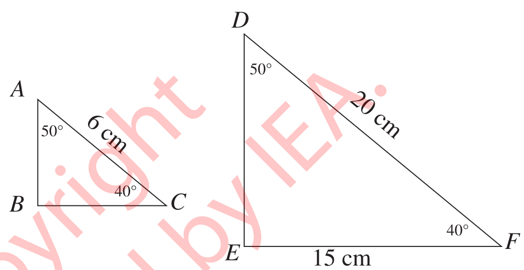
An Item That Students Reaching the Top 10% International Benchmark Are Likely to Answer Correctly*

TIMSS 1999 8th grade Mathematics

Content Area: Geometry

Description: Uses properties of similar triangles to find the length of a corresponding side.

The figure represents two similar triangles. The triangles are not drawn to scale.



In the actual triangle *ABC*, what is the length of side *BC*?

A 3.5 cm

B. 4.5 cm

C. 5 cm

D. 5.5 cm

E. 8 cm

Country	Overall Percent Correct	
Korea, Rep. of	70 (1.9)	▲
Japan	68 (1.9)	▲
Singapore	64 (2.7)	▲
Hong Kong, SAR †	56 (2.2)	▲
Chinese Taipei	52 (2.3)	▲
Belgium (Flemish) †	50 (3.2)	▲
Netherlands †	44 (3.1)	●
Hungary	43 (2.9)	●
Russian Federation	41 (2.7)	●
Finland	39 (2.9)	●
Australia	39 (2.8)	●
Romania	38 (2.9)	●
Slovak Republic	38 (3.0)	●
International Avg.	**37 (0.4)**	
United States	36 (1.6)	●
Moldova	36 (2.4)	●
Canada	35 (2.2)	●
New Zealand	34 (2.7)	●
Slovenia	34 (2.4)	●
England †	34 (2.7)	●
Bulgaria	33 (3.8)	●
Czech Republic	32 (2.5)	●
Malaysia	32 (1.9)	●
Jordan	32 (2.1)	●
Lithuania 1‡	31 (2.6)	●
Cyprus	31 (2.1)	●
Latvia (LSS) 1	30 (2.8)	●
Thailand	30 (1.9)	▼
Italy	29 (2.4)	▼
Israel 2	29 (2.4)	●
Macedonia, Rep. of	27 (2.5)	▼
Philippines	27 (1.4)	▼
Indonesia	26 (2.0)	▼
Iran, Islamic Rep.	26 (2.1)	▼
Tunisia	24 (1.9)	▼
Chile	23 (1.7)	▼
South Africa	23 (1.3)	▼
Turkey	22 (1.4)	▼

▲ Country average significantly higher than international average

● No statistically significant difference between country average and international average

▼ Country average significantly lower than international average

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

* 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.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, at the beginning of the next school year.

Internationally comparable data are unavailable for Morocco.

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

Exhibit 2.5 Top 10% TIMSS International Benchmark – Example Item 4

An Item That Students Reaching the Top 10% International Benchmark Are Likely to Answer Correctly*

TIMSS 1999 8th grade Mathematics

Content Area: Algebra

Description: Given the initial terms in a sequence and, for example, the 50th term of that sequence, generalizes to find the next term.

The figures show four sets consisting of circles.

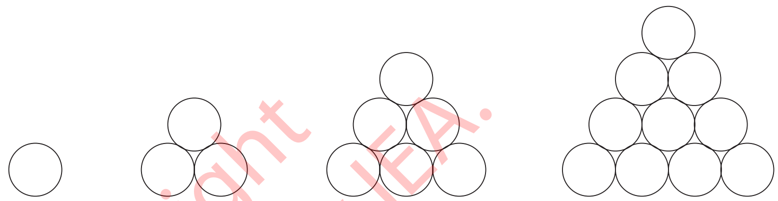


Figure 1 Figure 2 Figure 3 Figure 4

a) Complete the table below. First, fill in how many circles make up Figure 4. Then, find the number of circles that would be needed for the 5th figure if the sequence of figures is extended.

Figure	Number of circles
1	1
2	3
3	6
4	10
5	15

b) The sequence of figures is extended to the 7th figure. How many circles would be needed for Figure 7?

Answer: 28

c) The 50th figure in the sequence contains 1275 circles. Determine the number of circles in the 51st figure. Without drawing the 51st figure, explain or show how you arrived at your answer.

Because it is the 51st figure you have to add 51 to the base of the figure before it

$$\begin{array}{r} 1275 \\ +\ 51 \\ \hline 1326 \end{array}$$

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

Country	Overall Percent Correct	
Korea, Rep. of	70 (1.2)	▲
Chinese Taipei	68 (1.5)	▲
Japan	66 (1.6)	▲
Singapore	65 (2.4)	▲
Hong Kong, SAR †	57 (2.0)	▲
Netherlands †	48 (3.0)	▲
Belgium (Flemish) †	44 (1.7)	▲
Canada	43 (2.2)	▲
Australia	39 (2.3)	▲
Hungary	38 (1.9)	▲
Malaysia	37 (1.7)	▲
Slovenia	37 (2.3)	●
England †	35 (2.5)	●
United States	34 (1.3)	▲
Czech Republic	34 (2.5)	●
Slovak Republic	31 (2.5)	●
New Zealand	31 (2.0)	●
International Avg.	**30 (0.3)**	
Finland	30 (2.2)	●
Israel 2	27 (1.6)	●
Russian Federation	27 (2.0)	●
Moldova	26 (2.3)	●
Bulgaria	26 (2.2)	●
Thailand	25 (2.0)	●
Italy	24 (1.8)	▼
Indonesia	24 (1.6)	▼
Latvia (LSS) 1	22 (2.1)	▼
Romania	19 (2.0)	▼
Lithuania 1‡	19 (1.9)	▼
Cyprus	15 (1.5)	▼
Macedonia, Rep. of	13 (1.3)	▼
Jordan	13 (1.3)	▼
Turkey	11 (1.2)	▼
Philippines	9 (0.9)	▼
Chile	8 (1.0)	▼
Tunisia	8 (0.9)	▼
Iran, Islamic Rep.	8 (0.9)	▼
South Africa	3 (0.6)	▼
Morocco	3 (0.5)	▼

▲ Country average significantly higher than international average

● No statistically significant difference between country average and international average

▼ Country average significantly lower than international average

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

* 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.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

Achievement at the Upper Quarter Benchmark

2.6 Exhibit 2.6 describes performance at the Upper Quarter Benchmark. Eighth-grade students performing at this level applied their mathematical knowledge and understanding in a wide variety of relatively complex problem situations. For example, they demonstrated facility with fractions in a variety of formats, as illustrated by Example Item 5 shown in
2.7 Exhibit 2.7. This item required students to shade squares in a rectangular grid to represent a given fraction. Since the grid is divided into squares that are a multiple of the fraction's denominator, it requires more than one step to solve the problem. Internationally, about half of the students (49 percent on average) were able to shade in nine of the 24 squares to represent 3/8 of the region. Eighty percent or more of the students in Singapore, Hong Kong, Belgium (Flemish), Korea, and Chinese Taipei answered the question correctly.

Example Item 6 is a proportional reasoning word problem that students at the Upper Quarter Benchmark typically answered correctly (see
2.8 Exhibit 2.8). Given the number of magazines sold by each of two boys and the total amount of money made from the sales, students were to calculate how much money one of the boys made by selling his 80 magazines. On average, 44 percent of students internationally answered this question correctly. In Singapore and Chinese Taipei at least three-quarters of the students answered correctly.

Students reaching the Upper Quarter Benchmark generally were able to
2.9 apply knowledge of geometric properties. In Example Item 7 in Exhibit 2.9, students needed to use their knowledge of the properties of parallelograms and rectangles to solve for the area of the rectangle (dimensions not labeled) that was part of a different figure with given dimensions. Three-quarters or more of the students in Singapore, Japan, Hong Kong, Korea, and Chinese Taipei answered the item correctly. Internationally, however, less than half the eighth-grade students (43 percent on average) did so.

2.10 Exhibit 2.10 presents Example Item 8 asking for the number of triangles of a given dimension needed to cover a rectangle of given dimensions. The international average on this item was 46 percent correct. Many students (approximately 29 percent internationally) incorrectly chose Option A, which is half the number of required triangles needed to fill the rectangle but just enough to cover the perimeter. Japanese students

text continued page 70

Exhibit 2.6 Description of Upper Quarter TIMSS International Benchmark of Mathematics Achievement

TIMSS 1999 8th grade Mathematics

• Upper Quarter Benchmark

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; solve multi-step word problems involving proportions with whole numbers; solve probability problems; use knowledge of geometric properties to solve problems; identify and evaluate algebraic expressions and solve equations with one variable.

Students demonstrate some facility with fractions and decimals through computation, ordering, rounding, and use in word problems. They can recognize equivalent fractions, add, subtract, multiply and divide fractions with unlike denominators, and correctly order operations. They can identify the smallest decimal from a set of decimals with differing number of places and provide a fraction that is less than a given fraction. They can solve word problems involving multiplication and division of whole numbers and fractions and use pictorial representations of fractions in solving problems. They can identify the fraction of an hour representing a given time interval and identify fractions representing the comparison of part to whole, given each of two parts in a word problem setting.

Students can select the correct rounding of a number involving four decimal places, identify the decimal that is between two decimals given in hundredths, and solve a word problem that involves multiplying a decimal in thousandths by a multiple of a hundred. They can produce an example of a number that would round to a given value. Given a length rounded to the nearest centimeter, they can identify an example of the actual length expressed to one decimal place. Students can identify the ratio expressing a given whole number comparison in a word problem and recognize the effect of adding the same amount to both terms of a ratio. They can estimate products of whole numbers to solve problems. They can solve multi-step word problems involving proportions with whole numbers.

Students demonstrate their understanding of measurement in several settings. They can compare volumes by visualizing and counting cubes. They can calculate the areas of rectangles contained in diagrams of combined shapes. Given the start time and the duration of an event expressed as a fraction of an hour, they can determine the end time. They can estimate the distance between two points on a map, given the scale, and can read unlabeled tick marks on a scale.

Students can use basic properties of triangles, properties of angles on a straight line, and knowledge of symmetry to find the measures of angles. They can identify the angle in a diagram that represents the best estimate of a given measure and recognize that internal angles on a transversal are supplementary. They can visualize the center of a rotation for a two-dimensional figure, the arrangement of faces of a cube when shown its net, and the number of triangles of given dimensions needed to cover a given rectangle. They can identify false statements about congruent triangles and the properties of rectangles.

Students understand elementary concepts of probability, including independent events. 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 the smallest fraction. They can extrapolate from a graph and determine the number of values on the horizontal axis of a line graph that correspond to a given value on the vertical axis. On a given graph, students can interpolate to find a value between gradations on one axis matching a given value on the other axis.

Students can recognize that multiplication can represent repeated addition. They can identify the algebraic equation corresponding to a verbal description. They can select a simple, multiplicative expression in one variable that is positive for all negative values of the variable. They can substitute numbers for variables to evaluate an expression, and subtract fractions represented algebraically with the same numeric denominator.

Students can solve a linear equation with or without parentheses. They can identify the linear equation that describes the relationship between two variables given in a table of values and select the formula satisfied by the given values of the variables. They can identify the relationship between the first and second terms in a set of ordered pairs.

Given the first several terms of a sequence in pictorial form, growing in either one or two dimensions, they can find specified terms to extend the sequence.

75th Percentile: 555

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

continued from
page 68

had the highest performance on this item, with 80 percent answering correctly. About two-thirds or more of the students answered the item correctly in Korea, Hong Kong, Singapore, Belgium (Flemish), and the Netherlands.

2.11

Unlike students at lower benchmarks, students reaching the Upper Quarter level typically could solve simple linear equations. As illustrated by Example Item 9 in Exhibit 2.11, for example, students successfully solved for the value of x in a linear equation involving the variable on both sides of the equation. Eighty percent or more of the students in Japan, Hong Kong, and Korea answered this item correctly. On average internationally, 44 percent of students responded correctly.

Exhibits 2.7–2.11 Overleaf

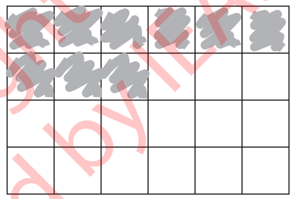
Exhibit 2.7 Upper Quarter TIMSS International Benchmark – Example Item 5

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

Content Area: Fractions and Number Sense

Description: Shades squares in a rectangular grid to represent a given fraction.

Shade in $\frac{3}{8}$ of the unit squares in the grid.



$8\overline{)24}$

$3 \times 3 = 9$

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

Country	Overall Percent Correct		
Singapore	89	(1.7)	▲
Hong Kong, SAR †	87	(1.7)	▲
Belgium (Flemish) †	87	(1.8)	▲
Korea, Rep. of	81	(1.4)	▲
Chinese Taipei	80	(1.9)	▲
Japan	78	(1.9)	▲
Malaysia	73	(2.1)	▲
Canada	68	(2.6)	▲
Finland	65	(2.5)	▲
Hungary	63	(2.5)	▲
Netherlands †	61	(4.7)	●
Australia	60	(2.9)	▲
Slovenia	55	(2.7)	●
Bulgaria	54	(4.3)	●
Cyprus	54	(2.6)	●
England †	52	(2.9)	●
Slovak Republic	52	(3.3)	●
Russian Federation	52	(3.2)	●
United States	49	(1.9)	●
International Avg.	**49**	**(0.4)**	
Thailand	49	(2.9)	●
New Zealand	46	(2.9)	●
Italy	46	(2.6)	●
Latvia (LSS) 1	46	(2.8)	●
Moldova	44	(3.2)	●
Czech Republic	42	(3.2)	●
Israel 2	40	(2.4)	▼
Romania	39	(2.9)	▼
Macedonia, Rep. of	32	(2.4)	▼
Jordan	31	(2.3)	▼
Iran, Islamic Rep.	31	(2.1)	▼
Tunisia	28	(1.8)	▼
Turkey	26	(2.2)	▼
Lithuania †‡	26	(2.8)	▼
Indonesia	21	(2.0)	▼
Chile	13	(1.7)	▼
Philippines	11	(1.3)	▼
Morocco	8	(1.1)	▼
South Africa	7	(1.4)	▼

▲ Country average significantly higher than international average

● No statistically significant difference between country average and international average

▼ Country average significantly lower than international average

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

* 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.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 2.8 Upper Quarter TIMSS International Benchmark – Example Item 6

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

TIMSS 1999 8th grade Mathematics

Content Area: Fractions and Number Sense

Description: Solves a multi-step word problem that involves dividing a quantity in a given ratio.

John sold 60 magazines and Mark sold 80 magazines. The magazines were all sold for the same price. The total amount of money received for the magazines was $700. How much money did Mark receive?

Answer: $400

80
+60
140 TOTAL

$MARK = \frac{80}{140} = \frac{8}{14} = \frac{4}{7}$

$$7\overline{)700}\;=\;100$$

100
x4
$400

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

Country	Overall Percent Correct	
Singapore	84 (2.0)	▲
Chinese Taipei	75 (1.8)	▲
Hong Kong, SAR †	72 (2.1)	▲
Korea, Rep. of	69 (1.4)	▲
Japan	67 (2.0)	▲
Malaysia	65 (2.0)	▲
Slovenia	60 (2.7)	▲
Belgium (Flemish) †	60 (3.7)	▲
Hungary	58 (2.5)	▲
Moldova	54 (3.1)	▲
Czech Republic	54 (3.8)	●
Slovak Republic	54 (3.3)	●
Lithuania 1‡	54 (2.9)	▲
Netherlands †	53 (4.5)	●
Russian Federation	52 (3.1)	●
Bulgaria	50 (3.9)	●
Latvia (LSS) 1	48 (3.4)	●
Finland	47 (3.2)	●
Canada	46 (2.4)	●
International Avg.	**44 (0.4)**	
Australia	44 (3.2)	●
Romania	43 (3.1)	●
United States	41 (2.0)	●
Cyprus	40 (2.5)	●
Tunisia	39 (2.0)	●
Thailand	38 (2.3)	●
Italy	36 (2.6)	●
New Zealand	33 (2.7)	▼
England †	31 (2.6)	▼
Israel 2	30 (2.5)	▼
Macedonia, Rep. of	30 (2.6)	▼
Iran, Islamic Rep.	28 (2.1)	▼
Indonesia	27 (1.8)	▼
Turkey	26 (1.9)	▼
Jordan	23 (2.0)	▼
Chile	22 (1.7)	▼
Philippines	12 (1.3)	▼
South Africa	9 (1.3)	▼
Morocco	3 (0.6)	▼

▲ Country average significantly higher than international average

● No statistically significant difference between country average and international average

▼ Country average significantly lower than international average

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

* 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.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 2.9 Upper Quarter TIMSS International Benchmark – Example Item 7

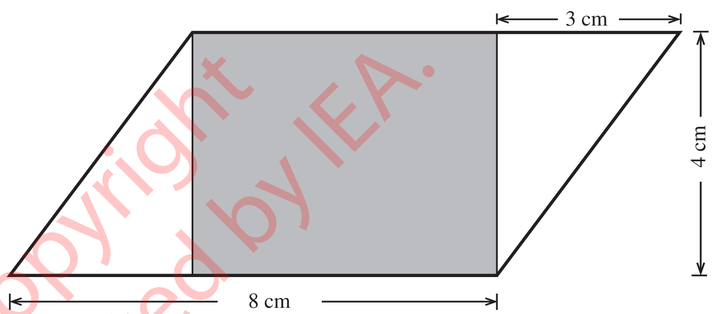
An Item That Students Reaching the Upper Quarter International Benchmark Are Likely to Answer Correctly*

TIMSS 1999 8th grade Mathematics

Content Area: Measurement

Description: Finds the area of a rectangle contained in a parallelogram of given dimensions.

The figure shows a shaded rectangle inside a parallelogram.



What is the area of the shaded rectangle?

Answer: 20

8-3=5

$$\begin{array}{r} 5 \\ \times\ 4 \\ \hline 20 \end{array}$$

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

Country	Overall Percent Correct	
Singapore	83 (1.5)	▲
Japan	80 (1.2)	▲
Hong Kong, SAR †	78 (1.6)	▲
Korea, Rep. of	78 (1.3)	▲
Chinese Taipei	75 (1.4)	▲
Belgium (Flemish) †	65 (2.0)	▲
Canada	58 (1.6)	▲
Slovak Republic	57 (2.5)	▲
Finland	57 (2.3)	▲
Malaysia	56 (1.9)	▲
Netherlands †	55 (4.7)	●
Australia	55 (1.8)	▲
Bulgaria	52 (3.2)	●
Slovenia	49 (2.1)	●
Russian Federation	49 (2.8)	●
Italy	48 (2.1)	●
England †	48 (2.3)	●
Czech Republic	46 (2.9)	●
Hungary	45 (2.0)	●
Latvia (LSS) 1	44 (2.5)	●
International Avg.	**43 (0.3)**	
Romania	43 (2.7)	●
New Zealand	41 (2.3)	●
Cyprus	41 (1.9)	●
Moldova	38 (2.6)	●
Tunisia	38 (1.6)	▼
Lithuania 1‡	35 (2.4)	▼
United States	34 (1.4)	▼
Thailand	33 (2.1)	▼
Israel 2	28 (1.8)	▼
Jordan	26 (1.5)	▼
Iran, Islamic Rep.	25 (2.0)	▼
Macedonia, Rep. of	25 (1.9)	▼
Turkey	20 (1.7)	▼
Indonesia	20 (1.4)	▼
Morocco	8 (0.9)	▼
Chile	7 (1.2)	▼
Philippines	6 (1.0)	▼
South Africa	3 (0.7)	▼

▲ Country average significantly higher than international average

● No statistically significant difference between country average and international average

▼ Country average significantly lower than international average

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

* 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.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

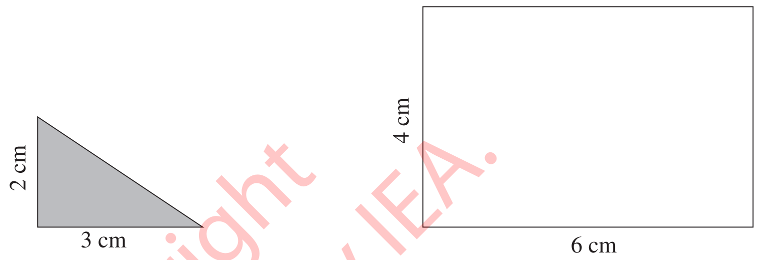
Exhibit 2.10 Upper Quarter TIMSS International Benchmark – Example Item 8

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

TIMSS1999 8th grade Mathematics

Content Area: Geometry

Description: Determines the number of triangles of given dimensions needed to cover a given rectangle.



How many of the shaded right triangles shown above are needed to exactly cover the surface of the rectangle?

A. Four

B. Six

C. Eight

D. Ten

	Overall Percent Correct	
Japan	80 (1.8)	▲
Korea, Rep. of	76 (1.7)	▲
Hong Kong, SAR †	75 (2.0)	▲
Singapore	72 (2.2)	▲
Belgium (Flemish) †	68 (2.7)	▲
Netherlands †	66 (3.8)	▲
Malaysia	60 (2.2)	▲
Chinese Taipei	60 (1.8)	▲
Hungary	59 (2.4)	▲
Slovenia	57 (2.6)	▲
Slovak Republic	57 (3.1)	▲
Australia	56 (2.7)	▲
Czech Republic	55 (3.6)	●
New Zealand	55 (2.4)	▲
Canada	50 (2.4)	●
Finland	49 (2.8)	●
Italy	49 (2.7)	●
England †	48 (2.6)	●
Latvia (LSS) [1]	48 (2.9)	●
United States	47 (2.0)	●
International Avg.	46 (0.4)	
Russian Federation	44 (2.8)	●
Lithuania [1]‡	43 (3.2)	●
Iran, Islamic Rep.	42 (2.1)	●
Israel [2]	41 (2.1)	●
Thailand	40 (2.0)	●
Cyprus	37 (3.1)	●
Moldova	37 (2.8)	▼
Romania	35 (2.7)	▼
Bulgaria	34 (3.8)	▼
Tunisia	33 (1.9)	▼
Turkey	30 (1.7)	▼
Macedonia, Rep. of	30 (2.6)	▼
Indonesia	29 (1.9)	▼
Chile	27 (1.8)	▼
Jordan	26 (2.0)	▼
Morocco	21 (1.7)	▼
Philippines	15 (1.4)	▼
South Africa	12 (1.5)	▼

Country average significantly higher than international average ▲

No statistically significant difference between country average and international average ●

Country average significantly lower than international average ▼

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

* 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.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 2.11 Upper Quarter TIMSS International Benchmark – Example Item 9

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

TIMSS 1999 8th grade Mathematics

Content Area: Algebra

Description: Solves a linear equation involving transposing.

Find the value of x if $12x - 10 = 6x + 32$

Answer: 7

$12x - 6x - 10 = 32$

$\Rightarrow 6x = 42$

$\Rightarrow \frac{6x}{6} = \frac{42}{6}$

$\Rightarrow x = 7.$

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

Country		Overall Percent Correct	
Japan		85 (1.4)	▲
Hong Kong, SAR	†	80 (1.9)	▲
Korea, Rep. of		80 (1.5)	▲
Slovak Republic		78 (2.6)	▲
Russian Federation		77 (3.1)	▲
Slovenia		76 (2.8)	▲
Singapore		75 (2.8)	▲
Hungary		74 (2.6)	▲
Chinese Taipei		73 (2.0)	▲
Romania		70 (3.2)	▲
Czech Republic		66 (2.8)	▲
Lithuania	1‡	62 (3.4)	▲
Latvia (LSS)	1	58 (2.9)	▲
Belgium (Flemish)	†	58 (1.9)	▲
Moldova		56 (3.0)	▲
Macedonia, Rep. of		54 (3.1)	●
Cyprus		51 (3.4)	●
Israel	2	51 (3.1)	●
Italy		46 (2.8)	●
International Avg.		**44 (0.4)**	
Malaysia		43 (2.7)	●
Bulgaria		34 (3.1)	▼
United States		34 (1.8)	▼
Canada		33 (3.1)	▼
Turkey		32 (2.6)	▼
Australia		31 (3.0)	▼
Thailand		29 (2.8)	▼
England	†	26 (2.7)	▼
Finland		24 (2.9)	▼
Iran, Islamic Rep.		23 (1.8)	▼
Netherlands	†	19 (2.9)	▼
New Zealand		19 (2.0)	▼
Jordan		18 (1.9)	▼
Indonesia		18 (2.0)	▼
Chile		12 (1.9)	▼
Morocco		7 (1.0)	▼
Philippines		6 (1.4)	▼
Tunisia		6 (1.0)	▼
South Africa		5 (0.9)	▼

Country average significantly higher than international average ▲

No statistically significant difference between country average and international average ●

Country average significantly lower than international average ▼

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

* 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.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

Achievement at the Median Benchmark

2.12–2.13

Students at the Median Benchmark demonstrated the ability to apply basic mathematical knowledge in straightforward situations (see Exhibit 2.12). For example, as shown by Example Item 10 in Exhibit 2.13, students showed that they understand rounding and can use it to estimate the results of computations. Given the number of rows of cars in a parking lot and the number of cars in each row, students chose the number sentence that would give the best estimate of the total number of cars. While students at the Lower Quarter Benchmark rounded to the nearest hundred, students at the Median Benchmark successfully rounded numbers to get the best estimate for a product. Moreover, middle-performing students demonstrated greater competence with word problems than did those at the Lower Quarter Benchmark. The international average percent correct for this item was 65 percent. Singapore outperformed other countries with 94 percent correct, followed by 85 percent in Hong Kong.

2.14

In geometry, students at the Median Benchmark were able to locate a point on a grid with five-unit divisions where the point lies between the grid lines (see Example Item 11 in Exhibit 2.14). Fifty-eight percent of the students on average internationally correctly chose Point S as the point on the grid that could have the coordinates (7,16). In Japan, Korea, Chinese Taipei, Hong Kong and Singapore, 80 percent or more of the students answered correctly. As might be anticipated, students answering incorrectly most commonly chose Point Q (16,7).

2.15

Example Item 12 shown in Exhibit 2.15 illustrates students' emerging familiarity with algebraic representation. Internationally on average, nearly two-thirds of the students correctly identified the linear equation corresponding to a given verbal statement involving a variable. In Hong Kong, Singapore, Japan, and Korea, 85 percent or more of the students answered correctly.

Exhibit 2.12 Description of Median TIMSS International Benchmark of Mathematics Achievement

TIMSS 1999 8th grade Mathematics

• Median Benchmark

Summary

Students can apply basic mathematical knowledge in straightforward situations. They can add or subtract to solve one-step word problems involving whole numbers and decimals; identify representations of common fractions and relative sizes of fractions; solve for missing terms in proportions; recognize basic notions of percents and probability; use basic properties of geometric figures; read and interpret graphs, tables, and scales; and understand simple algebraic relationships.

Students can apply basic mathematical knowledge in straightforward situations. They are able to use addition and subtraction to solve one-step word problems involving whole numbers and decimals. They can round whole numbers to the nearest hundred and identify the number sentence that gives the best estimate for the product of two numbers after rounding. Students 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. Students can approximate the quantity remaining after an amount is reduced by a given percent.

Students demonstrate an understanding of place value in decimal numbers. They can estimate the location of a point representing a decimal number in tenths on a number line marked in whole numbers and identify an unlabeled midway point on a number line marked in tenths. They can set up and solve one-step problems involving addition and subtraction of numbers having up to three decimal places, including situations where the numbers have a different number of decimal places. Given an object of one length, to one decimal place, they can estimate the length of another object.

Students can select the smallest fraction from a list of fractions and can recognize models representing fractions as shaded regions. They can find the missing term in a proportion in word problems and number sentences. Students can solve a simple word problem involving the likelihood of a successful outcome.

Students are able to select the appropriate metric unit to measure the mass of an object. They recognize the inverse relationship between the length of a unit and the number of units required to cover a distance.

Students can locate and interpret data presented in bar graphs, pictographs, pie graphs, and line graphs. Given a table of values for two variables, they can select the graph that represents the given data.

Students can solve problems involving the properties of congruent figures and can select a pair of similar triangles from a set of triangles. They can visualize a rotation of a three-dimensional figure made of cubes. They can locate points in the first quadrant of the Cartesian plane.

Students can select an expression to represent a situation involving multiplication, and identify a linear equation corresponding to a verbal statement. They can find a missing value in a table of values relating x and y values. Using the properties of a balance, they can reason to find an unknown weight. Given diagrams representing the first few terms of a sequence, growing in one dimension, and a partially completed table, they can find the next two terms.

50th Percentile: 479

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Exhibit 2.13 Median TIMSS International Benchmark – Example Item 10

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

TIMSS 1999 8th grade Mathematics

Content Area: Fractions and Number Sense

Description: In a word problem, uses rounding to identify the number sentence that gives the best estimate for the product.

There are 68 rows of cars in a parking lot. Each row has 92 cars. Which of these would give the closest estimate of the total number of cars in the parking lot?

A. $60 \times 90 = 5400$

B. $60 \times 100 = 6000$

C. $70 \times 90 = 6300$

D. $70 \times 100 = 7000$

Country	Overall Percent Correct	
Singapore	94 (1.0)	▲
Hong Kong, SAR †	85 (1.7)	▲
Belgium (Flemish) †	83 (3.0)	▲
Japan	82 (1.4)	▲
Korea, Rep. of	82 (1.2)	▲
Chinese Taipei	81 (1.5)	▲
Netherlands †	81 (3.1)	▲
Finland	79 (2.5)	▲
United States	79 (1.8)	▲
Slovak Republic	78 (2.4)	▲
Hungary	78 (2.1)	▲
Canada	78 (2.1)	▲
Czech Republic	78 (2.3)	▲
Malaysia	78 (1.6)	▲
Australia	77 (2.3)	▲
Slovenia	76 (2.5)	▲
England †	74 (2.8)	▲
New Zealand	67 (2.6)	●
Russian Federation	65 (2.7)	●
International Avg.	**65 (0.4)**	
Israel [2]	63 (2.4)	●
Latvia (LSS) [1]	62 (2.6)	●
Cyprus	60 (2.7)	●
Bulgaria	60 (4.7)	●
Thailand	58 (2.3)	●
Jordan	58 (2.3)	●
Lithuania [1‡]	57 (3.5)	●
Romania	55 (3.0)	●
Macedonia, Rep. of	53 (2.8)	▼
Italy	52 (2.5)	▼
Moldova	52 (2.7)	▼
Turkey	50 (2.0)	▼
Chile	48 (2.4)	▼
Tunisia	48 (2.1)	▼
Iran, Islamic Rep.	48 (2.0)	▼
Indonesia	44 (2.1)	▼
Philippines	42 (1.9)	▼
South Africa	30 (1.8)	▼
Morocco	17 (1.3)	▼

▲ Country average significantly higher than international average

● No statistically significant difference between country average and international average

▼ Country average significantly lower than international average

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

* 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.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 2.14 Median TIMSS International Benchmark – Example Item 11

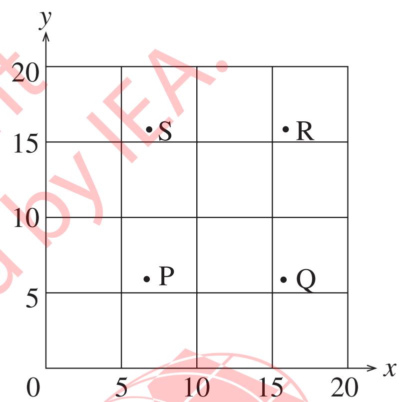
An Item That Students Reaching the Median International Benchmark Are Likely to Answer Correctly*

TIMSS 1999 8th grade Mathematics

Content Area: Geometry

Description: Locates the point on a grid with 5-unit divisions when the point lies between the grid lines.

Which point on the graph could have coordinates (7,16)?



A. Point P

B. Point Q

C. Point R

D. Point S

Country	Overall Percent Correct	
Japan	84 (1.7)	▲
Korea, Rep. of	84 (1.4)	▲
Chinese Taipei	83 (1.5)	▲
Hong Kong, SAR †	81 (1.7)	▲
Singapore	80 (2.3)	▲
Netherlands †	78 (2.5)	▲
Malaysia	78 (1.7)	▲
Slovenia	76 (2.4)	▲
Slovak Republic	76 (2.5)	▲
England †	75 (3.2)	▲
Australia	74 (2.3)	▲
Finland	72 (2.7)	▲
New Zealand	72 (2.6)	▲
Hungary	71 (2.5)	▲
Russian Federation	71 (2.2)	▲
Belgium (Flemish) †	71 (2.5)	▲
Canada	67 (2.6)	▲
United States	67 (1.6)	▲
Lithuania 1‡	63 (2.9)	●
Italy	62 (2.2)	●
Czech Republic	58 (3.2)	●
International Avg.	**58 (0.4)**	
Jordan	57 (2.6)	●
Iran, Islamic Rep.	55 (2.2)	●
Bulgaria	53 (2.8)	●
Israel 2	51 (2.7)	●
Indonesia	50 (2.1)	▼
Moldova	48 (2.9)	▼
Romania	47 (2.7)	▼
Latvia (LSS) 1	46 (2.9)	▼
Macedonia, Rep. of	44 (2.7)	▼
Thailand	37 (2.2)	▼
Turkey	32 (1.9)	▼
Morocco	26 (2.1)	▼
Cyprus	24 (2.1)	▼
Philippines	23 (1.7)	▼
Chile	23 (1.6)	▼
South Africa	20 (1.7)	▼
Tunisia	10 (1.2)	▼

▲ Country average significantly higher than international average

● No statistically significant difference between country average and international average

▼ Country average significantly lower than international average

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

* 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.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 2.15 Median TIMSS International Benchmark – Example Item 12

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

TIMSS 1999 8th grade Mathematics

Content Area: Algebra

Description: Identifies the linear equation corresponding to a given verbal statement involving a variable.

n is a number. When n is multiplied by 7, and 6 is then added, the result is 41. Which of these equations represents this relation?

A. $7n + 6 = 41$

B. $7n - 6 = 41$

C. $7n \times 6 = 41$

D. $7(n + 6) = 41$

	Overall Percent Correct	
Hong Kong, SAR †	93 (0.9)	▲
Singapore	89 (1.7)	▲
Japan	86 (0.8)	▲
Korea, Rep. of	85 (0.7)	▲
Chinese Taipei	84 (1.1)	▲
Slovenia	83 (1.1)	▲
Canada	82 (1.0)	▲
Russian Federation	82 (1.6)	▲
Slovak Republic	81 (1.5)	▲
Belgium (Flemish) †	81 (1.2)	▲
Netherlands †	80 (2.5)	▲
Hungary	80 (1.3)	▲
United States	77 (1.3)	▲
Bulgaria	76 (2.0)	▲
Australia	72 (1.9)	▲
Czech Republic	72 (1.7)	▲
Latvia (LSS)[1]	71 (1.6)	▲
Lithuania[1‡]	71 (1.8)	●
Finland	68 (1.5)	●
Israel[2]	68 (1.7)	●
Thailand	67 (1.5)	●
Romania	67 (2.1)	●
Cyprus	66 (1.3)	●
International Avg.	**65 (0.3)**	
Moldova	65 (1.6)	●
Macedonia, Rep. of	63 (1.9)	●
England †	62 (2.1)	●
Italy	58 (1.6)	▼
New Zealand	58 (2.2)	▼
Tunisia	58 (1.4)	▼
Malaysia	57 (1.8)	▼
Jordan	46 (1.4)	▼
Iran, Islamic Rep.	46 (1.5)	▼
Turkey	41 (1.6)	▼
Chile	38 (1.6)	▼
Indonesia	37 (1.4)	▼
Morocco	35 (1.1)	▼
South Africa	21 (1.3)	▼
Philippines	19 (1.6)	▼

▲ Country average significantly higher than international average

● No statistically significant difference between country average and international average

▼ Country average significantly lower than international average

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

* 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.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

Achievement at the Lower Quarter Benchmark

2.16 As shown in Exhibit 2.16, the few items anchoring at the Lower Quarter Benchmark provided evidence that students performing at this level can add, subtract, and round with whole numbers. For example, students answering Example Item 13 correctly rounded 691 and 208 to estimate 2.17 their sum as close to the sum of 700 and 200 (see Exhibit 2.17). The international average was 80 percent correct, and 27 countries had three-quarters or more of their students choosing the correct answer. In four countries – Singapore, Belgium (Flemish), Japan, and the Netherlands – 95 percent or more of the students gave the correct response.

2.18 As illustrated by Example Item 14 in Exhibit 2.18, students at the Lower Quarter Benchmark generally could subtract one three-decimal-place number from another with multiple regrouping. Internationally on average, 77 percent of the eighth-grade students selected the correct response to this item. Performance ranged from a high of 92 percent correct in Malaysia to a low of 42 percent correct in South Africa.

Similarly, students at this level could subtract one four-digit integer from another involving multiple regrouping with zeroes (see Example Item 15 2.19 in Exhibit 2.19). On this subtraction item also, Malaysia had the highest percentage of students answering this item correctly (94 percent) and South Africa the lowest (37 percent).

2.20 In addition, Example Item 16 in Exhibit 2.20 shows that students at this level could read a thermometer and locate the correct reading in a table. There were thirteen countries where at least 90 percent of the students selected the correct response. In only two countries, Turkey and South Africa, did less than 50 percent of the students answer the item correctly.

Exhibit 2.16 Description of Lower Quarter TIMSS International Benchmark of Mathematics Achievement

TIMSS 1999 8th grade Mathematics

• Lower Quarter Benchmark

Summary

Students can do basic computations with whole numbers.

The few items at this level provide some evidence that students can add, subtract, and round with whole numbers. When there are the same number of decimal places, they can subtract with multiple regrouping. Students can round whole numbers to the nearest hundred. They can read a thermometer and locate the reading in a table. Students recognize some basic notation.

25th Percentile: 396

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Exhibit 2.17 Lower Quarter TIMSS International Benchmark – Example Item 13

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

TIMSS 1999 8th grade Mathematics

Content Area: Fractions and Number Sense

Description: Rounds to estimate the sum of two three-digit numbers.

The sum 691 + 208 is closest to the sum

A. 600 + 200

B. 700 + 200

C. 700 + 300

D. 900 + 200

	Overall Percent Correct	
Singapore	97 (0.5)	▲
Belgium (Flemish) †	96 (0.7)	▲
Japan	95 (0.5)	▲
Netherlands †	95 (0.8)	▲
Hong Kong, SAR †	93 (0.7)	▲
Canada	93 (0.7)	▲
United States	93 (0.7)	▲
Hungary	93 (0.9)	▲
Korea, Rep. of	93 (0.6)	▲
Slovenia	92 (0.8)	▲
England †	92 (1.0)	▲
Czech Republic	91 (1.0)	▲
Australia	91 (0.8)	▲
Finland	91 (1.0)	▲
Slovak Republic	90 (1.1)	▲
Chinese Taipei	89 (0.7)	▲
New Zealand	88 (1.0)	▲
Malaysia	88 (0.8)	▲
Latvia (LSS) 1	87 (1.4)	▲
Bulgaria	86 (1.6)	▲
Cyprus	85 (1.1)	▲
Lithuania 1‡	84 (1.5)	●
Russian Federation	83 (1.9)	●
Israel 2	83 (1.6)	●
International Avg.	**80 (0.2)**	
Macedonia, Rep. of	79 (1.4)	●
Italy	77 (1.9)	●
Thailand	77 (1.5)	●
Turkey	74 (1.3)	▼
Romania	73 (1.8)	▼
Tunisia	67 (1.3)	▼
Jordan	66 (1.5)	▼
Moldova	66 (1.6)	▼
Chile	65 (1.3)	▼
Iran, Islamic Rep.	58 (1.5)	▼
Indonesia	54 (1.6)	▼
Philippines	53 (1.6)	▼
Morocco	43 (1.2)	▼
South Africa	37 (1.6)	▼

▲ Country average significantly higher than international average

● No statistically significant difference between country average and international average

▼ Country average significantly lower than international average

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

* 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.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 2.18 Lower Quarter TIMSS International Benchmark – Example Item 14

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

Content Area: Fractions and Number Sense

Description: Subtracts a three-decimal-place number from another with multiple regrouping.

Subtract: $4.722 - 1.935 =$

A. 2.787

B. 2.797

C. 2.887

D. 2.897

Country		Overall Percent Correct	
Malaysia		92 (1.1)	▲
Singapore		90 (1.4)	▲
Hungary		90 (1.7)	▲
Slovenia		90 (1.6)	▲
Korea, Rep. of		88 (1.2)	▲
Russian Federation		88 (1.9)	▲
Slovak Republic		87 (2.1)	▲
Japan		86 (1.3)	▲
Lithuania	1‡	86 (2.1)	▲
Czech Republic		85 (2.8)	●
Chinese Taipei		84 (1.5)	▲
Hong Kong, SAR	†	83 (1.8)	▲
Thailand		83 (1.6)	▲
Tunisia		82 (1.6)	●
Bulgaria		81 (2.6)	●
Moldova		80 (2.3)	●
Canada		80 (1.8)	●
Latvia (LSS)	1	79 (2.4)	●
Indonesia		78 (1.9)	●
Romania		77 (2.5)	●
United States		77 (1.7)	●
Italy		77 (2.3)	●
International Avg.		77 (0.4)	
Chile		75 (1.7)	●
Australia		74 (2.7)	●
Belgium (Flemish)	†	73 (2.0)	●
Finland		72 (3.0)	●
Cyprus		71 (2.2)	●
Macedonia, Rep. of		71 (2.4)	●
Iran, Islamic Rep.		71 (2.3)	●
Turkey		71 (1.9)	●
Netherlands	†	69 (4.3)	●
Philippines		69 (1.8)	▼
Jordan		65 (2.4)	▼
Israel	2	63 (2.5)	▼
Morocco		62 (2.5)	▼
New Zealand		61 (2.5)	▼
England	†	59 (2.7)	▼
South Africa		42 (1.8)	▼

Country average significantly higher than international average ▲

No statistically significant difference between country average and international average ●

Country average significantly lower than international average ▼

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

* 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.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 2.19 Lower Quarter TIMSS International Benchmark – Example Item 15

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

TIMSS1999 8th grade Mathematics

Content Area: Fractions and Number Sense

Description: Subtracts a four-digit number from another involving zeroes.

Subtract:

$$\begin{array}{r} 7003 \\ -\,4078 \\ \hline \end{array}$$

A. 2035

B. 2925

C. 3005

D. 3925

Country	Overall Percent Correct	
Malaysia	94 (0.9)	▲
Singapore	92 (1.3)	▲
Chinese Taipei	90 (1.2)	▲
Hong Kong, SAR [†]	90 (1.3)	▲
Korea, Rep. of	88 (1.2)	▲
Hungary	87 (1.8)	▲
Slovak Republic	86 (1.9)	▲
Japan	86 (1.4)	▲
Belgium (Flemish) [†]	85 (2.1)	▲
Slovenia	83 (2.2)	▲
Canada	83 (1.4)	▲
Czech Republic	82 (2.4)	●
United States	81 (1.6)	▲
Lithuania [1‡]	80 (2.7)	●
Tunisia	80 (1.7)	▲
Russian Federation	79 (2.2)	●
Moldova	79 (2.2)	●
Netherlands [†]	79 (3.4)	●
Australia	77 (2.5)	●
Thailand	77 (1.8)	●
Finland	76 (2.4)	●
Bulgaria	76 (2.9)	●
International Avg.	**74 (0.4)**	
Latvia (LSS) [1]	74 (3.1)	●
Iran, Islamic Rep.	73 (1.9)	●
Cyprus	70 (2.2)	●
Turkey	69 (1.9)	●
Jordan	69 (2.1)	●
Romania	68 (2.9)	●
Israel [2]	67 (2.4)	●
Italy	67 (2.7)	●
Macedonia, Rep. of	65 (2.7)	▼
Chile	59 (2.0)	▼
Philippines	58 (1.9)	▼
New Zealand	58 (2.4)	▼
Indonesia	55 (2.6)	▼
Morocco	54 (2.1)	▼
England [†]	51 (3.1)	▼
South Africa	37 (2.0)	▼

▲ Country average significantly higher than international average

● No statistically significant difference between country average and international average

▼ Country average significantly lower than international average

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

* 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.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 2.20 Lower Quarter TIMSS International Benchmark – Example Item 16

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

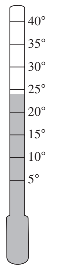
TIMSS 1999 8th grade Mathematics

Content Area: Data Representation, Analysis and Probability

Description: Reads a thermometer and locates the reading in a table.

This table shows temperatures at various times on four days.

TEMPERATURE					
	6 a.m.	9 a.m.	Noon	3 p.m.	6 p.m.
Monday	15°	17°	24°	21°	16°
Tuesday	20°	16°	15°	10°	9°
Wednesday	8°	14°	16°	19°	15°
Thursday	8°	11°	19°	26°	20°



Thermometer

On which day and at what time was the temperature shown in the table the same as that shown on the thermometer?

A. Monday, Noon

B. Tuesday, 6 a.m.

C. Wednesday, 3 p.m.

D. Thursday, 3 p.m.

Country	Overall Percent Correct	
Japan	96 (0.8)	▲
Singapore	95 (0.9)	▲
Belgium (Flemish) †	95 (1.5)	▲
Finland	93 (1.4)	▲
Korea, Rep. of	92 (0.9)	▲
England †	92 (2.2)	▲
Chinese Taipei	91 (1.2)	▲
Slovenia	91 (1.7)	▲
Czech Republic	91 (1.9)	▲
Australia	91 (2.2)	▲
Slovak Republic	91 (1.5)	▲
Hong Kong, SAR †	90 (1.5)	▲
Netherlands †	90 (2.6)	▲
Canada	89 (2.6)	▲
United States	89 (1.2)	▲
New Zealand	88 (1.9)	▲
Hungary	87 (2.0)	▲
Cyprus	86 (1.4)	▲
Russian Federation	85 (2.6)	●
Malaysia	85 (1.4)	▲
Lithuania 1‡	84 (2.4)	●
Latvia (LSS) 1	83 (2.3)	●
Italy	81 (2.0)	●
International Avg.	**79 (0.3)**	
Israel 2	74 (2.0)	●
Bulgaria	72 (2.8)	●
Chile	67 (1.9)	▼
Moldova	66 (2.8)	▼
Romania	65 (2.8)	▼
Jordan	65 (1.9)	▼
Macedonia, Rep. of	65 (2.9)	▼
Iran, Islamic Rep.	59 (2.5)	▼
Philippines	54 (2.0)	▼
Indonesia	50 (2.3)	▼
South Africa	43 (2.1)	▼
Turkey	38 (1.9)	▼

▲ Country average significantly higher than international average

● No statistically significant difference between country average and international average

▼ Country average significantly lower than international average

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

* 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.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, at the beginning of the next school year.

Internationally comparable data are unavailable for Morocco, Thailand, and Tunisia.

( ) 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?

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 Median 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 (16) presented in this chapter, there was a substantial range in performance for many countries. While some countries consistently registered high or low performance, and others had results consistently near the international average, 16 countries performed significantly above the international average on at least one item, and significantly below the international average on at least one item (Australia, Bulgaria, Canada, Cyprus, England, Finland, Latvia (LSS), Lithuania, Malaysia, Moldova, the Netherlands, New Zealand, Romania, Thailand, Tunisia, and the United States). For example, Malaysia had the highest percent correct on a subtraction item (Exhibit 2.19) but performed below the international average on an item requiring selection of information to solve a complex word problem (Exhibit 2.3). In some cases, differences of this sort will result from 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 1999 results may reveal aspects of curricula that merit further investigation.

CHAPTER 3

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 and trends are provided for five content areas: fractions and number sense; measurement; data representation, analysis, and probability; geometry; and algebra.

The TIMSS 1999 mathematics assessment was designed to allow as fair comparisons as possible among participating countries.[1] The test measured achievement on content covered in most systems up to and including the eighth grade. Nevertheless, curriculum data collected as part of TIMSS 1995 and TIMSS 1999 indicate differences among countries 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. Chapter 3 presents results by major content areas in mathematics to provide information about the possible effects of this curricular variation on average achievement.

The TIMSS 1999 mathematics test for the eighth grade was designed to enable reporting by five content areas in accordance with the TIMSS mathematics framework.[2] These areas, with their main topics, are:

- **Fractions and number sense**

  Includes whole numbers, fractions and decimals, integers, exponents, estimation and approximation, proportionality

- **Measurement**

  Includes standard and non-standard units, common measures, perimeter, area, volume, estimation of measures

- **Data representation, analysis, and probability**

  Includes representing and interpreting tables, charts, and graphs; range, mean; informal likelihood, simple numerical probability

- **Geometry**

  Includes points, lines, planes, angles, visualization, triangles, polygons, circles, transformations, symmetry, congruence, similarity, constructions

- **Algebra**

  Includes number patterns, representation of numerical situations, solving simple linear equations, operations with expressions, representations of relations and functions.

Chapter 3 presents average achievement for the five major content areas covered by the TIMSS 1999 mathematics test. Gender differences in each content area are shown, and trends in achievement between 1995 and 1999 are presented for those countries that participated in both TIMSS assessments.

1 Please see Appendix A for more information about the test development process. Appendix C provides an analysis of the match between the test and curriculum in different TIMSS 1999 countries and the effect of this match on the results.

2 Proportionality was included as a reporting category in TIMSS 1995, but only 11 items were classified in this content area. To improve the stability of trend comparisons with TIMSS 1995 and for TIMSS 1999 reporting, these items were allocated to other content categories for which they were suitable, mainly fractions and number sense.

How Does Achievement Differ Across Mathematics Content Areas?

3.1 Exhibit 3.1 presents average achievement in each of the five mathematics content areas. Countries are displayed in decreasing order of achievement for each content area, and symbols indicate whether a country's performance is statistically significantly above or below the international average. To allow comparison of the relative performance of each country in each content area, the international average for each content area was scaled to be 487, the same as the overall international average.

Differences in average achievement between the highest- and lowest-performing countries were greatest for fractions and number sense (308 scale-score points) and least for data representation, analysis, and probability (220 scale-score points). The six countries scoring highest in the overall mathematics assessment – Singapore, Korea, Chinese Taipei, Hong Kong, Japan, and Belgium (Flemish) – were also the highest-scoring countries (though not always in the same rank order) in each of the major content areas. Correspondingly, countries scoring lowest on the overall test tended to have low average performance across all five content areas.

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, the United States performed significantly above the international average in fractions and number sense; data representation, analysis, and probability; and algebra. In contrast, however, it performed similarly to the international average in measurement and geometry (a shift in ranking from 16th in data representation, analysis, and probability to 27th in geometry).

Exhibits B.1 through B.5 in Appendix B 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.

Exhibit 3.1 Overleaf

Exhibit 3.1 Average Achievement in Mathematics Content Areas

Fractions and Number Sense
Average Scale Score
(61 items)

Country	Sig.	Average Scale Score
Singapore	▲	608 (5.6)
Hong Kong, SAR †	▲	579 (4.5)
Chinese Taipei	▲	576 (4.2)
Korea, Rep. of	▲	570 (2.7)
Japan	▲	570 (2.6)
Belgium (Flemish) †	▲	557 (3.1)
Netherlands †	▲	545 (7.1)
Canada	▲	533 (2.5)
Malaysia	▲	532 (4.7)
Finland	▲	531 (3.8)
Slovenia	▲	527 (3.7)
Hungary	▲	526 (4.2)
Slovak Republic	▲	525 (4.8)
Australia	▲	519 (4.3)
Russian Federation	▲	513 (6.4)
United States	▲	509 (4.2)
Czech Republic	▲	507 (4.8)
Bulgaria	○	503 (6.6)
England †	○	497 (3.8)
Latvia (LSS) 1	○	496 (3.7)
New Zealand	○	493 (5.0)
International Avg.	○	**487 (0.7)**
Cyprus	○	481 (3.0)
Lithuania 1‡	○	479 (4.3)
Israel 2	▽	472 (4.4)
Thailand	○	471 (5.3)
Italy	▽	471 (5.0)
Moldova	▽	465 (4.2)
Romania	▽	458 (5.7)
Tunisia	▽	443 (2.8)
Iran, Islamic Rep.	▽	437 (4.5)
Macedonia, Rep. of	▽	437 (4.7)
Jordan	▽	432 (3.2)
Turkey	▽	430 (4.3)
Indonesia	▽	406 (4.1)
Chile	▽	403 (4.9)
Philippines	▽	378 (6.3)
Morocco	▽	335 (3.6)
South Africa	▽	300 (6.0)

Scale: 200 500 800

Measurement
Average Scale Score
(24 items)

Country	Sig.	Average Scale Score
Singapore	▲	599 (6.3)
Korea, Rep. of	▲	571 (2.8)
Hong Kong, SAR †	▲	567 (5.8)
Chinese Taipei	▲	566 (3.4)
Japan	▲	558 (2.4)
Belgium (Flemish) †	▲	549 (4.0)
Hungary	▲	538 (3.5)
Netherlands †	▲	538 (5.8)
Slovak Republic	▲	537 (3.3)
Czech Republic	▲	535 (5.0)
Australia	▲	529 (4.9)
Russian Federation	▲	527 (6.0)
Slovenia	▲	523 (3.7)
Canada	▲	521 (2.4)
Finland	▲	521 (4.7)
Malaysia	▲	514 (4.6)
England †	▲	507 (3.8)
Latvia (LSS) 1	▲	505 (3.5)
Italy	○	501 (5.0)
Bulgaria	○	497 (6.6)
New Zealand	○	496 (5.3)
Romania	○	491 (4.9)
International Avg.	○	**487 (0.7)**
United States	○	482 (3.9)
Moldova	○	479 (4.9)
Cyprus	▽	471 (4.0)
Lithuania 1‡	▽	467 (4.0)
Thailand	▽	463 (6.2)
Israel 2	▽	457 (5.1)
Macedonia, Rep. of	▽	451 (5.2)
Tunisia	▽	442 (3.1)
Jordan	▽	438 (4.4)
Turkey	▽	436 (6.5)
Chile	▽	412 (4.9)
Iran, Islamic Rep.	▽	401 (4.7)
Indonesia	▽	395 (5.1)
Philippines	▽	355 (6.2)
Morocco	▽	348 (3.5)
South Africa	▽	329 (4.8)

Scale: 200 500 800

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ Country average significantly higher than international average

○ Country average not significantly different from international average

▽ Country average significantly lower than international average

Significance tests adjusted for multiple comparisons

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90% of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

Data Representation, Analysis, and Probability
Average Scale Score

(21 items)

Country		Average Scale Score
Korea, Rep. of	▲	576 (4.2)
Singapore	▲	562 (6.2)
Chinese Taipei	▲	559 (5.1)
Japan	▲	555 (2.3)
Hong Kong, SAR[†]	▲	547 (5.4)
Belgium (Flemish)[†]	▲	544 (3.8)
Netherlands[†]	▲	538 (7.9)
Slovenia	▲	530 (4.2)
Finland	▲	525 (3.8)
Australia	▲	522 (6.3)
Slovak Republic	▲	521 (4.6)
Canada	▲	521 (4.5)
Hungary	▲	520 (5.9)
Czech Republic	▲	513 (5.9)
England[†]	○	506 (8.0)
United States	▲	506 (5.2)
Russian Federation	○	501 (4.8)
New Zealand	○	497 (5.0)
Latvia (LSS)[1]	○	495 (4.8)
Lithuania[1‡]	○	493 (3.6)
Bulgaria	○	493 (6.1)
Malaysia	○	491 (4.0)
International Avg.	○	**487 (0.7)**
Italy	○	484 (4.5)
Thailand	○	476 (4.0)
Cyprus	▽	472 (4.6)
Israel[2]	▽	468 (5.1)
Romania	▽	453 (4.7)
Moldova	▽	450 (5.7)
Tunisia	▽	446 (5.1)
Turkey	▽	446 (3.3)
Macedonia, Rep. of	▽	442 (6.2)
Jordan	▽	436 (7.8)
Iran, Islamic Rep.	▽	430 (6.0)
Chile	▽	429 (3.8)
Indonesia	▽	423 (4.4)
Philippines	▽	406 (3.5)
Morocco	▽	383 (3.5)
South Africa	▽	356 (3.8)

Scale: 200 500 800

Geometry
Average Scale Score

(21 items)

Country		Average Scale Score
Japan	▲	575 (5.1)
Korea, Rep. of	▲	573 (3.9)
Singapore	▲	560 (6.7)
Chinese Taipei	▲	557 (5.8)
Hong Kong, SAR[†]	▲	556 (4.9)
Belgium (Flemish)[†]	▲	535 (4.1)
Slovak Republic	▲	527 (7.3)
Bulgaria	▲	524 (5.9)
Latvia (LSS)[1]	▲	522 (5.6)
Russian Federation	▲	522 (6.0)
Netherlands[†]	▲	515 (5.5)
Czech Republic	▲	513 (5.5)
Canada	▲	507 (4.7)
Slovenia	○	506 (6.2)
Australia	○	497 (5.7)
Malaysia	○	497 (4.4)
Lithuania[1‡]	○	496 (5.8)
Finland	○	494 (6.0)
Hungary	○	489 (4.3)
International Avg.	○	**487 (0.7)**
Romania	○	487 (6.4)
Thailand	○	484 (4.4)
Cyprus	○	484 (4.6)
Tunisia	○	484 (4.4)
Italy	○	482 (5.6)
Moldova	○	481 (5.0)
New Zealand	○	478 (4.2)
United States	○	473 (4.4)
England[†]	▽	471 (4.2)
Israel[2]	▽	462 (5.4)
Macedonia, Rep. of	▽	460 (6.1)
Jordan	▽	449 (7.1)
Iran, Islamic Rep.	▽	447 (2.9)
Indonesia	▽	441 (5.1)
Turkey	▽	428 (5.7)
Chile	▽	412 (5.4)
Morocco	▽	407 (2.2)
Philippines	▽	383 (3.4)
South Africa	▽	335 (6.6)

Scale: 200 500 800

▲ Country average significantly higher than international average

○ Country average not significantly different from international average

▽ Country average significantly lower than international average

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Algebra
Average Scale Score

(35 items)

Country		Average Scale Score
Chinese Taipei	▲	586 (4.4)
Korea, Rep. of	▲	585 (2.7)
Singapore	▲	576 (6.2)
Japan	▲	569 (3.3)
Hong Kong, SAR †	▲	569 (4.5)
Belgium (Flemish) †	▲	540 (4.6)
Hungary	▲	536 (4.1)
Russian Federation	▲	529 (4.9)
Slovak Republic	▲	525 (4.6)
Slovenia	▲	525 (2.9)
Canada	▲	525 (2.4)
Netherlands †	▲	522 (7.7)
Australia	▲	520 (5.1)
Czech Republic	▲	514 (4.0)
Bulgaria	▲	512 (5.1)
United States	▲	506 (4.1)
Malaysia	▲	505 (4.8)
Latvia (LSS) 1	○	499 (4.3)
England †	○	498 (4.9)
Finland	▲	498 (3.1)
New Zealand	○	497 (4.7)
International Avg.	○	**487 (0.7)**
Lithuania 1‡	○	487 (3.7)
Italy	○	481 (3.6)
Romania	○	481 (5.2)
Israel 2	○	479 (4.5)
Cyprus	▽	479 (1.6)
Moldova	○	477 (3.7)
Macedonia, Rep. of	▽	465 (4.0)
Thailand	▽	456 (4.9)
Tunisia	▽	455 (2.7)
Jordan	▽	439 (5.3)
Iran, Islamic Rep.	▽	434 (4.9)
Turkey	▽	432 (4.6)
Indonesia	▽	424 (5.7)
Chile	▽	399 (4.3)
Morocco	▽	353 (4.7)
Philippines	▽	345 (5.8)
South Africa	▽	293 (7.7)

200 500 800

▲ Country average significantly higher than international average

○ Country average not significantly different from international average

▽ Country average significantly lower than international average

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

In Which Content Areas Are Countries Relatively Strong or Weak?

Exhibit 3.2 profiles the relative performance in mathematics content areas within each country, highlighting any variation in performance. 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. For example, it can be seen that Australia performed better in measurement than on the test as a whole, but worse in geometry. 3.2

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.[3]

Looking across countries, algebra was the content area least likely to feature either relatively strong or relatively weak performance. Even where there was variation, countries with disparate cultures and mathematical traditions made up both the group of countries relatively strong in algebra (Chinese Taipei, Hungary, Israel, Macedonia, and the United States) and the group that was relatively weak (Finland, the Philippines, and South Africa).

The profiles of relative performance also 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, in Morocco, the Philippines, and South Africa, differences of approximately two-thirds of a standard deviation between the highest and lowest content area averages occurred. On the other hand, there were only a small number of scale points of difference between highest and lowest content area means for countries such as Belgium (Flemish), Cyprus, Japan, Jordan, Korea, the Slovak Republic, and Turkey. For the latter countries, the data indicate a greater balance in mathematics content covered by the end of the eighth grade.

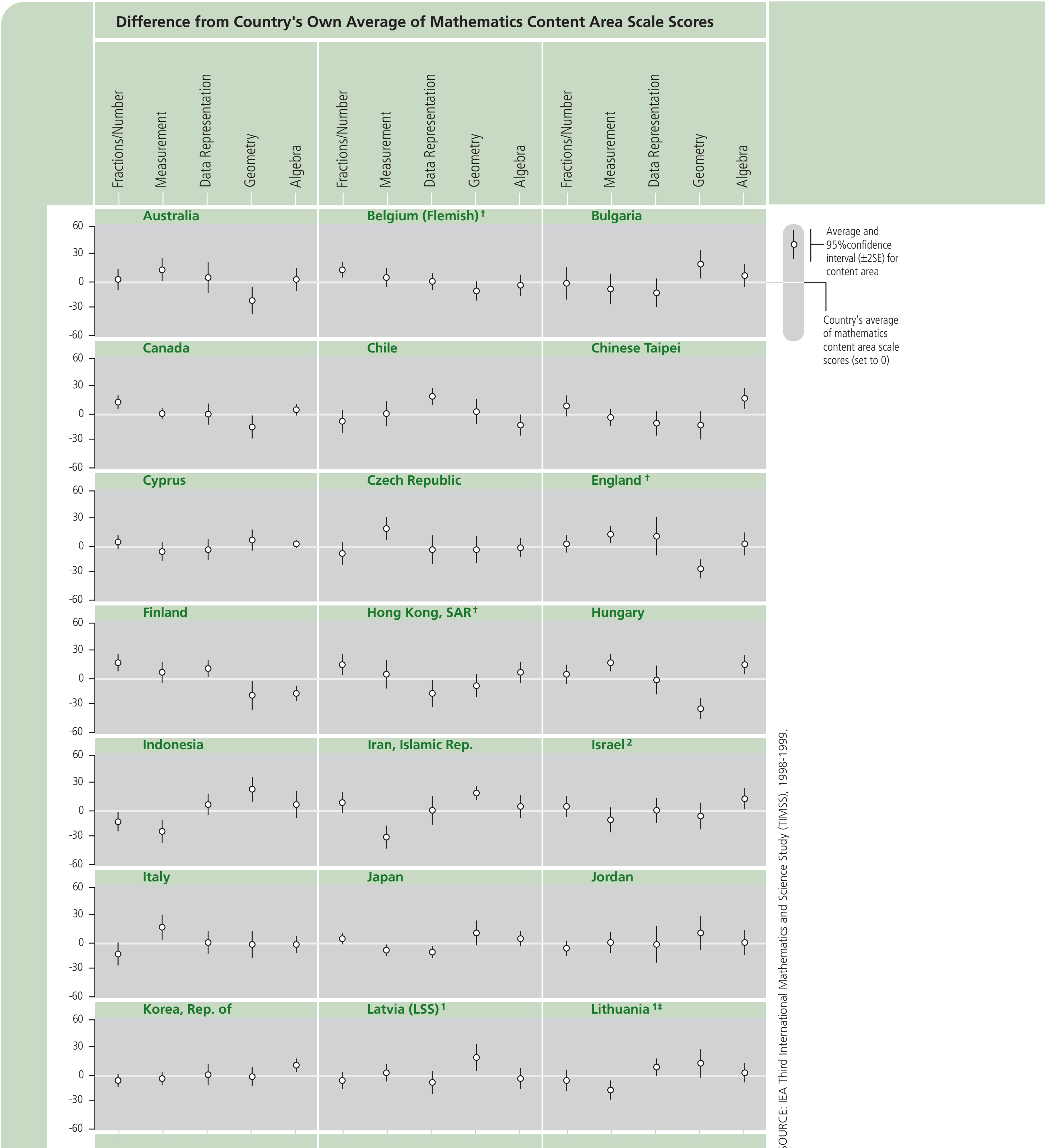
For some countries, national patterns of relative strengths and weaknesses profiled in Exhibit 3.2 are reflected in strengths and weaknesses relative to other countries (shown in Exhibit 3.1). For example, the Australian results show lower performance in geometry relative to

3 See Appendix C for information about the extent to which the TIMSS 1999 tests were judged to be relevant to the curriculum of the participating countries.

other content areas; geometry is also the only content area in which Australia did not perform significantly above the international average. In general, however, the within-country variations are difficult to discern in the results internationally across countries, particularly for countries with high or low performance.

Exhibit 3.2 Overleaf

Exhibit 3.2 Profiles of Relative Performance in Mathematics Content Areas



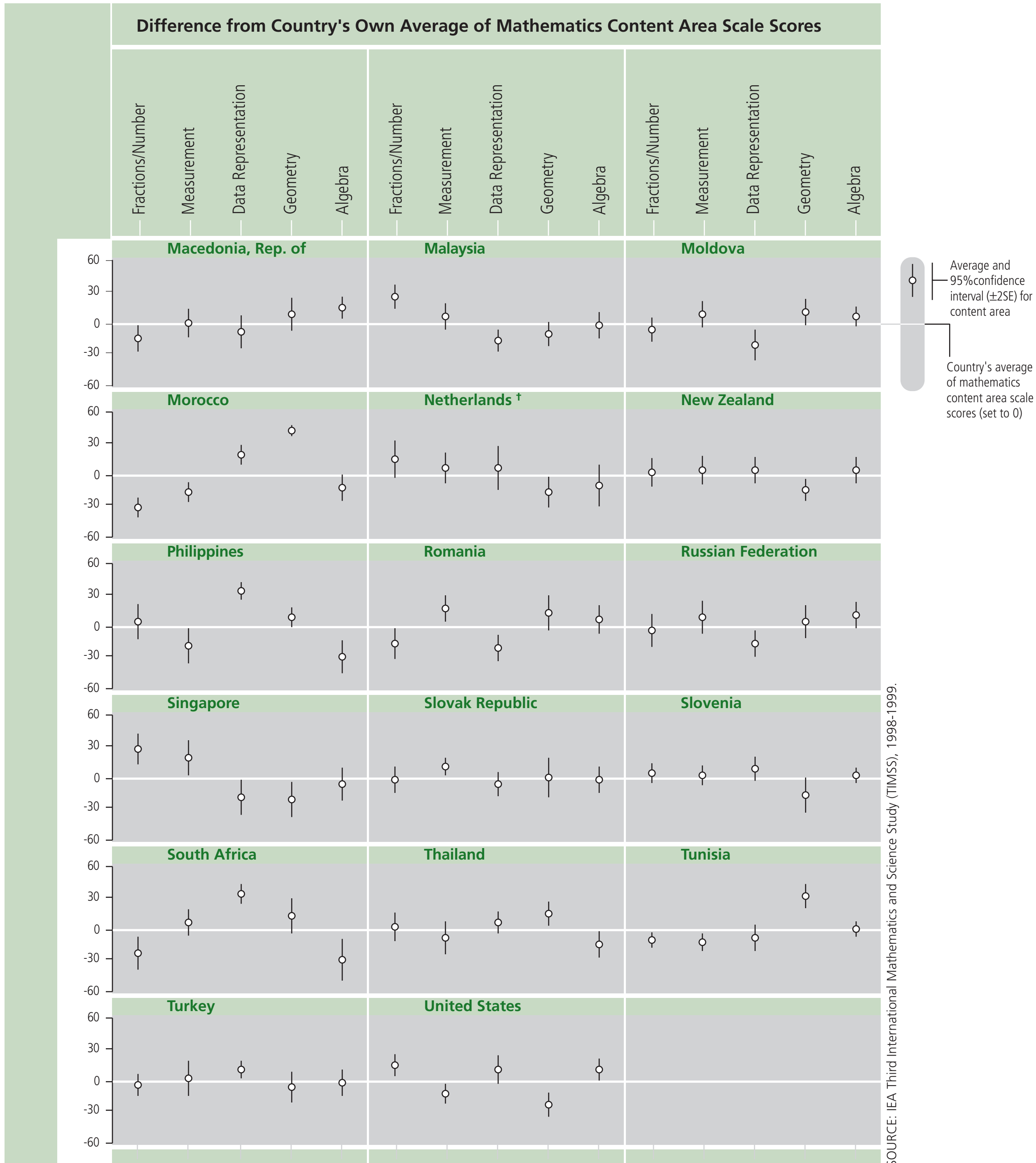
SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, at the beginning of the next school year.



SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

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

3.3 Exhibit 3.3 displays average achievement in mathematics content areas by gender. The most striking feature of the exhibit is the very small number of statistically significant differences. In geometry and algebra, there were no significant gender differences in average achievement in any country. Across all content areas, there were only five significant differences – three in Tunisia, and one apiece in Israel and the United States. Two of the cases occurred in fractions and number sense (Israel and Tunisia), two in measurement (Tunisia and the United States), and one in data representation, analysis, and probability (Tunisia). Only in fractions and number sense and in measurement were there significant differences in the international averages for girls and boys. It is noted, however, that the few significant differences in content area achievement showed boys having significantly higher achievement than girls.

An important stage of item selection for the TIMSS 1995 and TIMSS 1999 tests was the examination of item statistics to detect items that differentiated between groups, including girls and boys, at the country level. Such items were scrutinized and retained when there was no apparent source of gender bias. It is therefore likely that the absence of significant gender differences in the averages for girls and boys in a country is due partly to a balance between items on which one or the other gender tends to perform better. It is also reasonable to assume that where significant differences do occur, they result from gender differences in one or more of those factors in student backgrounds and schooling that have consistently been found to affect achievement in mathematics.

In spite of there being very few statistically significant differences between average achievement of girls and boys in the content areas, it is interesting to look at the patterns in differences. As highlighted by the differences in international averages, there is a strong tendency across countries for boys to have higher average achievement than girls in fractions and number sense, measurement, and geometry, and to a lesser extent in data representation, analysis, and probability. In algebra, the pattern shows girls with higher averages than boys (in 24 of the 38 countries).

The patterns in the performance of girls and boys found in TIMSS 1999 are consistent with previous IEA mathematics assessments. Girls tended to perform better than boys in algebra in both TIMSS 1995 and the Second International Mathematics Study (SIMS),[4] while boys were markedly stronger in measurement in previous studies.

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

Exhibit 3.3 Overleaf

Exhibit 3.3 Average Achievement in Mathematics Content Areas by Gender

	Average Scale Scores for Mathematics Content Areas					
	Fractions and Number Sense		Measurement		Data Representation, Analysis, and Probability	
	Girls	Boys	Girls	Boys	Girls	Boys
Australia	515 (4.7)	523 (5.7)	525 (6.4)	534 (6.5)	527 (10.6)	517 (6.2)
Belgium (Flemish) †	555 (6.0)	558 (7.7)	550 (6.5)	547 (8.2)	549 (6.7)	539 (8.8)
Bulgaria	502 (7.1)	505 (7.5)	494 (7.5)	500 (8.3)	493 (6.4)	492 (7.1)
Canada	530 (2.4)	536 (3.4)	519 (4.6)	523 (4.4)	520 (5.2)	522 (6.6)
Chile	400 (6.3)	406 (6.1)	403 (5.6)	420 (9.6)	426 (4.5)	431 (5.3)
Chinese Taipei	574 (4.9)	579 (5.2)	563 (3.3)	569 (5.2)	557 (5.5)	561 (7.9)
Cyprus	478 (3.8)	483 (3.9)	470 (3.8)	471 (5.5)	475 (6.1)	470 (7.5)
Czech Republic	498 (5.7)	517 (6.1)	525 (6.1)	545 (6.6)	502 (7.0)	524 (6.9)
England †	487 (6.0)	507 (5.4)	500 (6.4)	515 (5.4)	498 (6.8)	513 (10.9)
Finland	527 (4.1)	535 (4.9)	520 (5.5)	521 (4.8)	524 (5.5)	526 (6.4)
Hong Kong, SAR †	579 (4.5)	578 (6.1)	567 (5.7)	567 (7.3)	546 (5.3)	548 (7.4)
Hungary	520 (4.8)	531 (4.6)	533 (3.7)	543 (4.3)	514 (7.5)	527 (6.2)
Indonesia	407 (4.6)	406 (6.1)	394 (6.8)	396 (4.7)	419 (4.1)	428 (6.3)
Iran, Islamic Rep.	425 (6.8)	445 (4.9)	385 (6.9)	411 (7.9)	421 (6.4)	435 (8.3)
Israel 2	463 (4.9)	482 (5.2) ▲	449 (6.5)	465 (4.8)	464 (5.9)	473 (5.1)
Italy	463 (6.7)	479 (4.8)	494 (5.7)	508 (5.6)	483 (7.3)	484 (6.2)
Japan	563 (3.4)	576 (4.0)	556 (3.5)	559 (3.0)	552 (5.5)	559 (3.8)
Jordan	433 (5.3)	430 (5.5)	437 (7.9)	439 (7.1)	438 (9.9)	434 (7.2)
Korea, Rep. of	566 (4.3)	573 (3.3)	567 (3.8)	575 (3.2)	574 (6.2)	579 (5.4)
Latvia (LSS) 1	490 (4.9)	503 (5.2)	500 (4.5)	509 (5.5)	498 (5.0)	492 (7.4)
Lithuania 1‡	477 (5.1)	481 (4.9)	463 (4.1)	472 (5.4)	492 (5.4)	494 (5.7)
Macedonia, Rep. of	436 (6.1)	437 (5.4)	449 (8.9)	453 (6.6)	441 (9.7)	443 (6.3)
Malaysia	535 (5.3)	528 (6.6)	516 (5.6)	513 (7.4)	493 (6.1)	488 (10.7)
Moldova	461 (4.2)	470 (6.5)	479 (4.5)	478 (7.4)	449 (4.6)	452 (8.1)
Morocco	326 (5.7)	341 (4.5)	341 (6.4)	353 (4.6)	376 (5.5)	388 (3.3)
Netherlands †	540 (7.9)	551 (7.5)	535 (7.5)	540 (6.2)	534 (10.3)	541 (8.3)
New Zealand	496 (5.6)	490 (6.9)	494 (5.3)	498 (7.4)	502 (7.0)	492 (6.6)
Philippines	382 (7.4)	373 (6.3)	355 (6.4)	355 (8.6)	410 (5.2)	403 (4.3)
Romania	459 (5.4)	458 (7.1)	492 (5.9)	491 (6.8)	453 (6.0)	452 (5.8)
Russian Federation	510 (6.2)	516 (7.1)	524 (7.0)	529 (6.1)	502 (7.0)	501 (9.4)
Singapore	607 (6.2)	609 (6.8)	597 (7.3)	601 (9.0)	563 (6.8)	561 (8.8)
Slovak Republic	522 (5.4)	528 (5.3)	531 (3.9)	543 (4.7)	515 (5.1)	528 (5.9)
Slovenia	523 (4.8)	531 (4.5)	521 (4.9)	526 (5.5)	529 (6.6)	531 (6.9)
South Africa	292 (7.7)	308 (6.7)	322 (5.4)	336 (5.6)	352 (5.5)	361 (5.3)
Thailand	473 (6.4)	469 (5.6)	463 (8.9)	462 (6.4)	480 (6.5)	471 (5.1)
Tunisia	429 (3.1)	458 (3.4) ▲	429 (3.5)	455 (3.7) ▲	435 (6.6)	457 (4.5) ▲
Turkey	428 (5.2)	432 (5.0)	428 (6.7)	443 (7.7)	446 (5.0)	445 (4.8)
United States	505 (4.5)	514 (5.0)	475 (4.0)	489 (4.9) ▲	503 (7.0)	508 (6.3)
International Avg.	484 (0.9)	491 (0.9) ▲	483 (1.0)	491 (1.0) ▲	486 (1.1)	489 (1.1)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ Significantly higher than other gender

Significance tests adjusted for multiple comparisons

† Met guidelines for sample participation rates only after replacement schools were included (see Exhibit A.8).

1 National Desired Population does not cover all of International Desired Population (see Exhibit A.5). Because coverage falls below 65%, Latvia is annotated LSS for Latvian-Speaking Schools only.

2 National Defined Population covers less than 90 percent of National Desired Population (see Exhibit A.5).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

	Average Scale Scores for Mathematics Content Areas			
	Geometry		Algebra	
	Girls	Boys	Girls	Boys
Australia	496 (7.5)	498 (5.4)	523 (6.6)	517 (5.4)
Belgium (Flemish) †	538 (6.9)	531 (9.1)	545 (6.8)	535 (8.8)
Bulgaria	523 (5.8)	525 (7.8)	516 (5.6)	509 (5.7)
Canada	511 (6.5)	503 (4.9)	526 (3.7)	524 (5.2)
Chile	408 (6.2)	415 (6.0)	399 (4.5)	398 (6.3)
Chinese Taipei	555 (7.1)	560 (6.8)	585 (4.5)	588 (6.1)
Cyprus	487 (3.9)	482 (8.2)	487 (2.2)	472 (2.4)
Czech Republic	506 (7.6)	520 (4.9)	513 (3.9)	516 (6.7)
England †	467 (4.8)	474 (6.7)	493 (6.0)	502 (5.1)
Finland	495 (9.8)	494 (8.8)	498 (4.9)	498 (3.8)
Hong Kong, SAR †	558 (6.1)	554 (6.4)	570 (4.8)	568 (5.6)
Hungary	487 (8.1)	492 (7.3)	540 (4.9)	533 (4.9)
Indonesia	439 (7.3)	443 (5.8)	422 (6.8)	426 (5.9)
Iran, Islamic Rep.	433 (5.4)	457 (4.1)	431 (5.8)	435 (6.9)
Israel [2]	456 (7.1)	468 (6.8)	476 (5.6)	483 (5.4)
Italy	476 (8.6)	489 (5.1)	481 (5.4)	481 (4.0)
Japan	572 (5.8)	578 (5.8)	568 (4.2)	571 (3.6)
Jordan	451 (8.4)	447 (7.9)	446 (5.1)	433 (8.9)
Korea, Rep. of	569 (7.3)	578 (4.8)	585 (3.7)	585 (3.9)
Latvia (LSS) [1]	517 (4.2)	528 (9.0)	499 (4.5)	498 (5.0)
Lithuania [1‡]	494 (7.0)	498 (6.1)	490 (5.1)	483 (5.8)
Macedonia, Rep. of	459 (6.8)	460 (8.3)	469 (4.7)	461 (4.2)
Malaysia	496 (5.5)	497 (6.0)	508 (6.0)	502 (5.5)
Moldova	480 (7.0)	481 (7.6)	480 (4.6)	475 (5.5)
Morocco	405 (5.3)	408 (5.4)	350 (7.4)	354 (4.2)
Netherlands †	516 (7.0)	515 (5.2)	522 (9.3)	522 (7.4)
New Zealand	481 (8.3)	474 (6.7)	506 (5.6)	487 (6.4)
Philippines	383 (5.5)	383 (4.2)	355 (7.6)	333 (8.8)
Romania	490 (12.2)	484 (7.3)	489 (5.5)	473 (6.0)
Russian Federation	518 (7.2)	526 (7.4)	533 (5.7)	524 (6.3)
Singapore	556 (9.2)	565 (6.5)	578 (6.7)	574 (7.9)
Slovak Republic	524 (8.8)	529 (6.9)	530 (5.3)	521 (4.7)
Slovenia	507 (8.2)	505 (6.3)	530 (3.1)	520 (3.8)
South Africa	333 (8.5)	338 (6.1)	290 (8.4)	296 (9.7)
Thailand	483 (4.7)	486 (7.9)	460 (6.0)	452 (5.4)
Tunisia	476 (7.5)	492 (5.2)	450 (3.6)	460 (2.7)
Turkey	429 (5.5)	428 (8.1)	442 (5.1)	426 (4.7)
United States	469 (5.5)	477 (5.1)	507 (4.3)	504 (4.6)
International Avg.	485 (1.2)	489 (1.1)	489 (0.9)	485 (0.9)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

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 1995 and 1999 for items given in both the 1995 and 1999 TIMSS assessments, and the difference in performance between assessments. 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.

3.4

Changes in average achievement at a national level are not easy to bring about and inevitably take place over several years. Amending official curricula, producing relevant supporting resources, and changing teacher practice all take time, even under the most favorable conditions. TIMSS 1999 is only the second in what is expected to become a series of international surveys designed to reveal trends in achievement in mathematics and science. It is not surprising, therefore, that the trend data contained in Exhibit 3.4 reveal only a few significant changes in average achievement in the content areas. It is likely that the next TIMSS administration scheduled for 2003 will show more significant changes in achievement.

Still, even during the four years between 1995 and 1999, statistically significant improvements occurred for Canada and Latvia (LSS) in all content areas except measurement, and for Cyprus in three content areas. Each of these countries also showed slight improvement in the remaining content areas. Average achievement in the Czech Republic showed statistically significant decreases in three content areas, and a slight decline in the remaining two areas. A small but significant increase in the international average for data representation, analysis, and probability, the only content area with a significant change internationally between 1995 and 1999, may be a result of increasing efforts to include elementary statistical concepts at the primary grades.

Although the changes were not statistically significant, Australia, Belgium (Flemish), Hong Kong, the Netherlands, and the United States showed small increases in achievement in all five content area means. Conversely, Bulgaria and Italy had small decreases in average achievement in all content areas (with a significant change in Bulgaria in data representation, analysis, and probability).

Exhibit 3.4 Overleaf

Exhibit 3.4 Trends in Average Percent Correct in Mathematics Content Areas

	Average Percent Correct in Mathematics Content Areas*								
	Total Mathematics Trend Items (48 items)			Fractions and Number Sense Trend Items (17 items)			Measurement Trend Items (6 items)		
	1995	1999		1995	1999		1995	1999	
Australia	68 (0.9)	69 (1.1)	●	68 (0.8)	70 (1.0)	●	71 (0.9)	73 (1.1)	●
Belgium (Flemish)	73 (1.3)	76 (0.7)	●	75 (1.2)	77 (0.6)	●	77 (1.5)	79 (1.1)	●
Bulgaria	70 (1.3)	65 (1.3)	●	67 (1.6)	61 (1.4)	●	69 (1.5)	63 (1.1)	●
Canada	67 (0.5)	70 (0.4)	▲	69 (0.5)	72 (0.5)	▲	64 (0.6)	67 (0.7)	●
Cyprus	54 (0.5)	56 (0.4)	▲	55 (0.5)	58 (0.5)	▲	45 (0.8)	46 (0.6)	●
Czech Republic	72 (1.0)	67 (0.9)	▼	67 (1.2)	61 (1.1)	▼	80 (0.8)	77 (1.0)	●
England	64 (0.6)	63 (0.9)	●	65 (0.7)	65 (0.9)	●	67 (0.8)	66 (1.2)	●
Hong Kong, SAR	77 (1.3)	79 (0.9)	●	78 (1.3)	81 (0.9)	●	76 (1.4)	77 (1.0)	●
Hungary	67 (0.8)	68 (0.8)	●	63 (0.8)	65 (0.9)	●	73 (0.8)	74 (0.7)	●
Iran, Islamic Rep.	44 (0.6)	44 (0.6)	●	46 (0.7)	45 (0.7)	●	31 (1.0)	34 (0.7)	●
Italy	60 (0.9)	58 (1.1)	●	57 (1.0)	55 (1.1)	●	64 (1.2)	63 (1.2)	●
Japan	78 (0.3)	78 (0.3)	●	76 (0.4)	76 (0.4)	●	75 (0.4)	74 (0.5)	●
Korea, Rep. of	80 (0.4)	81 (0.4)	●	76 (0.5)	77 (0.4)	●	81 (0.6)	83 (0.4)	●
Latvia (LSS)	59 (0.8)	64 (0.8)	▲	54 (0.9)	59 (0.9)	▲	66 (1.0)	70 (1.0)	●
Lithuania	56 (1.0)	57 (1.0)	●	52 (1.0)	54 (1.1)	●	57 (0.9)	56 (0.9)	●
Netherlands	70 (1.6)	74 (1.6)	●	70 (1.3)	75 (1.7)	●	76 (1.6)	77 (1.6)	●
New Zealand	64 (1.1)	62 (1.2)	●	65 (1.0)	63 (1.2)	●	66 (1.2)	65 (1.3)	●
Romania	55 (1.0)	54 (1.1)	●	51 (0.9)	50 (1.1)	●	57 (1.2)	57 (1.3)	●
Russian Federation	68 (1.4)	68 (1.3)	●	64 (1.7)	64 (1.4)	●	69 (1.1)	73 (1.3)	●
Singapore	84 (0.7)	83 (1.1)	●	87 (0.6)	85 (1.0)	●	86 (0.7)	83 (1.1)	●
Slovak Republic	69 (0.7)	69 (0.9)	●	66 (0.8)	67 (1.1)	●	75 (0.7)	75 (0.9)	●
Slovenia	69 (0.7)	70 (0.6)	●	68 (0.8)	69 (0.7)	●	72 (0.8)	72 (0.7)	●
United States	61 (1.1)	63 (0.9)	●	63 (1.1)	66 (0.9)	●	53 (1.1)	55 (1.1)	●
International Avg. §	66 (0.2)	67 (0.2)	●	65 (0.2)	66 (0.2)	●	67 (0.2)	68 (0.2)	●
Countries with Unapproved Sampling Procedures at the Classroom Level in 1995									
Israel	66 (1.3)	59 (1.1)	▼	67 (1.2)	61 (1.0)	▼	63 (1.5)	55 (1.1)	▼
South Africa	29 (1.2)	27 (0.8)	●	31 (1.2)	29 (0.8)	●	30 (1.4)	28 (0.7)	●
Thailand	65 (1.3)	54 (1.0)	▼	66 (1.3)	55 (1.1)	▼	63 (1.5)	51 (1.2)	▼

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

* Applies only to items that appeared on both the 1995 and 1999 assessments.

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian-Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

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

	Average Percent Correct in Mathematics Content Areas*					
	Data Representation, Analysis, and Probability Trend Items		Geometry Trend Items		Algebra Trend Items	
	(8 items)		(6 items)		(11 items)	
	1995	1999	1995	1999	1995	1999
Australia	71 (0.8)	74 (1.0) ●	58 (1.1)	59 (1.4) ●	67 (1.0)	69 (1.2) ●
Belgium (Flemish)	74 (1.3)	77 (0.9) ●	66 (1.4)	70 (1.1) ●	72 (1.6)	73 (0.8) ●
Bulgaria	74 (1.3)	66 (1.1) ▼	76 (1.2)	73 (1.5) ●	71 (1.5)	66 (1.4) ●
Canada	70 (0.7)	73 (0.5) ▲	61 (0.7)	64 (0.7) ▲	64 (0.7)	70 (0.6) ▲
Cyprus	56 (0.7)	59 (0.6) ▲	56 (0.8)	59 (0.7) ●	53 (0.6)	54 (0.6) ●
Czech Republic	75 (0.8)	73 (0.8) ●	73 (1.2)	67 (1.2) ▼	72 (1.3)	65 (1.1) ▼
England	71 (0.7)	73 (0.9) ●	51 (1.0)	49 (1.2) ●	61 (0.8)	60 (1.2) ●
Hong Kong, SAR	74 (1.1)	78 (0.8) ●	78 (1.6)	80 (1.1) ●	78 (1.4)	79 (1.0) ●
Hungary	74 (0.6)	75 (0.9) ●	56 (1.1)	55 (1.1) ●	70 (0.9)	72 (0.8) ●
Iran, Islamic Rep.	45 (0.7)	47 (0.6) ●	44 (0.9)	44 (0.8) ●	48 (0.9)	47 (0.8) ●
Italy	67 (0.9)	65 (1.3) ●	59 (1.2)	58 (1.3) ●	58 (1.0)	55 (1.3) ●
Japan	79 (0.3)	80 (0.4) ●	84 (0.4)	82 (0.5) ●	79 (0.4)	79 (0.5) ●
Korea, Rep. of	85 (0.5)	85 (0.3) ●	83 (0.6)	84 (0.5) ●	81 (0.4)	83 (0.5) ●
Latvia (LSS)	63 (0.9)	69 (0.8) ▲	67 (1.0)	73 (0.9) ▲	56 (1.0)	60 (0.9) ▲
Lithuania	60 (1.0)	66 (0.9) ▲	64 (1.3)	63 (1.4) ●	55 (1.2)	54 (1.2) ●
Netherlands	77 (1.6)	80 (1.5) ●	62 (1.8)	66 (1.7) ●	65 (2.1)	70 (2.0) ●
New Zealand	70 (1.0)	69 (1.3) ●	55 (1.3)	51 (1.4) ●	60 (1.2)	60 (1.5) ●
Romania	57 (1.1)	56 (1.1) ●	62 (1.3)	59 (1.3) ●	56 (1.2)	55 (1.3) ●
Russian Federation	69 (1.4)	69 (1.2) ●	71 (1.0)	70 (1.6) ●	69 (1.5)	71 (1.4) ●
Singapore	79 (0.8)	79 (1.1) ●	82 (0.9)	81 (1.3) ●	83 (0.9)	82 (1.3) ●
Slovak Republic	71 (0.8)	73 (0.9) ●	71 (0.9)	71 (1.2) ●	67 (1.0)	66 (1.1) ●
Slovenia	75 (0.7)	76 (0.7) ●	64 (0.9)	63 (0.9) ●	69 (0.8)	69 (0.7) ●
United States	67 (1.0)	69 (0.9) ●	50 (1.1)	52 (1.0) ●	63 (1.3)	66 (1.0) ●
International Avg. §	70 (0.2)	71 (0.2) ▲	65 (0.2)	65 (0.2) ●	66 (0.2)	66 (0.2) ●
Countries with Unapproved Sampling Procedures at the Classroom Level in 1995						
Israel	66 (1.5)	62 (1.1) ●	65 (1.6)	56 (1.3) ▼	65 (1.6)	59 (1.2) ●
South Africa	31 (1.1)	29 (0.8) ●	23 (1.2)	22 (0.7) ●	27 (1.4)	26 (1.0) ●
Thailand	66 (1.0)	58 (1.0) ▼	68 (1.4)	57 (1.3) ▼	64 (1.5)	50 (1.1) ▼

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

CHAPTER 4

4

Students' Backgrounds and Attitudes Towards Mathematics

There is abundant evidence that student achievement is related to home background factors, and to students' activities and attitudes. To help interpret the achievement results, Chapter 4 provides detailed information about students' home backgrounds, how they spend their time out of school, their self-concept in mathematics, and their attitudes towards mathematics. Also provided is information on changes in results between 1995 and 1999.

To provide an educational context for interpreting the mathematics achievement results, TIMSS collected detailed information from students about their home backgrounds, how they spend their time out of school, and their attitudes towards mathematics. This chapter presents eighth-grade students' responses to a subset of these questions, together with changes in results between 1995 and 1999. Specifically, one set of questions addresses home resources and support for academic achievement. Another examines how much out-of-school time students spend on their schoolwork. A third set of questions elicits information on students' self-concept in mathematics and their feelings towards mathematics.

In an effort to summarize this information concisely and focus attention on educationally relevant support and practice, TIMSS sometimes has combined information from individual questions to form an index that was more global and reliable than the component questions (e.g., home educational resources). According to their responses, students were placed in a "high," "medium," or "low" category. Cutoff points were established so that the high level of an index corresponds to conditions or activities generally associated with good educational practice and high academic achievement. For each index, the percentages of students in each category are presented in relation to their mathematics achievement. The data for the component questions and more detail about some topic areas are provided in the reference section of this report (see reference section R.1).

What Educational Resources Do Students Have in Their Homes?

There is no shortage of evidence that students from homes with extensive educational resources have higher achievement in mathematics and other subjects than those from less advantaged backgrounds. This has been documented most recently in a study of the eighth-grade results from TIMSS in 1995.[1] The international report for these data[2] showed that students from homes with large numbers of books, with a range of educational study aids, or with parents with university-level education also had higher mathematics achievement. For the 1999 data presented in this report, student responses to these three variables were combined to form an index of home educational resources (HER).

1 Martin, M.O., Mullis, I.V.S., Gregory, K.D., Hoyle, C.D., and Shen, C. (2000), *Effective Schools in Science and Mathematics: IEA's Third International Mathematics and Science Study*, Chestnut Hill, MA: Boston College.

2 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.

4.1 Exhibit 4.1 summarizes the home educational resources index in a two-page display. The index is described on the first page. Students assigned to the high level of this index reported coming from homes with more than 100 books, with all three study aids (a computer, a study desk or table for the student's own use, and a dictionary), and where at least one parent finished university. Students assigned to the low level had 25 or fewer books in the home, not all three study aids, and parents that had not completed secondary education. The remaining students were assigned to the medium level.

The first page of the display also presents the percentage of students at each level of the index for each country, together with the average mathematics achievement for those students. Standard errors are also shown. Countries are ordered by the percentage of students at the high level of the index. The international average across all countries is shown at the bottom of each column. On the second page of the display, the percentage of students at the high level of the index is shown graphically for each country.

There are large differences among countries in the distribution of students across the three categories of the index. Students at the high level of the home educational resources index are relatively rare in most countries, with just nine percent in this category on average internationally. Countries with the greatest percentages included Canada, Australia, Israel, and the United States, each of which had more than one-fifth (22 percent or more) of their students at the high level. At the other extreme, Thailand, Iran, and Morocco had more than half of their students at the low level.

The educational significance of this wide divergence becomes apparent when achievement differences between the levels of the index are considered. There was a substantial difference in the average mathematics achievement of students at the three index levels in every country for which data were available. This is reflected in the international average, where the achievement difference between students at the high level (559) and the low level (431) amounted to 128 score points. This difference is slightly larger than the difference between the highest performing country, Singapore, and the international average.

Since the association between home educational resources and mathematics achievement is well documented in TIMSS and in extensive educational research, low average student achievement in some of the less wealthy countries most likely reflects the low level of educational resources in students' homes. However, since there is far from a one-to-one correspondence between high performance and home resources, there are clearly other influences at work also. For example, Singapore had about the same percentage of students (five percent) at the high level of the index as Romania and Malaysia, but the average mathematics achievement of its students was considerably higher than that of most participating countries, including Romania and Malaysia.

More detailed information on the student responses that were combined in the home educational resources index is presented in Exhibits R1.1 through R1.5 in the reference section. Exhibit R1.1 shows the percentage of eighth-grade students in each country that had a dictionary, study desk or table, or computer, and shows that students reporting having all three had higher average mathematics achievement than those without all three. The changes in these percentages presented in Exhibit R1.2 show that between 1995 and 1999 many countries had significant increases in the percentages of students having all three educational aids as well as those with computers in their homes (10 percent increase internationally, on average, for both).

R R1.1

R R1.2

Exhibit R1.3 shows for each country the percentage of students at each of five ranges of numbers of books in the home in relation to average mathematics achievement; changes in these results are shown in Exhibit R1.4. In most countries, the more books students reported in the home, the higher their mathematics achievement. Interestingly, however, the trend appears to be in the direction of having fewer books in the home. Taken together with the increase in home computers, this may reflect the emerging reliance on the Internet as a source of information.

R R1.3

R R1.4

The percentages of students in each of five categories of parents' educational level are shown in Exhibit R1.5, together with their average mathematics achievement. Although participants did their best to use educational categories that were comparable across all countries, the range of educational provision made this difficult. About half of the participating countries had to modify the response options presented to students in the questionnaire in order to conform to their national education system. Exhibit R1.6 provides details of how these modifications were aligned with the categories of parents' education used in this report. Despite the different educational approaches, structures, and organizations across the TIMSS countries, it is clear that parents' education is positively related to students' mathematics achievement. The pattern across countries was that eighth-grade students whose parents had more education were also those who had higher achievement in mathematics.

R R1.5

R R1.6

text continued page 120

Exhibit 4.1 Index of Home Educational Resources (HER)

Index of Home Educational Resources

Index based on students' responses to three questions about home educational resources: number of books in the home; educational aids in the home (computer, study desk/table for own use, dictionary); parents' education (see reference exhibits R1.1, R1.3, R1.5). High level indicates more than 100 books in the home; all three educational aids; and either parent's highest level of education is finished university. Low level indicates 25 or fewer books in the home; not all three educational aids; and both parents' highest level of education is some secondary or less or is not known. Medium level includes all other possible combinations of responses. See reference exhibit R1.6 for national definitions of educational levels; response categories were defined by each country to conform to their own educational system and may not be strictly comparable across countries.

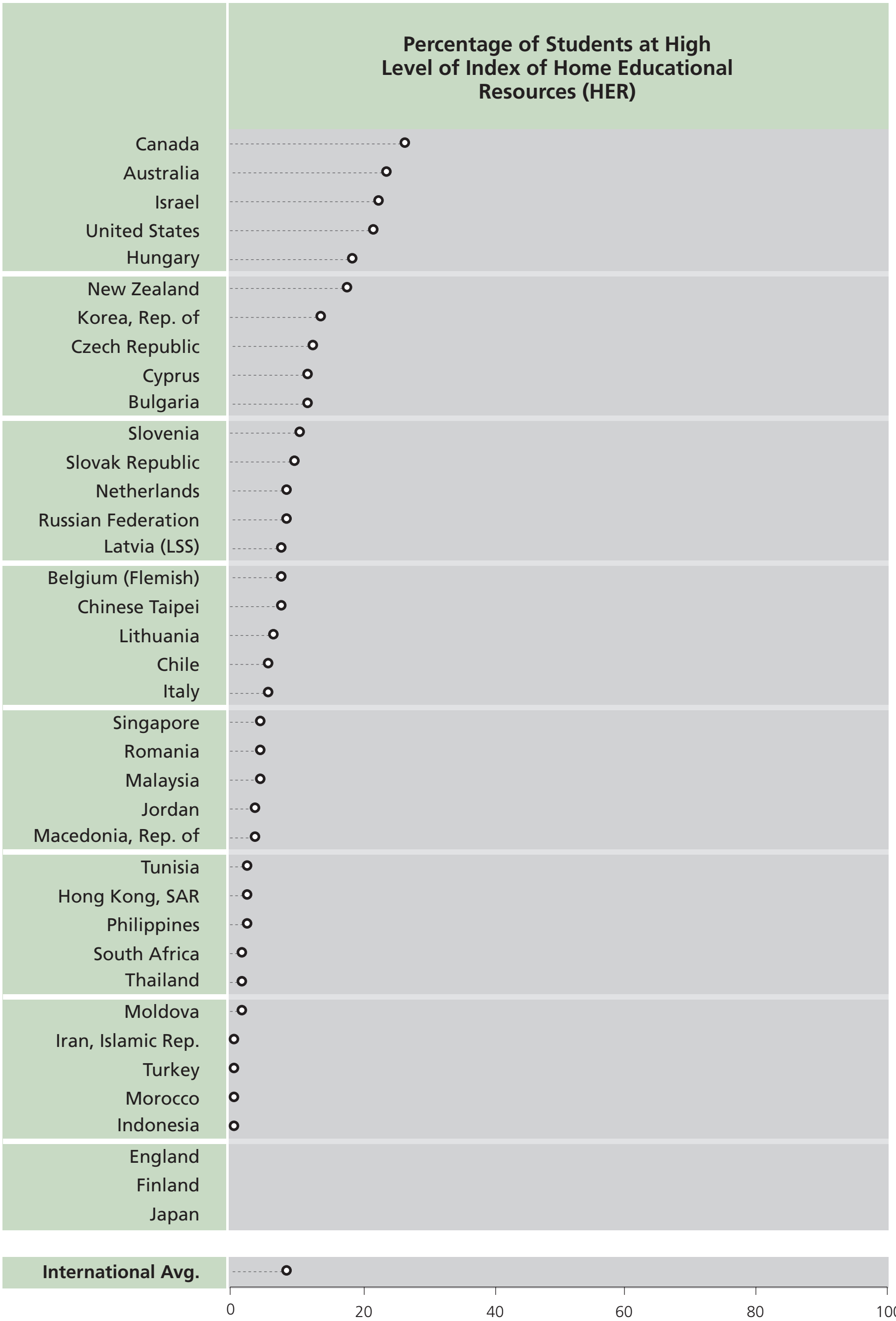
	High HER		Medium HER		Low HER	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Canada	27 (1.0)	552 (4.1)	71 (1.0)	525 (2.2)	2 (0.2)	~ ~
Australia	24 (1.5)	557 (5.1)	72 (1.4)	517 (4.9)	3 (0.4)	466 (12.5)
Israel	23 (1.2)	514 (4.8)	72 (1.1)	461 (3.5)	5 (0.6)	387 (10.0)
United States	22 (1.5)	555 (5.1)	73 (1.4)	492 (3.1)	4 (0.5)	427 (6.4)
Hungary	19 (1.2)	588 (5.3)	75 (1.2)	525 (3.1)	5 (0.7)	427 (7.9)
New Zealand	18 (1.2)	546 (6.5)	76 (1.1)	484 (4.8)	6 (0.5)	418 (9.3)
Korea, Rep. of	14 (0.8)	637 (2.8)	80 (0.8)	583 (1.9)	5 (0.3)	513 (5.0)
Czech Republic	13 (0.8)	560 (6.8)	83 (0.8)	517 (3.9)	4 (0.5)	460 (11.3)
Cyprus	12 (0.7)	526 (4.5)	81 (0.8)	476 (1.6)	8 (0.5)	415 (7.1)
Bulgaria	12 (1.7)	571 (12.9)	82 (1.5)	507 (4.7)	7 (0.8)	455 (9.8)
Slovenia	11 (0.8)	588 (5.8)	84 (0.8)	527 (2.6)	5 (0.5)	470 (8.8)
Slovak Republic	10 (0.9)	586 (6.8)	86 (0.9)	531 (3.7)	4 (0.5)	463 (8.0)
Netherlands	9 (1.1)	575 (10.4)	89 (1.1)	538 (7.1)	2 (0.8)	~ ~
Russian Federation	9 (0.8)	560 (8.3)	86 (0.7)	527 (5.9)	6 (0.5)	474 (12.6)
Latvia (LSS)	8 (0.7)	552 (7.2)	88 (0.8)	504 (3.4)	4 (0.5)	428 (7.9)
Belgium (Flemish)	8 (0.7)	599 (6.5)	86 (1.3)	559 (3.9)	6 (1.3)	490 (11.7)
Chinese Taipei	8 (0.7)	666 (7.2)	84 (0.7)	586 (3.6)	8 (0.6)	502 (6.6)
Lithuania ‡	7 (0.8)	552 (9.2)	83 (1.1)	483 (3.8)	10 (1.0)	420 (8.4)
Chile	6 (0.9)	476 (13.0)	56 (1.3)	410 (4.3)	38 (1.6)	355 (3.2)
Italy	6 (0.6)	528 (7.3)	81 (0.8)	484 (3.7)	14 (0.8)	434 (6.4)
Singapore	5 (0.7)	663 (10.0)	87 (0.6)	605 (6.0)	8 (0.7)	552 (7.3)
Romania	5 (0.7)	546 (9.7)	73 (1.6)	482 (5.2)	22 (1.7)	435 (7.3)
Malaysia	5 (0.6)	595 (5.5)	71 (0.9)	527 (4.6)	25 (1.1)	481 (4.3)
Jordan	4 (0.4)	502 (10.8)	71 (1.0)	440 (3.5)	25 (1.1)	391 (4.8)
Macedonia, Rep. of	4 (0.5)	517 (10.8)	73 (1.4)	465 (3.8)	23 (1.6)	389 (7.2)
Tunisia	3 (0.5)	493 (5.6)	59 (1.3)	455 (2.7)	38 (1.5)	434 (2.7)
Hong Kong, SAR	3 (0.3)	612 (8.8)	78 (0.8)	586 (4.2)	19 (0.9)	566 (5.2)
Philippines	3 (0.5)	431 (28.1)	67 (1.1)	353 (6.7)	30 (1.2)	322 (6.6)
South Africa	2 (0.4)	~ ~	54 (1.7)	293 (8.1)	44 (1.8)	246 (6.2)
Thailand	2 (0.3)	~ ~	47 (1.4)	487 (5.9)	51 (1.4)	447 (5.1)
Moldova	2 (0.4)	~ ~	80 (1.3)	476 (4.1)	18 (1.3)	443 (6.2)
Iran, Islamic Rep.	1 (0.4)	~ ~	45 (1.7)	443 (4.2)	54 (1.9)	404 (2.7)
Turkey	1 (0.2)	~ ~	51 (1.5)	445 (5.3)	48 (1.5)	410 (3.9)
Morocco	1 (0.2)	~ ~	36 (1.5)	349 (4.0)	63 (1.6)	333 (3.1)
Indonesia	1 (0.2)	~ ~	56 (1.6)	420 (5.1)	44 (1.7)	381 (5.4)
England	– –	– –	– –	– –	– –	– –
Finland	– –	– –	– –	– –	– –	– –
Japan	– –	– –	– –	– –	– –	– –
International Avg.	9 (0.1)	559 (2.3)	72 (0.2)	487 (0.8)	19 (0.2)	431 (1.2)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available. A tilde (~) indicates insufficient data to achievement.



SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

continued from
page 117

Students who speak a language (or languages) in the home that is different from the language spoken in school sometimes benefit from being multilingual. However, sometimes they are still developing proficiency in the language of instruction and can be at a disadvantage in learning situations. Exhibit 4.2 contains students' reports of how frequently they spoke the language of the TIMSS test at home in relation to their average mathematics achievement. 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. On average internationally, however, more than 20 percent of students were from homes where the language of the test was spoken only sometimes (17 percent), or never (5 percent). Many countries tested in more than one language in order to cover their whole student population. These included Canada (English and French), Finland (Finnish and Swedish), Hong Kong (Chinese and English), Israel (Hebrew and Arabic), Italy (Italian and German), Macedonia (Macedonian and Albanian), Moldova (Moldavian and Russian), the Philippines (Filipino and English), Romania (Romanian and Hungarian), and South Africa (English and Afrikaans). However, in countries like Indonesia, Morocco, the Philippines, Singapore, and South Africa, where less than one-third of students were from homes where the language of the test is routinely spoken, testing in all possible dialects and languages was prohibitive. Exhibit 4.3 displays, for countries that also took part in TIMSS in 1995, trend data for the language of the test spoken in the home. On average across countries there was very little change.

4.2

4.3

By the end of the eighth grade, students in most countries can say what their expectations are for further education. Although more than one-quarter of the students in some countries did not know, Exhibit 4.4 shows that, on average across countries, more than half of the students reported that they expected to finish university (a four-year degree program or equivalent). The highest percentages were in Canada, Korea, and the United States, where more than three-fourths expected to finish university, but the percentages were substantial in almost every country. In almost every country, also, there was a positive association between educational expectations and mathematics achievement.

4.4

R1.7 – R1.9

Exhibits R1.7 to R1.9 in the reference section present eighth-grade students' reports about how they themselves, their mothers, and their friends feel about the importance of doing well in various academic and non-academic activities. On average, more than 90 percent of the students reported that they and their mothers agreed that it was important to do well in mathematics, science, and language. Somewhat fewer reported that their friends agreed it was important to do well in these three subjects (77 to 86 percent). As might be anticipated, slightly more students reported that they and their friends felt it was important to have fun (92 percent) than reported that their mothers found this important (85 percent). More moderate agreement was reported for the importance of doing well in sports (from 81 to 87 percent). Students also were asked why they needed to do well in mathematics (see Exhibit R1.10). Although a motivating factor for 71 percent of the students on average internationally, pleasing their parents was secondary to getting into their desired secondary school or university (87 percent) or getting their desired job (81 percent).

R1.10
R

Exhibit 4.2 Frequency with Which Students Speak Language of the Test at Home

TIMSS 1999 8th grade Mathematics

		Always or Almost Always		Sometimes		Never	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Australia		89 (1.2)	529 (4.9)	10 (1.1)	516 (10.4)	1 (0.3)	~ ~
Belgium (Flemish)		86 (1.3)	566 (3.2)	8 (0.7)	531 (8.0)	6 (0.9)	522 (13.5)
Bulgaria		88 (1.9)	517 (6.3)	11 (1.7)	471 (13.7)	1 (0.3)	~ ~
Canada		91 (0.6)	532 (2.5)	8 (0.5)	523 (6.6)	2 (0.2)	~ ~
Chile	r	94 (0.5)	396 (4.9)	6 (0.5)	346 (7.7)	1 (0.1)	~ ~
Chinese Taipei		67 (1.4)	606 (3.9)	31 (1.3)	545 (5.3)	2 (0.2)	~ ~
Cyprus		89 (1.1)	482 (2.2)	9 (1.0)	459 (7.4)	2 (0.3)	~ ~
Czech Republic		98 (0.5)	523 (4.0)	1 (0.3)	~ ~	1 (0.2)	~ ~
England		95 (0.9)	500 (4.2)	5 (0.8)	471 (12.1)	0 (0.1)	~ ~
Finland		97 (0.7)	524 (2.7)	3 (0.7)	495 (15.6)	1 (0.2)	~ ~
Hong Kong, SAR	r	80 (2.4)	571 (4.5)	17 (1.9)	600 (8.5)	3 (0.5)	609 (12.2)
Hungary	r	99 (0.2)	538 (4.1)	0 (0.2)	~ ~	1 (0.1)	~ ~
Indonesia		28 (2.5)	411 (8.0)	63 (2.3)	397 (5.0)	9 (0.8)	428 (10.6)
Iran, Islamic Rep.		59 (3.4)	433 (4.3)	26 (2.1)	405 (4.2)	15 (1.6)	408 (5.0)
Israel		85 (1.2)	471 (3.6)	13 (1.1)	455 (10.0)	2 (0.3)	~ ~
Italy		77 (1.1)	493 (3.5)	20 (1.0)	434 (5.6)	4 (0.5)	442 (11.8)
Japan		97 (0.3)	581 (1.8)	3 (0.3)	532 (11.5)	0 (0.1)	~ ~
Jordan		85 (0.9)	433 (3.9)	13 (0.8)	415 (5.5)	2 (0.3)	~ ~
Korea, Rep. of		96 (0.3)	589 (2.0)	4 (0.3)	545 (4.9)	0 (0.0)	~ ~
Latvia (LSS)		92 (1.2)	506 (3.6)	6 (0.8)	493 (10.6)	2 (0.6)	~ ~
Lithuania ‡		99 (0.3)	482 (4.5)	1 (0.3)	~ ~	0 (0.1)	~ ~
Macedonia, Rep. of	s	93 (1.5)	470 (4.6)	5 (0.9)	436 (15.1)	2 (0.8)	~ ~
Malaysia		61 (2.3)	503 (4.4)	30 (1.7)	540 (6.1)	10 (1.0)	558 (8.5)
Moldova		89 (1.2)	473 (4.1)	10 (1.1)	445 (7.4)	1 (0.3)	~ ~
Morocco		20 (1.0)	322 (5.5)	51 (1.6)	346 (3.1)	30 (1.6)	335 (3.8)
Netherlands		86 (2.4)	544 (7.8)	8 (1.2)	529 (9.0)	6 (1.8)	531 (13.7)
New Zealand		90 (0.9)	495 (5.1)	9 (0.7)	470 (9.3)	1 (0.3)	~ ~
Philippines		11 (1.6)	301 (8.0)	70 (1.5)	356 (6.7)	19 (0.9)	337 (6.6)
Romania		92 (2.4)	477 (5.9)	5 (1.5)	442 (12.9)	3 (0.9)	440 (19.5)
Russian Federation		94 (2.3)	527 (5.9)	5 (2.3)	527 (36.9)	1 (0.2)	~ ~
Singapore		27 (1.8)	629 (7.1)	63 (1.6)	595 (6.4)	10 (0.5)	601 (8.2)
Slovak Republic		87 (1.9)	539 (4.2)	9 (1.4)	503 (7.7)	3 (0.7)	506 (12.6)
Slovenia		91 (1.0)	537 (2.8)	7 (0.7)	483 (8.3)	2 (0.4)	~ ~
South Africa		23 (2.2)	370 (11.7)	53 (1.6)	259 (4.7)	24 (1.8)	224 (9.3)
Thailand		72 (2.4)	477 (5.6)	25 (2.1)	446 (6.6)	3 (0.4)	424 (11.7)
Tunisia		88 (1.5)	449 (2.5)	8 (1.0)	443 (6.6)	4 (0.7)	453 (13.5)
Turkey		92 (1.4)	433 (3.9)	7 (1.3)	389 (12.2)	1 (0.2)	~ ~
United States		90 (1.0)	509 (3.8)	9 (1.0)	456 (8.2)	1 (0.1)	~ ~
International Avg.		79 (0.3)	493 (0.8)	17 (0.2)	466 (2.3)	5 (0.1)	455 (4.1)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 tilde (~) indicates insufficient data to report achievement.

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

Exhibit 4.3 Trends in Frequency with Which Students Speak Language of the Test at Home

TIMSS 1999 8th grade Mathematics

	Always or Almost Always		Sometimes		Never	
	Percent of Students	1995-1999 Difference	Percent of Students	1995-1999 Difference	Percent of Students	1995-1999 Difference
Australia	89 (1.2)	-2 (1.6) ●	10 (1.1)	2 (1.5) ●	1 (0.3)	0 (0.4) ●
Belgium (Flemish)	86 (1.3)	-1 (1.8) ●	8 (0.7)	0 (1.1) ●	6 (0.9)	1 (1.2) ●
Canada	91 (0.6)	1 (1.1) ●	8 (0.5)	-1 (1.0) ●	2 (0.2)	0 (0.3) ●
Cyprus	89 (1.1)	-2 (1.3) ●	9 (1.0)	2 (1.2) ●	2 (0.3)	0 (0.5) ●
Czech Republic	98 (0.5)	-1 (0.5) ●	1 (0.3)	1 (0.4) ●	1 (0.2)	0 (0.2) ●
England	95 (0.9)	-1 (1.1) ●	5 (0.8)	1 (1.1) ●	0 (0.1)	0 (0.2) ●
Hong Kong, SAR	– –	– –	– –	– –	– –	– –
Hungary r	99 (0.2)	0 (0.3) ●	0 (0.2)	0 (0.2) ●	1 (0.1)	0 (0.2) ●
Iran, Islamic Rep.	59 (3.4)	6 (4.4) ●	26 (2.1)	-7 (3.0) ●	15 (1.6)	1 (2.1) ●
Israel †	85 (1.5)	-3 (2.4) ●	13 (1.3)	3 (2.0) ●	2 (0.4)	-1 (0.7) ●
Italy	76 (1.4)	-2 (1.9) ●	21 (1.3)	2 (1.8) ●	3 (0.4)	-1 (0.7) ●
Japan	– –	– –	– –	– –	– –	– –
Korea, Rep. of	96 (0.3)	0 (0.5) ●	4 (0.3)	0 (0.5) ●	0 (0.0)	0 (0.1) ●
Latvia (LSS)	92 (1.2)	-6 (1.3) ▼	6 (0.8)	4 (1.0) ▲	2 (0.6)	1 (0.6) ●
Lithuania	99 (0.3)	0 (0.6) ●	1 (0.3)	0 (0.5) ●	0 (0.1)	0 (0.2) ●
Netherlands	86 (2.4)	-5 (2.7) ●	8 (1.2)	1 (1.5) ●	6 (1.8)	4 (1.9) ●
New Zealand	90 (0.9)	-1 (1.1) ●	9 (0.7)	1 (1.0) ●	1 (0.3)	0 (0.3) ●
Romania	92 (2.4)	9 (3.1) ▲	5 (1.5)	-8 (1.8) ▼	3 (0.9)	-2 (1.9) ●
Russian Federation	94 (2.3)	-3 (2.4) ●	5 (2.3)	3 (2.3) ●	1 (0.2)	0 (0.3) ●
Singapore	27 (1.8)	7 (2.2) ●	63 (1.6)	-8 (1.9) ▼	10 (0.5)	1 (0.8) ●
Slovak Republic	87 (1.9)	-2 (2.6) ●	9 (1.4)	0 (2.0) ●	3 (0.7)	1 (0.9) ●
Slovenia	91 (1.0)	-3 (1.3) ●	7 (0.7)	2 (1.0) ●	2 (0.4)	1 (0.5) ●
Thailand †	72 (2.4)	-3 (3.5) ●	25 (2.1)	6 (2.9) ●	3 (0.4)	-3 (0.9) ▼
United States	90 (1.0)	0 (1.7) ●	9 (1.0)	0 (1.6) ●	1 (0.1)	0 (0.2) ●
International Avg. §	87 (0.3)	0 (0.4) ●	10 (0.2)	-1 -(1.0) ●	3 (0.1)	0 (0.2) ●

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

Background data provided by students.

† Countries with unapproved sampling procedures at the classroom level in 1995.

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

Background data for Bulgaria and South Africa are unavailable for 1995.

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

A dash (–) indicates data are not available.

An "r" indicates a 70-84% student response rate, based on the lower response rate in either 1995 or 1999.

Exhibit 4.4 Students' Expectations for Finishing School*

Country	Finish University[1]		Some Vocational/ Technical Education or University Only[2]		Finish Secondary School Only[3]		Some Secondary School Only		Do Not Know	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Australia	55 (1.8)	554 (5.0)	14 (0.7)	524 (5.0)	17 (1.0)	479 (7.1)	5 (0.5)	460 (7.0)	9 (0.7)	501 (7.5)
Belgium (Flemish)	26 (1.1)	605 (6.4)	30 (0.9)	563 (3.8)	16 (0.9)	509 (4.5)	0 (0.0)	~ ~	29 (1.0)	544 (2.9)
Bulgaria	60 (2.9)	538 (7.2)	8 (0.6)	473 (6.8)	22 (2.2)	467 (6.1)	1 (0.2)	~ ~	9 (0.9)	477 (8.9)
Canada	76 (0.9)	539 (2.6)	13 (0.6)	522 (4.7)	4 (0.3)	482 (7.7)	1 (0.1)	~ ~	7 (0.6)	497 (6.0)
Chile r	54 (1.6)	428 (6.0)	18 (0.8)	367 (5.4)	19 (1.0)	347 (5.2)	2 (0.2)	~ ~	7 (0.5)	359 (6.7)
Chinese Taipei	62 (1.4)	624 (3.7)	24 (1.0)	527 (3.0)	2 (0.3)	~ ~	0 (0.1)	~ ~	11 (0.6)	534 (7.2)
Cyprus	51 (1.0)	515 (2.3)	14 (0.7)	455 (3.9)	13 (0.6)	431 (4.8)	6 (0.5)	372 (8.4)	16 (0.9)	460 (5.2)
Czech Republic	38 (1.8)	564 (4.1)	5 (0.6)	542 (7.1)	39 (1.5)	496 (3.3)	8 (1.0)	452 (7.1)	10 (0.8)	493 (7.6)
England	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –
Finland	10 (0.8)	564 (5.8)	22 (1.0)	541 (3.2)	41 (1.2)	503 (3.4)	3 (0.4)	481 (7.9)	24 (0.8)	519 (4.8)
Hong Kong, SAR	63 (1.7)	601 (3.8)	20 (0.9)	562 (4.9)	10 (0.8)	529 (7.7)	1 (0.2)	~ ~	6 (0.4)	562 (6.8)
Hungary	56 (1.8)	575 (3.7)	0 (0.0)	~ ~	39 (1.7)	482 (4.0)	1 (0.2)	~ ~	4 (0.4)	511 (9.5)
Indonesia	39 (1.8)	435 (5.7)	30 (1.1)	401 (5.3)	12 (0.9)	381 (6.1)	5 (0.5)	336 (9.2)	13 (1.0)	373 (8.4)
Iran, Islamic Rep.	48 (1.7)	444 (4.6)	6 (0.4)	415 (9.6)	6 (0.5)	377 (8.8)	4 (0.5)	378 (8.7)	36 (1.2)	411 (4.0)
Israel	59 (1.0)	492 (4.2)	16 (0.6)	457 (7.0)	11 (0.7)	419 (6.2)	1 (0.2)	~ ~	13 (0.7)	438 (7.5)
Italy	33 (1.3)	517 (4.1)	19 (0.9)	487 (4.4)	31 (1.1)	463 (4.0)	7 (0.6)	396 (10.4)	9 (0.7)	461 (8.7)
Japan	38 (0.9)	614 (2.7)	18 (0.6)	564 (2.6)	18 (0.7)	532 (3.0)	1 (0.1)	~ ~	25 (0.7)	572 (3.1)
Jordan	60 (1.1)	461 (3.9)	11 (0.6)	376 (6.1)	5 (0.5)	365 (7.8)	3 (0.3)	372 (12.6)	21 (0.8)	407 (4.8)
Korea, Rep. of	77 (0.7)	605 (1.9)	8 (0.4)	521 (4.2)	4 (0.3)	500 (6.3)	0 (0.1)	~ ~	11 (0.5)	551 (4.3)
Latvia (LSS)	65 (1.5)	525 (3.9)	13 (0.9)	481 (5.5)	8 (0.7)	467 (6.1)	1 (0.1)	~ ~	13 (1.0)	466 (6.1)
Lithuania ‡	45 (2.1)	523 (4.4)	25 (1.2)	455 (4.6)	6 (0.6)	439 (8.3)	2 (0.3)	~ ~	23 (1.2)	446 (5.4)
Macedonia, Rep. of	53 (1.8)	491 (3.6)	11 (0.7)	444 (5.2)	17 (1.1)	413 (6.2)	8 (0.6)	375 (9.4)	11 (0.9)	395 (10.0)
Malaysia	65 (1.4)	533 (4.4)	18 (0.9)	498 (5.8)	4 (0.4)	483 (8.7)	2 (0.2)	~ ~	11 (0.8)	501 (6.5)
Moldova	45 (1.7)	493 (4.2)	20 (1.1)	466 (6.5)	9 (0.8)	451 (7.7)	4 (0.6)	441 (12.5)	22 (1.2)	444 (5.5)
Morocco	43 (0.9)	356 (4.6)	22 (0.9)	326 (4.7)	6 (0.4)	321 (11.2)	6 (0.7)	306 (7.3)	23 (0.7)	340 (7.4)
Netherlands	22 (2.8)	582 (9.6)	30 (1.8)	549 (5.7)	29 (2.6)	507 (9.0)	1 (0.2)	~ ~	18 (0.9)	533 (8.1)
New Zealand	52 (1.5)	520 (5.8)	16 (0.7)	477 (5.2)	16 (0.8)	451 (4.9)	3 (0.3)	433 (7.7)	13 (0.7)	465 (7.0)
Philippines	64 (2.0)	374 (6.3)	10 (0.6)	299 (7.3)	9 (0.6)	293 (9.3)	8 (0.8)	293 (14.3)	8 (0.7)	315 (9.8)
Romania	43 (2.0)	520 (5.9)	10 (0.6)	446 (9.4)	25 (1.3)	454 (6.9)	4 (0.8)	460 (17.0)	19 (1.3)	428 (7.8)
Russian Federation	61 (1.5)	547 (5.4)	19 (1.0)	505 (6.1)	7 (0.5)	481 (10.4)	2 (0.5)	~ ~	11 (0.7)	496 (7.8)
Singapore	57 (2.1)	625 (6.1)	26 (1.6)	576 (5.5)	2 (0.3)	~ ~	0 (0.0)	~ ~	15 (0.7)	587 (8.2)
Slovak Republic	46 (2.3)	572 (3.8)	11 (0.8)	525 (5.5)	33 (1.6)	498 (3.6)	2 (0.3)	~ ~	8 (0.7)	499 (7.3)
Slovenia	40 (1.0)	579 (2.8)	32 (0.9)	508 (4.0)	18 (0.7)	495 (4.2)	4 (0.4)	436 (7.7)	6 (0.5)	498 (7.5)
South Africa	55 (1.4)	292 (8.8)	18 (0.9)	262 (9.1)	10 (0.6)	263 (7.5)	9 (0.7)	236 (12.1)	8 (0.6)	260 (11.0)
Thailand	55 (1.6)	493 (5.5)	4 (0.3)	458 (10.2)	23 (1.2)	439 (5.6)	5 (0.5)	415 (10.4)	13 (0.9)	437 (6.8)
Tunisia	59 (1.0)	457 (3.3)	23 (0.7)	437 (2.6)	6 (0.4)	425 (6.9)	2 (0.2)	~ ~	10 (0.5)	442 (6.2)
Turkey	62 (1.3)	454 (5.0)	15 (0.8)	394 (5.0)	8 (0.5)	386 (6.9)	4 (0.4)	374 (9.1)	12 (0.5)	394 (5.9)
United States	78 (1.2)	516 (3.8)	9 (0.6)	466 (5.1)	5 (0.4)	426 (6.2)	1 (0.1)	~ ~	7 (0.5)	474 (5.9)
International Avg.	52 (0.3)	517 (0.8)	17 (0.1)	469 (1.0)	15 (0.2)	442 (1.0)	3 (0.1)	390 (3.1)	14 (0.1)	462 (1.1)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

* Response categories were defined by each country to conform to their own educational system and may not be strictly comparable across countries. See reference exhibit R1.6 for country modifications to the definitions of educational levels.

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

2 In some countries, may include higher post-secondary education levels.

3 In most countries, finish secondary school corresponds to completion of an upper-secondary track terminating after 11 to 13 years of schooling (ISCED level 3 vocational, apprenticeship or academic tracks).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available. A tilde (~) indicates insufficient data to report achievement.

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

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

One of the major ways that students can consolidate and extend classroom learning is to spend time out of school studying or doing homework in school subjects. Well-chosen homework assignments can reinforce classroom learning, and by providing a challenge can encourage students to extend their understanding of the subject matter. Homework also allows students who are having trouble keeping up with their classmates to review material taught in class.

To summarize the amount of time typically devoted to homework in each country, TIMSS constructed an index of out-of-school study time (OST) that assigns students to a high, medium, or low level on the basis of the amount of time they reported studying mathematics, science, and other subjects. Students at the high level reported spending more than three hours each day out of school studying all subjects combined. Students at the medium level reported spending more than one hour but not more than three, while those at the low level reported one hour or less per day of out-of-school study.

Exhibit 4.5 presents the percentages of students at the various levels of this index across countries, and their average mathematics achievement. On average across countries, 38 percent of eighth-grade students were at the high level of the out-of-school study time index, and a further 48 percent were at the medium level. Only 14 percent, on average, were at the low level, with just one hour of homework or less each day. Countries with a heavy emphasis on homework included Iran, Malaysia, Singapore, Italy, Jordan, Tunisia, Turkey, Macedonia, Romania, Moldova, and Morocco, where more than half of the students were at the high level of the index. In these countries, homework seems to be an important part of teachers' instructional strategy. In contrast, there seems to be relatively little emphasis on homework in Australia, Chile, Chinese Taipei, the Czech Republic, Hong Kong, Japan, Korea, New Zealand, and the United States, where one-fifth or more of students were at the low level of the index. 4.5

On average internationally, and in most of the countries, students at the low level of the index also had lower mathematics achievement, on average, than their classmates who reported more out-of-school study time. However, spending a lot of time studying was not usually associated with higher achievement. On average internationally and in many countries, students at the medium level of the study index had average achievement that was as high as or higher than that of students at the high level. This pattern suggests that, compared with their higher-achieving counterparts, the lower-performing students may do less homework, either because they simply do not do it or because their teachers do not assign it, or more homework, perhaps in an effort to keep up academically.

4.6 Exhibit 4.6 presents information on trends in the index of out-of-school study time from 1995 to 1999. Internationally on average there was no change. Among countries with a significant decrease in the percentage at the high level were Cyprus, Hong Kong, Japan, Korea, Singapore, and Thailand. In contrast, Canada, Latvia (LSS), Lithuania, and the Russian Federation had increased percentages at the high level of the index.

More detailed information on the amount of time students reported
4.7 spending on mathematics homework is presented in Exhibit 4.7. The results reveal that students spend 1.1 hours per day doing mathematics homework, on average internationally. The exhibit also shows the percentages of students that reported spending one hour or more, less than one hour, and no time at all studying mathematics or doing mathematics homework on a normal school day, together with their average mathematics achievement. Half the students, on average internationally, reported spending some time but less than one hour each day, and these students had higher average achievement than those spending one hour or more or those spending no time at all. Another 40 percent reported spending more than one hour per day doing mathematics homework. Countries where more than half of the students reported spending an hour or more included Indonesia, Iran, Italy, Jordan, Malaysia, Morocco, the Philippines, Romania, Singapore, South Africa, Tunisia, and Turkey. The countries where students reported the least mathematics homework included four of the top-performing countries – Chinese Taipei, Hong Kong, Japan, and Korea. In these countries, one-fourth or more of students (25 to 34 percent) reported spending no out-of-school time studying mathematics or doing mathematics homework on a normal school day.

Further detail on the student data that underlie the index of out-of-school
R1.11 study time is provided in Exhibit R1.11 in the reference section. On average, in comparison with the 1.1 hours each day students spent on mathematics homework, they reported 2.8 hours of homework in total. Exhibit
R1.12 R1.12 shows essentially no change on average internationally in the amount of homework reported by students from 1995 to 1999. To provide a fuller picture of how students spend their out-of-school time on a
R1.13 school day, Exhibit R1.13, also in the reference section, gives students' reports on how they spend their daily leisure time. The two most popular activities are watching television or videos and playing or talking with friends (each about two hours per day).

Exhibits 4.5 – 4.7 Overleaf

Exhibit 4.5 Index of Out-of-School Study Time (OST)

Index of Out-of-School Study Time

Index based on students' responses to three questions about out-of-school study time: time spent after school studying mathematics or doing mathematics homework; time spent after school studying science or doing science homework; time spent after school studying or doing homework in school subjects other than mathematics and science (see reference exhibit R1.11). Number of hours based on: no time = 0, less than 1 hour = 0.5, 1-2 hours = 1.5, 3-5 hours = 4, more than 5 hours = 7. High level indicates more than three hours studying all subjects combined. Medium level indicates more than one hour to three hours studying all subjects combined. Low level indicates one hour or less studying all subjects combined.

		High OST		Medium OST		Low OST	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Iran, Islamic Rep.	r	69 (1.1)	431 (3.6)	27 (0.9)	420 (4.3)	4 (0.4)	389 (11.8)
Malaysia		65 (1.2)	522 (4.2)	31 (1.0)	524 (6.2)	3 (0.3)	494 (11.2)
Singapore		59 (1.2)	608 (5.8)	35 (0.9)	609 (7.4)	7 (0.6)	559 (10.2)
Italy		58 (1.3)	489 (4.1)	36 (1.2)	487 (4.6)	6 (0.6)	405 (9.1)
Jordan	s	58 (1.2)	449 (4.7)	33 (0.9)	448 (5.3)	8 (0.7)	372 (11.1)
Tunisia	r	58 (0.9)	450 (3.0)	34 (0.8)	457 (3.1)	8 (0.6)	454 (7.1)
Turkey	r	56 (1.3)	442 (4.7)	39 (1.0)	429 (5.0)	6 (0.5)	404 (9.2)
Macedonia, Rep. of	r	55 (1.3)	463 (4.0)	39 (1.1)	463 (4.6)	6 (0.5)	428 (9.4)
Romania	r	55 (1.6)	491 (6.0)	33 (1.1)	468 (5.3)	12 (1.0)	430 (7.9)
Moldova	r	52 (1.3)	478 (4.8)	38 (1.1)	476 (4.8)	10 (0.8)	455 (7.6)
Morocco	s	51 (1.5)	349 (3.2)	34 (1.1)	349 (6.3)	15 (0.8)	339 (6.9)
Russian Federation		48 (1.3)	540 (4.7)	46 (1.2)	532 (7.0)	6 (0.6)	479 (9.3)
Philippines	s	48 (0.9)	363 (6.3)	45 (0.9)	370 (6.4)	7 (0.5)	315 (8.1)
Indonesia		47 (1.4)	413 (5.5)	43 (1.0)	408 (5.3)	11 (0.8)	392 (8.1)
Thailand		45 (1.2)	482 (5.6)	47 (1.0)	463 (5.6)	8 (0.5)	428 (6.0)
Bulgaria		45 (1.5)	526 (6.8)	40 (1.0)	516 (5.7)	15 (1.2)	491 (7.4)
South Africa	s	44 (1.3)	288 (8.1)	41 (0.7)	304 (11.2)	15 (1.1)	258 (7.7)
Belgium (Flemish)		41 (1.3)	554 (3.3)	52 (1.1)	571 (3.8)	7 (1.0)	516 (16.4)
Hungary		40 (1.3)	534 (4.1)	52 (1.1)	539 (4.2)	8 (0.6)	489 (7.8)
Latvia (LSS)		40 (1.2)	499 (4.2)	54 (1.2)	516 (4.0)	6 (0.5)	484 (9.3)
Cyprus		35 (1.1)	479 (2.8)	51 (1.1)	495 (2.3)	14 (0.7)	431 (6.4)
Lithuania ‡		35 (1.2)	492 (4.8)	57 (1.2)	485 (4.4)	8 (0.8)	443 (10.1)
Israel		35 (1.5)	456 (5.2)	53 (1.2)	488 (3.2)	12 (0.8)	471 (7.9)
Slovenia		32 (1.0)	514 (3.8)	55 (0.9)	543 (3.1)	13 (0.8)	530 (5.7)
Chile		29 (0.9)	397 (6.9)	51 (0.7)	403 (5.1)	20 (0.8)	389 (5.4)
Slovak Republic		24 (0.9)	522 (4.3)	65 (1.1)	541 (4.1)	10 (0.7)	536 (7.3)
Canada		24 (0.8)	516 (3.5)	59 (1.0)	540 (2.8)	18 (0.8)	528 (4.1)
Chinese Taipei		23 (1.0)	625 (4.5)	42 (0.8)	602 (3.9)	35 (1.3)	542 (4.4)
United States		22 (0.8)	508 (4.8)	56 (0.9)	517 (4.1)	23 (1.3)	477 (3.9)
Netherlands		19 (1.4)	521 (11.5)	74 (1.3)	548 (6.5)	7 (1.0)	529 (12.8)
Australia		17 (0.9)	518 (6.0)	61 (1.4)	539 (5.0)	22 (1.4)	497 (5.6)
New Zealand		17 (1.0)	488 (6.8)	63 (1.3)	511 (5.2)	20 (1.2)	449 (5.4)
Japan		17 (0.9)	586 (2.9)	49 (0.9)	587 (2.1)	35 (1.3)	564 (3.1)
Hong Kong, SAR		16 (0.8)	600 (5.3)	42 (0.9)	595 (3.9)	42 (1.4)	564 (5.0)
Czech Republic		16 (1.1)	500 (5.7)	62 (1.4)	527 (4.7)	22 (1.3)	519 (6.5)
Korea, Rep. of		16 (0.7)	612 (4.3)	43 (0.7)	601 (2.5)	41 (1.0)	565 (2.5)
Finland		9 (0.7)	498 (6.6)	82 (1.0)	525 (2.6)	9 (0.8)	512 (6.2)
England		– –	– –	– –	– –	– –	– –
International Avg.		38 (0.2)	492 (0.9)	48 (0.2)	497 (0.8)	14 (0.1)	463 (1.6)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

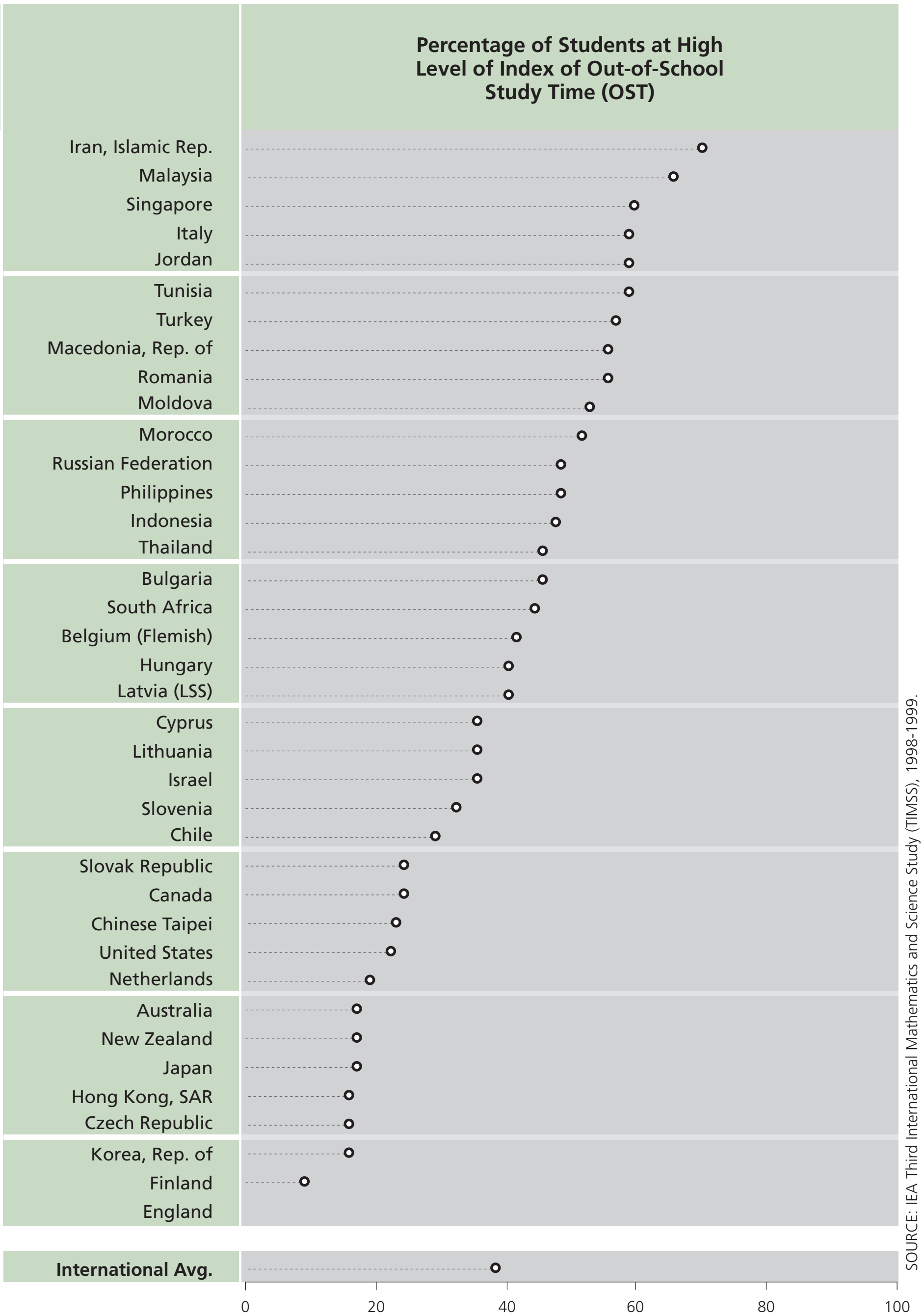

Percentage of Students at High Level of Index of Out-of-School Study Time (OST)
Iran, Islamic Rep.
Malaysia
Singapore
Italy
Jordan
Tunisia
Turkey
Macedonia, Rep. of
Romania
Moldova
Morocco
Russian Federation
Philippines
Indonesia
Thailand
Bulgaria
South Africa
Belgium (Flemish)
Hungary
Latvia (LSS)
Cyprus
Lithuania
Israel
Slovenia
Chile
Slovak Republic
Canada
Chinese Taipei
United States
Netherlands
Australia
New Zealand
Japan
Hong Kong, SAR
Czech Republic
Korea, Rep. of
Finland
England
International Avg.
0
20
40
60
80
100
SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Exhibit 4.6 Trends in Index of Out-of-School Study Time (OST)

	High OST Percent of Students			Medium OST Percent of Students			Low OST Percent of Students		
	1995	1999	1995-1999 Difference	1995	1999	1995-1999 Difference	1995	1999	1995-1999 Difference
Australia	16 (0.7)	17 (0.9)	1 (1.1) ●	58 (1.1)	61 (1.4)	2 (1.7) ●	26 (1.2)	22 (1.4)	-3 (1.9) ●
Belgium (Flemish)	42 (1.6)	41 (1.3)	-1 (2.0) ●	52 (1.3)	52 (1.1)	-1 (1.7) ●	6 (0.7)	7 (1.0)	1 (1.2) ●
Canada	19 (0.9)	24 (0.8)	4 (1.3) ▲	55 (1.2)	59 (1.0)	4 (1.6) ●	26 (1.5)	18 (0.8)	-8 (1.7) ▼
Cyprus	41 (0.9)	35 (1.1)	-5 (1.4) ▼	44 (0.9)	51 (1.1)	7 (1.4) ▲	15 (0.8)	14 (0.7)	-2 (1.0) ●
Czech Republic	13 (0.7)	16 (1.1)	3 (1.3) ●	60 (1.3)	62 (1.4)	2 (1.9) ●	27 (1.6)	22 (1.3)	-5 (2.1) ●
England	– –	– –	– –	– –	– –	– –	– –	– –	– –
Hong Kong, SAR	28 (1.1)	16 (0.8)	-12 (1.4) ▼	50 (1.0)	42 (0.9)	-8 (1.4) ▼	22 (1.4)	42 (1.4)	20 (2.0) ▲
Hungary	39 (1.4)	40 (1.3)	2 (1.9) ●	53 (1.3)	52 (1.1)	0 (1.7) ●	9 (0.7)	8 (0.6)	-1 (0.9) ●
Iran, Islamic Rep. s	74 (1.6)	69 (1.1)	-4 (1.9) ●	24 (1.4)	27 (0.9)	3 (1.7) ●	3 (0.4)	4 (0.4)	2 (0.6) ●
Israel †	31 (1.9)	33 (1.7)	2 (2.5) ●	54 (1.7)	55 (1.4)	1 (2.2) ●	14 (1.3)	12 (0.9)	-3 (1.6) ●
Italy	60 (1.6)	60 (1.6)	0 (2.2) ●	34 (1.4)	34 (1.4)	1 (2.0) ●	6 (0.7)	6 (0.7)	-1 (1.0) ●
Japan	27 (1.0)	17 (0.9)	-10 (1.3) ▼	52 (0.9)	49 (0.9)	-3 (1.3) ●	21 (1.1)	35 (1.3)	14 (1.7) ▲
Korea, Rep. of	27 (1.2)	16 (0.7)	-11 (1.4) ▼	50 (1.1)	43 (0.7)	-6 (1.3) ▼	24 (1.0)	41 (1.0)	17 (1.4) ▲
Latvia (LSS)	26 (1.2)	40 (1.2)	13 (1.6) ▲	60 (1.3)	54 (1.2)	-5 (1.7) ▼	14 (1.0)	6 (0.5)	-8 (1.2) ▼
Lithuania	26 (1.4)	35 (1.2)	10 (1.8) ▲	60 (1.3)	57 (1.2)	-3 (1.8) ●	15 (1.0)	8 (0.8)	-7 (1.3) ▼
Netherlands	16 (0.8)	19 (1.4)	3 (1.6) ●	76 (1.2)	74 (1.3)	-2 (1.7) ●	8 (1.0)	7 (1.0)	-1 (1.4) ●
New Zealand	16 (0.8)	17 (1.0)	1 (1.3) ●	64 (1.2)	63 (1.3)	-1 (1.8) ●	21 (1.2)	20 (1.2)	-1 (1.7) ●
Romania r	51 (1.5)	55 (1.6)	4 (2.2) ●	28 (1.1)	33 (1.1)	5 (1.6) ●	21 (1.3)	12 (1.0)	-9 (1.7) ▼
Russian Federation	36 (1.4)	48 (1.3)	13 (1.9) ▲	54 (1.4)	46 (1.2)	-8 (1.8) ▼	10 (0.7)	6 (0.6)	-4 (0.9) ▼
Singapore	76 (1.0)	59 (1.2)	-18 (1.5) ▼	21 (0.8)	35 (0.9)	14 (1.3) ▲	3 (0.4)	7 (0.6)	4 (0.7) ▲
Slovak Republic	22 (0.9)	24 (0.9)	2 (1.3) ●	64 (1.1)	65 (1.1)	2 (1.5) ●	14 (1.0)	10 (0.7)	-4 (1.2) ▼
Slovenia	35 (1.0)	32 (1.0)	-3 (1.4) ●	53 (1.0)	55 (0.9)	2 (1.4) ●	12 (0.7)	13 (0.8)	1 (1.1) ●
Thailand †	51 (1.6)	45 (1.2)	-6 (2.0) ▼	43 (1.3)	47 (1.0)	4 (1.6) ●	6 (0.5)	8 (0.5)	2 (0.7) ▲
United States	22 (0.8)	22 (0.8)	0 (1.1) ●	54 (1.1)	56 (0.9)	2 (1.5) ●	25 (1.3)	23 (1.3)	-2 (1.8) ●
International Avg. §	34 (0.3)	33 (0.2)	0 (0.4) ●	51 (0.3)	51 (0.2)	0 (0.4) ●	15 (0.2)	16 (0.2)	0 (0.3) ●

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

Background data provided by students.

† Countries with unapproved sampling procedures at the classroom level in 1995.

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

Background data for Bulgaria and South Africa are unavailable for 1995.

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

A dash (–) indicates data are not available.

An "r" indicates a 70-84% student response rate, based on the lower response rate in either 1995 or 1999. An "s" indicates a 50-69% student response rate, based on the lower response rate in either 1995 or 1999.

Exhibit 4.7 Total Amount of Out-of-School Time Students Spend Studying Mathematics or Doing Mathematics Homework on a Normal School Day

TIMSS 1999 8th grade Mathematics

Country	One Hour or More: Percent of Students	One Hour or More: Average Achievement	Less Than One Hour: Percent of Students	Less Than One Hour: Average Achievement	No Time: Percent of Students	No Time: Average Achievement	Average Hours[1]
Australia	22 (1.0)	515 (6.3)	63 (1.1)	537 (5.0)	15 (1.0)	493 (6.3)	0.7 (0.02)
Belgium (Flemish)	47 (1.2)	550 (3.1)	50 (1.0)	573 (3.7)	3 (0.8)	476 (21.2)	1.1 (0.03)
Bulgaria	43 (1.7)	521 (7.9)	45 (1.3)	516 (5.5)	12 (1.2)	494 (9.5)	1.1 (0.04)
Canada	28 (1.0)	510 (3.3)	61 (1.0)	542 (2.8)	11 (0.8)	527 (5.2)	0.8 (0.02)
Chile	29 (1.0)	394 (7.1)	54 (0.7)	400 (4.7)	17 (0.8)	384 (5.9)	0.9 (0.02)
Chinese Taipei	25 (1.0)	627 (4.7)	44 (0.8)	604 (3.5)	31 (1.3)	529 (4.8)	0.7 (0.02)
Cyprus	40 (1.1)	469 (2.4)	51 (1.1)	496 (2.7)	9 (0.6)	425 (7.2)	1.1 (0.03)
Czech Republic	20 (1.1)	493 (5.2)	68 (1.3)	528 (4.6)	12 (1.0)	525 (9.2)	0.7 (0.02)
England	– –	– –	– –	– –	– –	– –	– –
Finland	8 (0.7)	486 (6.8)	85 (0.8)	525 (2.5)	7 (0.6)	506 (8.1)	0.6 (0.01)
Hong Kong, SAR	24 (1.1)	600 (4.8)	51 (0.9)	591 (3.9)	25 (1.2)	552 (6.1)	0.7 (0.02)
Hungary	25 (1.1)	514 (5.0)	71 (1.0)	540 (3.6)	4 (0.4)	497 (9.9)	0.8 (0.02)
Indonesia	51 (1.4)	406 (5.4)	38 (1.0)	405 (5.6)	10 (0.8)	396 (8.4)	1.2 (0.03)
Iran, Islamic Rep.	75 (1.0)	427 (3.7)	22 (0.8)	425 (3.7)	3 (0.3)	375 (14.1)	1.9 (0.03)
Israel	44 (1.4)	454 (4.3)	48 (1.1)	491 (4.2)	8 (0.6)	436 (11.3)	1.1 (0.03)
Italy	57 (1.3)	482 (4.0)	39 (1.2)	488 (4.5)	5 (0.5)	400 (9.5)	1.3 (0.03)
Japan	20 (0.9)	585 (2.5)	54 (0.9)	586 (2.0)	26 (1.2)	558 (3.8)	0.6 (0.01)
Jordan	60 (1.0)	445 (4.3)	33 (0.8)	441 (4.6)	8 (0.6)	374 (9.8)	1.7 (0.03)
Korea, Rep. of	21 (0.9)	610 (4.1)	45 (0.7)	598 (2.0)	34 (1.0)	560 (2.6)	0.6 (0.02)
Latvia (LSS)	40 (1.3)	493 (4.1)	58 (1.3)	516 (4.1)	3 (0.4)	480 (13.8)	1.0 (0.02)
Lithuania ‡	29 (1.3)	483 (5.3)	68 (1.4)	486 (4.4)	3 (0.5)	417 (15.8)	0.9 (0.03)
Macedonia, Rep. of	45 (1.2)	448 (4.1)	49 (1.1)	461 (4.6)	6 (0.4)	429 (9.2)	1.2 (0.03)
Malaysia	71 (1.0)	519 (4.2)	28 (0.9)	523 (6.5)	2 (0.2)	~ ~	1.6 (0.02)
Moldova	44 (1.6)	473 (5.0)	48 (1.4)	476 (4.1)	8 (0.7)	452 (7.6)	1.1 (0.03)
Morocco r	58 (1.5)	350 (3.2)	29 (0.9)	341 (6.6)	13 (0.9)	324 (8.0)	1.7 (0.07)
Netherlands	14 (1.5)	507 (12.2)	78 (1.3)	546 (6.7)	8 (1.1)	559 (14.0)	0.6 (0.02)
New Zealand	20 (1.2)	480 (6.6)	66 (1.2)	507 (5.3)	14 (0.9)	444 (6.7)	0.7 (0.02)
Philippines	53 (0.8)	347 (6.7)	42 (0.8)	363 (6.2)	5 (0.4)	288 (13.2)	1.7 (0.04)
Romania	66 (1.8)	494 (5.4)	25 (1.5)	457 (6.2)	9 (0.7)	417 (7.7)	1.6 (0.05)
Russian Federation	45 (1.5)	530 (5.2)	49 (1.3)	537 (6.7)	6 (0.5)	483 (10.0)	1.1 (0.03)
Singapore	61 (1.1)	604 (5.7)	34 (1.0)	612 (7.6)	5 (0.5)	562 (10.7)	1.3 (0.02)
Slovak Republic	23 (0.9)	513 (4.7)	70 (0.8)	542 (3.9)	6 (0.6)	535 (8.3)	0.8 (0.02)
Slovenia	29 (1.0)	511 (4.1)	63 (1.1)	541 (3.3)	8 (0.7)	530 (7.7)	0.8 (0.02)
South Africa	53 (1.1)	273 (7.9)	37 (0.7)	293 (8.6)	10 (0.8)	241 (14.1)	1.8 (0.04)
Thailand	49 (1.2)	482 (5.8)	45 (1.1)	459 (5.8)	6 (0.4)	424 (5.6)	1.1 (0.02)
Tunisia	66 (0.9)	450 (2.9)	27 (0.8)	452 (3.4)	7 (0.5)	439 (5.3)	1.8 (0.03)
Turkey	52 (1.4)	448 (4.7)	41 (1.0)	422 (4.4)	6 (0.6)	398 (7.1)	1.2 (0.02)
United States	27 (1.1)	505 (4.5)	58 (0.7)	514 (4.0)	15 (1.1)	466 (4.8)	0.8 (0.02)
International Avg.	40 (0.2)	486 (0.9)	50 (0.2)	495 (0.8)	10 (0.1)	455 (1.7)	1.1 (0.00)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

1 Average hours based on: No time=0; less than 1 hour=.5; 1-2 hours=1.5; 3-5 hours=4; more than 5 hours=7.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available. A tilde (~) indicates insufficient data to report achievement.

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

How Do Students Perceive Their Ability in Mathematics?

To investigate how students think of their abilities in mathematics, TIMSS created an index of students' self-concept in mathematics (SCM). This index is based on student's responses to five statements about their mathematics ability:

- I would like mathematics much more if it were not so difficult
- Although I do my best, mathematics is more difficult for me than for many of my classmates
- Nobody can be good in every subject, and I am just not talented in mathematics
- Sometimes when I do not understand a new topic in mathematics initially, I know that I will never really understand it
- Mathematics is not one of my strengths.

Students who disagreed or strongly disagreed with all five statements were assigned to the high level of the index, while students who agreed or strongly agreed with all five were assigned to the low level. The medium level includes all other possible combinations of responses. (As an example of one of the components of the index, Exhibit R1.14 in the reference section provides the percentages of disagreement and agreement in relation to mathematics achievement for the statement "mathematics is not one of my strengths.")

R1.14 R

4.8

The percentages of eighth-grade students at each level of this index, and their average mathematics achievement, are presented in Exhibit 4.8. On average internationally, 18 percent of students had a high self-concept in mathematics. The percentages ranged from a high of 45 percent in the Russian Federation to a low of less than five percent in Indonesia, the Philippines, and Thailand. Although there was a clear positive association between self-concept and mathematics achievement internationally and in every country, at the country level the relationship was more complex. Several countries with high average mathematics achievement, including Singapore, Hong Kong, Chinese Taipei, Korea, and Japan, had 15 percent or less of their students in the high self-concept category. Since all of these are Asian Pacific countries, they may share cultural traditions that encourage a modest self-concept. Also, it may be that their rigorous mathematics curricula pose a greater challenge to students. Internationally on average, about 15 percent of the eighth-grade students seem to be convinced that they just cannot do mathematics. They may think they can be good with numbers or with words, but not both. Mathematics to them may seem dry and unimportant to daily life.

Exhibit 4.9 presents the percentages of girls and of boys in each country at the high, medium, and low levels of the mathematics self-concept index. Even though the gender differences in TIMSS mathematics achievement were negligible at the eighth grade in both 1995 and 1999, there was a modest but statistically significant difference favoring boys internationally, especially at the upper quartile within each country (see Exhibit 1.12). Moreover, detailed analyses of the 1995 data showed that gender differences favoring males emerged in several countries during the final year of secondary school.[3] Therefore, it may not be that surprising to find differences in mathematics self-concept between boys and girls at the eighth grade, internationally and in some countries. 4.9

Significantly more boys than girls had a high mathematics self-concept in Canada, Chinese Taipei, the Czech Republic, England, Finland, Hong Kong, Japan, Korea, the Netherlands, and the United States. Conversely, significantly more girls than boys had a low self-concept in Belgium (Flemish), Japan, Morocco, and Tunisia.

3 Mullis, I.V.S., Martin, M.O., Fierros, E.G., Goldberg, A.L., and Stemler, S.E. (2000), *Gender Differences in Achievement: IEA's Third International Mathematics and Science Study*, Chestnut Hill, MA: Boston College.

Exhibit 4.8 Index of Students' Self-Concept in Mathematics (SCM)

Index of Students' Self-Concept in Mathematics

Index based on students' responses to five statements about their mathematics ability: 1) I would like mathematics much more if it were not so difficult; 2) although I do my best, mathematics is more difficult for me than for many of my classmates; 3) nobody can be good in every subject, and I am just not talented in mathematics; 4) sometimes, when I do not understand a new topic in mathematics initially, I know that I will never really understand it; 5) mathematics is not one of my strengths. High level indicates student disagrees or strongly disagrees with all five statements. Low level indicates student agrees or strongly agrees with all five statements. Medium level includes all other possible combinations of responses.

	High SCM		Medium SCM		Low SCM	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Russian Federation	45 (1.5)	568 (4.7)	44 (1.1)	510 (6.5)	11 (0.8)	470 (10.9)
Canada	35 (1.0)	573 (2.9)	56 (1.0)	517 (2.4)	9 (0.5)	459 (6.1)
Finland	32 (1.2)	566 (3.5)	55 (1.2)	509 (2.7)	14 (0.8)	465 (4.2)
United States	31 (1.0)	551 (4.6)	58 (0.8)	493 (3.9)	11 (0.6)	435 (5.6)
Australia	30 (1.2)	571 (4.7)	57 (1.0)	517 (5.0)	13 (0.7)	458 (5.4)
England	30 (1.3)	543 (5.0)	61 (1.2)	487 (3.9)	9 (0.6)	430 (6.5)
Hungary	28 (1.0)	589 (4.8)	60 (1.0)	522 (3.6)	13 (0.7)	459 (5.1)
New Zealand	27 (1.3)	556 (5.4)	59 (1.1)	482 (4.4)	14 (0.8)	418 (4.8)
Israel	27 (1.0)	523 (5.2)	63 (0.9)	460 (3.7)	10 (0.6)	390 (7.8)
Netherlands	27 (2.0)	578 (7.0)	65 (1.8)	532 (7.7)	8 (0.9)	490 (9.8)
Belgium (Flemish)	25 (0.8)	600 (5.4)	62 (0.8)	554 (3.3)	13 (1.1)	506 (7.8)
Italy	24 (0.9)	539 (3.8)	63 (0.9)	474 (3.8)	13 (0.8)	412 (5.4)
Slovenia	21 (0.9)	593 (4.3)	69 (0.9)	523 (2.7)	10 (0.6)	457 (5.5)
Slovak Republic	20 (1.1)	587 (5.2)	62 (0.9)	535 (3.6)	18 (1.0)	479 (3.7)
Czech Republic	19 (1.2)	585 (5.7)	66 (1.0)	515 (4.0)	15 (1.0)	461 (5.5)
Malaysia	19 (1.0)	567 (5.5)	77 (0.9)	511 (4.0)	5 (0.4)	466 (5.8)
Lithuania ‡	18 (1.3)	543 (6.7)	69 (1.2)	479 (3.8)	13 (0.9)	418 (5.8)
Turkey	18 (0.7)	488 (5.8)	62 (0.7)	430 (4.1)	19 (0.7)	399 (4.6)
Latvia (LSS)	18 (0.9)	566 (4.9)	63 (1.0)	505 (3.8)	19 (0.8)	453 (4.6)
Bulgaria	17 (2.4)	578 (9.8)	61 (1.7)	514 (4.7)	22 (1.5)	468 (6.2)
Macedonia, Rep. of	16 (0.8)	517 (6.5)	63 (0.9)	454 (4.1)	21 (0.9)	406 (5.2)
Cyprus	16 (0.8)	539 (3.6)	68 (0.8)	478 (2.0)	16 (0.9)	421 (4.4)
Singapore	15 (1.0)	656 (8.8)	74 (0.8)	603 (5.7)	11 (0.7)	547 (7.1)
Hong Kong, SAR	14 (0.7)	624 (4.6)	71 (0.8)	585 (3.8)	14 (0.8)	531 (6.3)
Iran, Islamic Rep.	14 (0.7)	482 (5.2)	71 (0.8)	423 (3.4)	15 (0.7)	380 (4.2)
Tunisia	14 (0.6)	488 (4.6)	69 (0.7)	447 (2.6)	17 (0.6)	424 (3.1)
Moldova	13 (0.9)	518 (6.3)	67 (1.1)	472 (4.5)	20 (1.1)	446 (5.2)
Jordan	12 (0.6)	517 (6.1)	66 (0.8)	438 (3.9)	22 (0.8)	388 (4.4)
Chile	11 (0.7)	466 (9.5)	68 (0.8)	398 (3.8)	21 (0.9)	347 (5.4)
Chinese Taipei	11 (0.5)	660 (6.0)	75 (0.7)	591 (3.9)	14 (0.7)	506 (4.2)
Romania	10 (0.7)	539 (7.5)	62 (1.1)	483 (5.2)	27 (1.4)	441 (6.8)
Korea, Rep. of	10 (0.5)	646 (4.0)	85 (0.5)	585 (1.8)	5 (0.3)	515 (5.7)
South Africa	7 (0.7)	392 (12.7)	67 (0.9)	279 (7.2)	26 (0.9)	239 (5.5)
Japan	6 (0.4)	634 (6.2)	82 (0.5)	581 (1.8)	12 (0.5)	536 (3.8)
Morocco r	5 (0.4)	405 (9.8)	74 (0.8)	344 (3.0)	21 (0.7)	319 (6.9)
Indonesia	4 (0.4)	470 (10.1)	83 (0.6)	407 (4.8)	13 (0.6)	366 (7.1)
Philippines	4 (0.5)	411 (13.2)	77 (0.7)	353 (6.1)	19 (0.7)	320 (5.3)
Thailand	2 (0.2)	~ ~	79 (0.6)	474 (5.0)	19 (0.7)	434 (6.1)
International Avg.	18 (0.2)	547 (1.1)	67 (0.2)	486 (0.7)	15 (0.1)	436 (0.9)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 tilde (~) indicates insufficient data to report achievement.

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

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Exhibit 4.9 Index of Students' Self-Concept in Mathematics (SCM) by Gender

TIMSS 1999 8th grade Mathematics

	High SCM Percent of Students		Medium SCM Percent of Students		Low SCM Percent of Students	
	Girls	Boys	Girls	Boys	Girls	Boys
Australia	28 (1.5)	33 (1.5)	59 (1.4)	55 (1.3)	14 (1.0)	12 (0.9)
Belgium (Flemish)	24 (1.3)	26 (1.2)	61 (1.5)	63 (1.2)	16 (1.4) ▲	11 (1.1)
Bulgaria	17 (2.3)	17 (3.0)	62 (2.2)	60 (1.8)	21 (1.9)	23 (2.2)
Canada	31 (1.4)	39 (1.1) ▲	59 (1.6) ▲	52 (1.0)	9 (0.7)	9 (0.5)
Chile	10 (0.7)	13 (1.0)	68 (0.9)	67 (1.0)	22 (1.1)	20 (1.1)
Chinese Taipei	7 (0.5)	14 (0.8) ▲	79 (0.8) ▲	72 (1.0)	14 (0.8)	14 (0.9)
Cyprus	17 (1.1)	15 (1.0)	68 (1.1)	68 (1.0)	15 (1.3)	17 (1.0)
Czech Republic	16 (1.3)	22 (1.5) ▲	69 (1.3)	63 (1.3)	15 (1.0)	15 (1.5)
England	24 (1.5)	36 (1.8) ▲	65 (1.5) ▲	57 (1.7)	11 (1.0)	7 (0.7)
Finland	23 (1.1)	40 (1.7) ▲	62 (1.5) ▲	48 (1.5)	16 (1.3)	12 (0.9)
Hong Kong, SAR	11 (0.9)	18 (0.9) ▲	74 (1.2) ▲	69 (1.0)	15 (1.1)	14 (1.1)
Hungary	27 (1.3)	29 (1.5)	60 (1.4)	59 (1.5)	13 (1.0)	12 (1.0)
Indonesia	4 (0.5)	5 (0.5)	83 (0.8)	83 (0.8)	13 (0.9)	13 (0.7)
Iran, Islamic Rep.	14 (0.7)	14 (1.1)	71 (1.2)	71 (1.1)	15 (1.1)	15 (1.0)
Israel	26 (1.1)	29 (1.4)	64 (0.9)	62 (1.4)	10 (1.0)	9 (0.7)
Italy	22 (1.1)	25 (1.3)	64 (1.3)	63 (1.3)	14 (1.0)	13 (1.0)
Japan	3 (0.4)	8 (0.7) ▲	80 (0.9)	83 (0.9)	17 (0.8) ▲	8 (0.5)
Jordan	12 (0.9)	12 (0.9)	65 (1.3)	67 (1.1)	23 (1.2)	21 (1.2)
Korea, Rep. of	7 (0.6)	12 (0.7) ▲	87 (0.6) ▲	84 (0.7)	6 (0.4)	4 (0.4)
Latvia (LSS)	17 (1.2)	18 (1.2)	63 (1.5)	63 (1.1)	20 (1.1)	18 (1.1)
Lithuania ‡	18 (1.6)	18 (1.5)	69 (1.7)	69 (1.4)	12 (1.2)	13 (1.3)
Macedonia, Rep. of	17 (1.1)	16 (0.8)	64 (1.3)	62 (1.3)	19 (1.1)	22 (1.3)
Malaysia	20 (1.0)	17 (1.2)	76 (1.0)	77 (1.2)	4 (0.4)	6 (0.6)
Moldova	13 (1.1)	13 (1.2)	67 (1.3)	68 (1.6)	20 (1.3)	19 (1.4)
Morocco r	5 (0.7)	5 (0.4)	71 (1.1)	76 (0.9) ▲	24 (1.0) ▲	19 (0.8)
Netherlands	21 (2.1)	33 (2.6) ▲	69 (1.8)	61 (2.7)	10 (1.2)	6 (1.0)
New Zealand	27 (1.6)	28 (1.6)	59 (1.4)	58 (1.3)	14 (1.0)	14 (1.1)
Philippines	4 (0.5)	5 (0.6)	79 (0.9)	75 (1.0)	18 (1.0)	20 (0.9)
Romania	9 (0.8)	11 (0.9)	64 (1.4)	60 (1.5)	27 (1.6)	28 (1.6)
Russian Federation	48 (1.8)	42 (1.8)	42 (1.5)	45 (1.4)	10 (0.9)	13 (1.0)
Singapore	13 (0.9)	17 (1.4)	77 (0.9) ▲	72 (1.0)	11 (0.8)	12 (0.9)
Slovak Republic	19 (1.3)	21 (1.4)	63 (1.3)	62 (1.4)	18 (1.2)	17 (1.2)
Slovenia	21 (1.1)	21 (1.2)	70 (1.2)	68 (1.4)	9 (0.9)	11 (0.9)
South Africa	6 (0.8)	7 (0.8)	66 (1.0)	68 (1.2)	28 (1.2)	24 (1.0)
Thailand	2 (0.3)	2 (0.3)	82 (0.7) ▲	77 (1.0)	16 (0.7)	21 (1.0) ▲
Tunisia	13 (0.8)	14 (0.8)	66 (1.1)	71 (0.9)	20 (1.0) ▲	14 (0.8)
Turkey	17 (0.8)	19 (1.0)	63 (1.3)	62 (0.9)	20 (1.1)	19 (0.9)
United States	28 (1.3)	34 (1.2) ▲	61 (1.2) ▲	54 (1.0)	11 (0.7)	11 (0.7)
International Avg.	17 (0.2)	20 (0.2) ▲	68 (0.2) ▲	66 (0.2)	16 (0.2) ▲	15 (0.2)

▲ Significantly higher than other gender

Significance tests adjusted for multiple comparisons

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

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

What Are Students' Attitudes Towards Mathematics?

Generating positive attitudes towards mathematics among students is an important goal of mathematics education in many countries. To gain some understanding about eighth-graders' view about the utility of mathematics and their enjoyment of it as a school subject, TIMSS created an index of positive attitudes towards mathematics (PATM). Students were asked to state their agreement with the following five statements:

- I like mathematics
- I enjoy learning mathematics
- Mathematics is boring[4]
- Mathematics is important to everyone's life
- I would like a job that involved using mathematics.

For each statement, students responded on a four-point scale indicating whether their feelings about mathematics were strongly positive, positive, negative, or strongly negative. The responses were averaged, with students being placed in the high category if their average indicated a positive or strongly positive attitude on average. Students with a negative or strongly negative attitude on average were placed in the low category. The students between these extremes were placed in the medium category. The results are presented in Exhibit 4.10.[5] 4.10

Eighth-grade students generally had positive attitudes towards mathematics, with 37 percent on average across countries in the high category, and a further 52 percent in the medium category. Only 11 percent of students were in the low category. Countries with large percentages of students at the high level included Malaysia, Morocco, South Africa, the Philippines, Tunisia, Jordan, Iran, and Indonesia, with more than half the students in this category.

Students' attitudes towards any curriculum area can be related to their achievement in ways that reinforce higher or lower performance. That is, students who do well in mathematics generally have more positive attitudes towards the subject, and those who have more positive attitudes tend to perform better. Within nearly every country there was a clear association between attitudes and mathematics achievement, with students having more positive attitudes also having higher average achievement. As in previous findings, however, the two countries with the least positive attitudes were high-performing Japan and Korea. Again, it may be that the students follow a demanding mathematics cur-

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

5 Additional information on students' liking mathematics, one of the components of the index, is provided in Exhibit R1.15 in the reference section.

riculum, one that leads to high achievement but little enthusiasm for mathematics.

4.11 Exhibit 4.11 presents the percentages of girls and boys in each country at each level of the positive attitudes towards mathematics index. There were significantly greater percentages of boys than girls with a high level of positive attitudes towards mathematics on average internationally and in a number of countries (i.e., Australia, Bulgaria, Canada, Chile, Chinese Taipei, England, Finland, Hong Kong, Japan, the Netherlands, Singapore, Tunisia, Turkey, and the United States). Only in the Philippines was there a significantly greater percentage of girls at the high level of the index.

4.12 Exhibit 4.12 provides information on trends in the index of positive attitudes towards mathematics from 1995 to 1999. There was little change overall or among the countries. Australia and Lithuania had increased percentages of students at the high index level in 1999, and Korea, Slovenia, and Thailand had decreases. At the low level, decreases were found in Hong Kong and Lithuania and increases in Japan and Korea.

4.13 Exhibit 4.13 displays trends from 1995 to 1999 in the percentages of girls and boys at the high level of the index. There was very little change over time in the relative attitudes of girls and boys towards mathematics; no country experienced a significant change, positive or negative, in the gender difference in attitudes. For Japan, Australia, the Netherlands, England, and Hong Kong, the gender differences favoring boys at the high level found in 1999 were also present in 1995. Italy and New Zealand had significant differences favoring boys in 1995 that no longer appeared in 1999. Conversely, however, for the United States, Canada, and Singapore, significant differences favoring boys in the high category of positive attitudes appeared in 1999 when none had existed in 1995.

Exhibits 4.10 – 4.13 Overleaf

Exhibit 4.10 Index of Students' Positive Attitudes Towards Mathematics (PATM)

Index of Students' Positive Attitudes Towards Mathematics

Index based on students' responses to five statements about mathematics: 1) I like mathematics; 2) I enjoy learning mathematics; 3) mathematics is boring (reversed scale); 4) mathematics is important to everyone's life; 5) I would like a job that involved using mathematics. Average is computed across the five items based on a 4-point scale: 1 = strongly negative; 2 = negative; 3 = positive; 4 = strongly positive. High level indicates average is greater than 3. Medium level indicates average is greater than 2 and less than or equal to 3. Low level indicates average is less than or equal to 2.

	High PATM		Medium PATM		Low PATM	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Malaysia	74 (0.8)	526 (4.6)	25 (0.8)	501 (4.9)	1 (0.1)	~ ~
Morocco r	73 (1.0)	351 (3.1)	25 (1.0)	317 (4.0)	2 (0.2)	~ ~
South Africa	62 (1.0)	286 (7.6)	33 (0.9)	259 (7.3)	5 (0.3)	264 (11.4)
Philippines	59 (1.3)	365 (6.1)	38 (1.2)	328 (6.2)	2 (0.2)	~ ~
Tunisia	57 (1.1)	463 (3.1)	35 (0.9)	432 (2.8)	8 (0.5)	415 (3.8)
Jordan	54 (1.3)	457 (4.8)	38 (1.1)	410 (3.6)	8 (0.6)	412 (7.0)
Iran, Islamic Rep.	54 (1.1)	439 (4.1)	40 (1.0)	410 (3.6)	6 (0.4)	395 (6.4)
Indonesia	51 (1.2)	413 (5.0)	48 (1.2)	396 (5.5)	1 (0.2)	~ ~
Cyprus	50 (1.2)	498 (2.7)	41 (1.1)	459 (2.8)	9 (0.7)	446 (5.8)
Macedonia, Rep. of	46 (1.2)	459 (4.9)	48 (1.1)	449 (4.5)	7 (0.5)	451 (8.0)
Chile	45 (1.3)	408 (5.7)	47 (1.1)	385 (4.0)	8 (0.5)	379 (8.2)
Singapore	45 (1.0)	620 (6.4)	48 (0.9)	595 (6.7)	7 (0.5)	568 (9.1)
Israel	44 (1.4)	472 (5.7)	45 (1.2)	474 (4.4)	10 (0.7)	445 (5.7)
England	41 (1.3)	506 (5.4)	51 (1.2)	495 (4.5)	8 (0.5)	478 (8.1)
Turkey	41 (1.0)	455 (5.2)	52 (0.9)	421 (3.9)	7 (0.4)	408 (9.7)
Thailand	37 (1.1)	488 (5.4)	61 (1.1)	457 (5.3)	3 (0.2)	435 (9.8)
Bulgaria	36 (2.4)	538 (9.5)	51 (1.9)	506 (5.1)	13 (1.3)	486 (7.8)
Russian Federation	36 (1.3)	555 (5.3)	58 (1.2)	518 (6.3)	5 (0.4)	496 (8.3)
Italy	35 (1.2)	512 (4.2)	51 (1.1)	469 (4.3)	14 (0.8)	449 (5.1)
Canada	35 (0.9)	552 (3.4)	51 (1.0)	526 (2.7)	14 (0.7)	500 (4.6)
United States	35 (1.1)	522 (4.5)	49 (0.7)	500 (3.9)	16 (0.7)	481 (4.7)
New Zealand	34 (1.1)	510 (6.2)	55 (1.1)	488 (4.8)	10 (0.7)	463 (7.8)
Romania	34 (1.3)	509 (5.9)	57 (1.1)	465 (5.3)	9 (0.7)	437 (8.5)
Slovak Republic	31 (1.5)	562 (4.9)	60 (1.2)	524 (3.8)	9 (0.8)	516 (7.9)
Lithuania ‡	30 (1.3)	511 (6.5)	62 (1.1)	471 (4.2)	8 (0.7)	465 (7.2)
Australia	30 (1.2)	544 (6.0)	55 (1.2)	520 (5.4)	15 (0.9)	508 (6.9)
Hong Kong, SAR	28 (0.9)	613 (4.1)	61 (0.8)	578 (4.1)	11 (0.6)	533 (4.8)
Moldova	27 (1.1)	478 (5.7)	70 (1.1)	471 (3.9)	3 (0.4)	459 (8.7)
Latvia (LSS)	26 (1.2)	529 (5.3)	65 (1.3)	500 (3.8)	9 (0.8)	481 (6.0)
Belgium (Flemish)	25 (0.9)	598 (4.7)	53 (0.9)	555 (3.5)	22 (1.1)	523 (4.5)
Chinese Taipei	23 (0.8)	643 (5.1)	59 (0.8)	582 (4.1)	18 (0.7)	529 (5.4)
Finland	21 (1.2)	552 (3.7)	59 (1.1)	518 (2.8)	19 (1.3)	493 (5.0)
Hungary	19 (0.9)	578 (5.9)	65 (1.0)	525 (3.7)	16 (1.0)	508 (5.3)
Czech Republic	19 (1.2)	559 (6.2)	63 (1.2)	515 (4.9)	18 (1.0)	500 (5.8)
Slovenia	19 (0.9)	567 (4.7)	63 (1.0)	526 (3.0)	18 (1.0)	509 (4.5)
Netherlands	17 (1.4)	555 (11.7)	63 (1.0)	543 (7.1)	20 (1.4)	522 (8.4)
Japan	9 (0.5)	619 (5.4)	61 (0.7)	585 (2.0)	29 (0.9)	554 (2.9)
Korea, Rep. of	9 (0.4)	647 (4.2)	65 (0.8)	591 (2.1)	26 (0.8)	560 (2.6)
International Avg.	37 (0.2)	512 (0.9)	52 (0.2)	481 (0.8)	11 (0.1)	473 (1.2)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 tilde (~) indicates insufficient data to report achievement.

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

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Exhibit 4.11 Index of Positive Attitudes Towards Mathematics (PATM) by Gender

	High PATM Percent of Students		Medium PATM Percent of Students		Low PATM Percent of Students	
	Girls	Boys	Girls	Boys	Girls	Boys
Australia	26 (1.5)	34 (1.5) ▲	57 (1.4)	53 (1.5)	17 (1.2)	13 (1.0)
Belgium (Flemish)	24 (1.4)	26 (1.7)	53 (1.8)	53 (1.4)	23 (1.6)	21 (1.3)
Bulgaria	31 (2.3)	42 (2.9) ▲	54 (1.7) ▲	47 (2.3)	15 (1.9)	11 (1.3)
Canada	31 (1.1)	38 (1.2) ▲	53 (1.4) ▲	48 (1.1)	15 (0.9)	13 (0.9)
Chile	39 (1.5)	51 (1.6) ▲	51 (1.3) ▲	43 (1.5)	10 (0.6) ▲	6 (0.6)
Chinese Taipei	18 (0.9)	27 (1.1) ▲	61 (1.0)	58 (1.0)	21 (0.9) ▲	15 (0.8)
Cyprus	51 (1.7)	50 (1.3)	41 (1.5)	41 (1.3)	7 (0.8)	10 (1.0)
Czech Republic	16 (1.5)	22 (1.7)	64 (1.7)	61 (1.4)	20 (1.4)	17 (1.3)
England	35 (1.7)	48 (1.7) ▲	55 (1.5) ▲	47 (1.5)	10 (0.8) ▲	6 (0.7)
Finland	15 (1.1)	28 (1.8) ▲	61 (1.3)	58 (1.6)	24 (1.6) ▲	15 (1.5)
Hong Kong, SAR	22 (1.1)	34 (1.2) ▲	65 (1.0) ▲	57 (1.1)	13 (0.8) ▲	8 (0.6)
Hungary	18 (1.3)	20 (1.2)	66 (1.4)	64 (1.3)	16 (1.2)	16 (1.2)
Indonesia	51 (1.6)	51 (1.6)	48 (1.6)	48 (1.5)	1 (0.2)	1 (0.3)
Iran, Islamic Rep.	54 (1.5)	54 (1.6)	40 (1.6)	41 (1.4)	6 (0.7)	6 (0.6)
Israel	42 (1.8)	47 (1.6)	48 (1.5)	43 (1.4)	11 (0.8)	10 (0.9)
Italy	33 (1.6)	38 (1.4)	52 (1.5)	49 (1.4)	15 (1.0)	13 (1.0)
Japan	6 (0.5)	13 (0.7) ▲	59 (1.0)	64 (1.0) ▲	36 (1.2) ▲	23 (0.9)
Jordan	50 (1.8)	58 (1.7)	40 (1.6)	35 (1.4)	9 (1.0)	7 (0.8)
Korea, Rep. of	8 (0.6)	10 (0.6)	64 (1.2)	66 (1.0)	28 (1.3)	25 (0.9)
Latvia (LSS)	25 (1.4)	26 (1.6)	65 (1.6)	66 (1.6)	10 (1.0)	8 (1.0)
Lithuania ‡	32 (1.8)	28 (1.8)	59 (1.7)	64 (1.6)	8 (0.9)	8 (0.8)
Macedonia, Rep. of	46 (1.3)	46 (1.6)	48 (1.3)	48 (1.4)	7 (0.6)	7 (0.6)
Malaysia	75 (1.2)	74 (1.2)	24 (1.1)	26 (1.2)	1 (0.2)	1 (0.2)
Moldova	28 (1.4)	26 (1.4)	70 (1.4)	69 (1.4)	2 (0.4)	5 (0.6)
Morocco r	72 (1.6)	73 (1.1)	25 (1.6)	25 (1.1)	2 (0.3)	2 (0.4)
Netherlands	12 (1.5)	23 (1.8) ▲	62 (1.4)	63 (1.9)	26 (1.9) ▲	14 (1.4)
New Zealand	32 (1.5)	37 (1.3)	57 (1.5)	53 (1.4)	11 (1.0)	10 (1.0)
Philippines	62 (1.4) ▲	57 (1.5)	37 (1.4)	40 (1.5)	2 (0.3)	3 (0.3)
Romania	35 (1.6)	33 (1.7)	57 (1.6)	58 (1.5)	8 (0.9)	9 (1.0)
Russian Federation	37 (1.6)	36 (1.6)	58 (1.5)	59 (1.4)	5 (0.5)	5 (0.6)
Singapore	41 (1.4)	48 (1.4) ▲	52 (1.1) ▲	45 (1.3)	7 (0.7)	7 (0.7)
Slovak Republic	29 (1.6)	32 (1.9)	62 (1.4)	59 (1.8)	10 (1.1)	8 (1.0)
Slovenia	18 (1.2)	20 (1.2)	64 (1.5)	62 (1.2)	18 (1.4)	18 (1.2)
South Africa	62 (1.1)	62 (1.2)	33 (1.0)	33 (1.1)	5 (0.5)	4 (0.4)
Thailand	37 (1.5)	36 (1.3)	60 (1.4)	61 (1.2)	3 (0.3)	3 (0.3)
Tunisia	51 (1.3)	62 (1.4) ▲	38 (1.2) ▲	32 (1.1)	11 (0.8) ▲	5 (0.6)
Turkey	38 (1.3)	44 (1.2) ▲	53 (1.2)	51 (1.0)	8 (0.7)	6 (0.5)
United States	32 (1.3)	37 (1.2) ▲	52 (1.1) ▲	46 (0.9)	16 (0.7)	16 (1.1)
International Avg.	35 (0.2)	39 (0.2) ▲	53 (0.2) ▲	51 (0.2)	12 (0.2) ▲	10 (0.1)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ Significantly higher than other gender

Significance tests adjusted for multiple comparisons

Background data provided by students.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

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

Exhibit 4.12 Trends in Index of Positive Attitudes Towards Mathematics (PATM)

TIMSS 1999 8th grade Mathematics

	High PATM Percent of Students			Medium PATM Percent of Students			Low PATM Percent of Students		
	1995	1999	1995-1999 Difference	1995	1999	1995-1999 Difference	1995	1999	1995-1999 Difference
Australia	25 (0.9)	30 (1.2)	5 (1.5) ▲	57 (0.7)	55 (1.2)	-2 (1.4) ●	18 (0.7)	15 (0.9)	-3 (1.1) ●
Belgium (Flemish)	26 (1.1)	25 (0.9)	-1 (1.5) ●	54 (1.1)	53 (0.9)	-1 (1.4) ●	20 (0.8)	22 (1.1)	2 (1.3) ●
Canada	36 (1.1)	35 (0.9)	-1 (1.4) ●	51 (0.9)	51 (1.0)	0 (1.3) ●	13 (0.6)	14 (0.7)	1 (1.0) ●
Cyprus	49 (1.4)	50 (1.2)	1 (1.8) ●	42 (1.1)	41 (1.1)	-1 (1.5) ●	9 (0.7)	9 (0.7)	-1 (1.0) ●
Czech Republic	20 (1.1)	19 (1.2)	-1 (1.6) ●	63 (1.2)	63 (1.2)	0 (1.7) ●	17 (1.1)	18 (1.0)	1 (1.5) ●
England	41 (1.4)	41 (1.3)	0 (1.9) ●	52 (1.3)	51 (1.2)	-1 (1.7) ●	7 (0.7)	8 (0.5)	1 (0.8) ●
Hong Kong, SAR	24 (1.0)	28 (0.9)	4 (1.4) ●	62 (1.0)	61 (0.8)	0 (1.3) ●	14 (1.0)	11 (0.6)	-4 (1.1) ▼
Hungary	19 (0.8)	19 (0.9)	0 (1.2) ●	66 (0.9)	65 (1.0)	-1 (1.3) ●	16 (0.9)	16 (1.0)	0 (1.3) ●
Iran, Islamic Rep.	54 (1.6)	54 (1.1)	-1 (1.9) ●	39 (1.2)	40 (1.0)	1 (1.6) ●	7 (0.7)	6 (0.4)	-1 (0.8) ●
Israel †	37 (2.0)	43 (1.6)	5 (2.6) ●	51 (1.8)	47 (1.4)	-4 (2.3) ●	12 (1.5)	10 (0.7)	-1 (1.6) ●
Italy	40 (1.4)	35 (1.4)	-5 (2.0) ●	47 (1.1)	51 (1.3)	3 (1.7) ●	13 (1.0)	15 (1.1)	2 (1.5) ●
Japan	10 (0.5)	9 (0.5)	-1 (0.7) ●	69 (0.9)	61 (0.7)	-8 (1.2) ▼	21 (1.0)	29 (0.9)	9 (1.3) ▲
Korea, Rep. of	12 (0.7)	9 (0.4)	-3 (0.8) ▼	72 (1.0)	65 (0.8)	-7 (1.3) ▼	17 (0.7)	26 (0.8)	10 (1.1) ▲
Latvia (LSS)	26 (1.2)	26 (1.2)	-1 (1.7) ●	65 (1.2)	65 (1.3)	1 (1.7) ●	9 (0.8)	9 (0.8)	0 (1.1) ●
Lithuania	19 (1.1)	30 (1.3)	12 (1.7) ▲	67 (1.2)	62 (1.1)	-5 (1.6) ▼	15 (0.9)	8 (0.7)	-7 (1.1) ▼
Netherlands	15 (1.2)	17 (1.4)	2 (1.8) ●	62 (1.3)	63 (1.0)	0 (1.6) ●	22 (1.7)	20 (1.4)	-2 (2.2) ●
New Zealand	36 (1.1)	34 (1.1)	-1 (1.6) ●	53 (0.9)	55 (1.1)	2 (1.4) ●	11 (0.6)	10 (0.7)	0 (1.0) ●
Romania	35 (1.3)	34 (1.3)	-1 (1.9) ●	57 (1.2)	57 (1.1)	1 (1.6) ●	8 (0.6)	9 (0.7)	0 (0.9) ●
Russian Federation	32 (0.9)	36 (1.3)	5 (1.6) ●	61 (0.9)	58 (1.2)	-3 (1.5) ●	7 (0.6)	5 (0.4)	-2 (0.7) ●
Singapore	45 (1.2)	45 (1.0)	0 (1.5) ●	50 (1.0)	48 (0.9)	-2 (1.3) ●	6 (0.5)	7 (0.5)	1 (0.7) ●
Slovak Republic	29 (1.0)	31 (1.5)	2 (1.8) ●	61 (0.9)	60 (1.2)	0 (1.5) ●	10 (0.6)	9 (0.8)	-1 (1.0) ●
Slovenia	24 (1.3)	19 (0.9)	-5 (1.6) ▼	61 (1.3)	63 (1.0)	2 (1.6) ●	15 (1.2)	18 (1.0)	3 (1.6) ●
Thailand †	44 (1.9)	37 (1.1)	-8 (2.2) ▼	54 (1.7)	61 (1.1)	7 (2.0) ▲	2 (0.3)	3 (0.2)	1 (0.4) ●
United States	35 (1.1)	35 (1.1)	0 (1.5) ●	50 (1.0)	49 (0.7)	-1 (1.2) ●	15 (0.8)	16 (0.7)	1 (1.1) ●
International Avg. §	30 (0.2)	30 (0.2)	0 (0.3) ●	57 (0.2)	56 (0.2)	-1 (0.3) ●	13 (0.2)	14 (0.2)	1 (0.3) ●

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

Background data provided by students.

† Countries with unapproved sampling procedures at the classroom level in 1995.

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian-Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

Background data for Bulgaria and South Africa are unavailable for 1995.

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

Exhibit 4.13 Trends in Gender Differences in Percentages of Students at High Level of Index of Positive Attitudes Towards Mathematics (PATM)

TIMSS 1999 8th grade Mathematics

	1995			1999			Change in Gender Difference*
	Girls	Boys	Difference (Absolute Value)	Girls	Boys	Difference (Absolute Value)	
Latvia (LSS)	28 (1.7)	24 (1.7)	5 (2.2)	25 (1.4)	26 (1.6)	0 (1.8)	↔
Iran, Islamic Rep.	54 (2.4)	55 (2.2)	1 (3.3)	54 (1.5)	54 (1.6)	0 (2.4)	↔
Thailand	44 (2.0)	45 (2.3)	0 (2.1)	37 (1.5)	36 (1.3)	1 (1.6)	↔
Russian Federation	34 (1.2)	29 (1.4)	5 (1.8)	37 (1.6)	36 (1.6)	1 (1.7)	↔
Slovenia	24 (1.6)	24 (1.5)	0 (1.8)	18 (1.2)	20 (1.2)	1 (1.4)	↔
Korea, Rep. of	11 (0.9)	13 (1.0)	2 (1.4)	8 (0.6)	10 (0.6)	2 (0.8)	↔
Cyprus	49 (1.6)	49 (1.8)	0 (2.0)	51 (1.7)	50 (1.3)	2 (2.0)	↔
Romania	34 (1.4)	35 (1.7)	0 (1.7)	35 (1.6)	33 (1.7)	2 (2.0)	↔
Hungary	21 (1.2)	17 (1.0)	4 (1.6)	18 (1.3)	20 (1.2)	2 (1.7)	↔
Belgium (Flemish)	25 (1.7)	26 (1.4)	1 (2.1)	24 (1.4)	26 (1.7)	2 (2.5)	↔
Slovak Republic	26 (1.4)	31 (1.5)	5 (2.1)	29 (1.6)	32 (1.9)	3 (1.8)	↔
Italy	36 (1.9)	44 (1.7) ▲	8 (2.4)	33 (2.0)	37 (1.5)	4 (2.0)	↔
Lithuania ‡	19 (1.4)	18 (1.4)	2 (1.8)	32 (1.8)	28 (1.8)	4 (2.4)	↔
United States	34 (1.2)	36 (1.3)	2 (1.4)	32 (1.3)	37 (1.2) ▲	5 (1.3)	↔
New Zealand	33 (1.5)	39 (1.3) ▲	6 (1.7)	32 (1.5)	37 (1.3)	5 (1.8)	↔
Czech Republic	19 (1.4)	20 (1.4)	1 (1.9)	16 (1.5)	22 (1.7)	6 (2.1)	↔
Israel	35 (2.6)	41 (2.3)	6 (2.7)	40 (2.0)	46 (1.7)	6 (2.0)	↔
Canada	34 (1.2)	39 (1.4)	5 (1.6)	31 (1.1)	38 (1.2) ▲	7 (1.5)	↔
Singapore	42 (1.5)	47 (1.5)	5 (1.9)	41 (1.4)	48 (1.4) ▲	7 (2.0)	↔
Japan	8 (0.7)	13 (0.8) ▲	5 (1.0)	6 (0.5)	13 (0.7) ▲	7 (0.8)	↔
Australia	22 (0.9)	28 (1.4) ▲	5 (1.5)	26 (1.5)	34 (1.5) ▲	8 (1.8)	↔
Netherlands	10 (1.0)	21 (1.9) ▲	11 (1.7)	12 (1.5)	23 (1.8) ▲	11 (1.6)	↔
England	36 (1.7)	46 (2.0) ▲	11 (2.4)	35 (1.7)	48 (1.7) ▲	12 (2.3)	↔
Hong Kong, SAR	16 (1.2)	31 (1.4) ▲	15 (1.9)	22 (1.1)	34 (1.2) ▲	13 (1.4)	↔
International Avg.	29 (0.3)	32 (0.3) ▲	3 (0.4)	29 (0.3)	33 (0.3) ▲	4 (0.4)	↔

▲ Significantly higher than other gender

Significance tests adjusted for multiple comparisons

Increased ⬈
Decreased ⬊
No change ↔

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

* Indicates whether 1999 gender difference is significantly different than 1995 gender difference.

† Countries with unapproved sampling procedures at the classroom level in 1995.

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian-Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

Background data for Bulgaria and South Africa are unavailable for 1995.

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

CHAPTER 5

The Mathematics Curriculum

5

The first part of Chapter 5 presents information about the curricular goals in the TIMSS 1999 countries, referred to as the intended curriculum. Data are provided about how the curriculum is supported and monitored within each country and the relationship between national testing and the curriculum. The second part of the chapter contains teachers' reports about the mathematics topics actually studied in their classrooms, also known as the implemented curriculum.

5

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. At the most fundamental level, students' opportunity to learn the content, skills, and processes tested in the TIMSS 1999 assessment depends to a great extent 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 what mathematics students are taught.

Chapter 5 presents information about the curricular goals in the TIMSS 1999 countries and teachers' reports about the mathematics content studied. Teacher's 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 sorts (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 at the eighth grade in each of the TIMSS 1999 countries, the National Research Coordinators responsible for implementing the study completed questionnaires and participated in interviews. As part of the process, information was gathered about factors related to supporting and monitoring the implementation of the official curriculum, including the availability of teacher training, instructional materials, assessments, and audits aligned with the curriculum.

In many cases, teachers need to interpret and modify the intended curriculum according to their perceptions of the needs and abilities of their classes, 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 1999 completed questionnaires about whether students had been taught the various mathematics topics covered in the test.

Does Decision Making About the Intended Curriculum Take Place at the National or Local Level?

Depending on the educational system, students' learning goals are commonly set at three levels: the national or regional level, the school level, and the classroom level. Some countries are highly centralized, with the ministry of education (or highest authority in the system) being exclusively responsible for the major decisions governing the direction of education. In others, such decisions are made regionally or locally. Each approach has its strengths and weaknesses. Centralized decision making can add coherence and uniformity in curriculum coverage, but may constrain a school or teacher's flexibility in tailoring instruction to the needs of students.

5.1 Exhibit 5.1 presents information for each TIMSS 1999 country about the highest level of authority responsible for making decisions about the curriculum and gives the curriculum's current status. The data reveal that 35 of the 38 countries reported that the specifications for students' curricular goals were developed as national curricula. Australia determined curricula at the state level, with local input; the United States did so at both the state and local levels, with variability across states; and Canada determined what students are expected to learn at the provincial level.

In recent decades, it has become common for intended curricula to be updated regularly. At the time of the TIMSS 1999 testing, the official mathematics curriculum in 29 countries had been in place for less than a decade, and more than half of them were in revision. Of the eight countries with a mathematics curriculum of more than 10 years' standing, five were being revised. In Australia, Canada, and the United States, curriculum change is made at the state or provincial level, and some mathematics curricula were in revision at the time of testing. The mathematics curricula in these three countries were relatively recent, having been developed within ten years prior to the study.

Exhibit 5.1 Mathematics Curriculum

TIMSS 1999 8th grade Mathematics

	National or Regional Curriculum	Year Curriculum Introduced	Status of Curriculum
Australia	Regional & Local	1995-1998	In revision (2 states); not being revised (3 states); no curriculum statement (3 states)
Belgium (Flemish)	National	1997	As introduced
Bulgaria	National	1997	As introduced
Canada	Regional	1997-1998 (most provinces)	As introduced
Chile	National	1980	In revision
Chinese Taipei	National	1997	In revision
Cyprus	National	1987	In revision
Czech Republic	National	1996	In revision
England	National	1995	In revision, same structure with minor revisions (to be implemented 2000/01)
Finland	National	1994	As introduced
Hong Kong, SAR	National	1987	In revision
Hungary	National	1986	In revision
Indonesia	National	1994	In revision
Iran, Islamic Rep.	National	1985	As introduced
Israel	National	1990	As introduced
Italy	National	1979	As introduced
Japan	National	1993	As introduced
Jordan	National	1993-1994	In revision
Korea, Rep. of	National	1995	As introduced
Latvia (LSS)	National	1992	In revision
Lithuania	National	1997	In revision
Macedonia, Rep. of	National	1979 (adaptations in 1995)	As introduced
Malaysia	National	1990	In revision
Moldova	National	1991	In revision
Morocco	National	1991	In revision
Netherlands	National	1993	As introduced
New Zealand	National	1993	As introduced
Philippines	National	1998	In revision
Romania	National	1993	In revision
Russian Federation	National	1997	In revision
Singapore	National	1993	In revision
Slovak Republic	National	–	–
Slovenia	National	1983	In revision
South Africa	National	1996	In revision
Thailand	National	1990	In revision
Tunisia	National	1997	As introduced
Turkey	National	1991	In revision
United States [1]	Regional & Local	1994-1999	As of 1999, 49 of 50 states completed standards

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by National Research Coordinators.

[1] United States: The NCTM standards were developed in 1989 and are in revision. As of 1999, most states had developed content standards. Currently, many states are in the process of updating and revising their standards.

A dash (–) indicates data are not available.

How Do Countries Support and Monitor Curriculum Implementation?

Education systems use different ways to achieve the best match between the intended and the implemented curriculum. For example, teachers can be trained in the content and pedagogical approaches specified in the curriculum guides. Another way to help ensure alignment is to develop instructional materials, including textbooks, instructional guides, and ministry notes, that are tailored to the curriculum. Systems can also monitor implementation by means of school inspection or audit. The different
5.2 methods used by the TIMSS 1999 countries are shown in Exhibit 5.2. It is assumed that monitoring implementation encourages teachers to use the official curriculum in planning their teaching programs. Testing and assessment of the intended curriculum are also widely used to support and monitor curriculum implementation; these are addressed in Exhibits 5.3 and 5.4.

Of the methods for supporting and monitoring curriculum implementation shown in Exhibit 5.2, 10 countries reported using all six, and a further 14 countries used five. Nearly all countries (34) used in-service teacher education, and most countries (31) used mandated or recommended textbooks. Ministry notes and directives, or a system of school inspection or audit, were used in 30 countries. Beyond the methods included in the questionnaire, a majority of representatives from the TIMSS national centers reported in interviews that mathematics specialists were employed to advise mathematics teachers.

Exhibit 5.2 Methods Used to Support or Monitor Curriculum Implementation*

TIMSS 1999 8th grade Mathematics

	Pre-Service Teacher Education	In-Service Teacher Education	Mandated or Recommended Textbook(s)	Instructional or Pedagogical Guide	Ministry Notes and Directives	System of School Inspection or Audit
Australia [1]	●	●		●	●	
Belgium (Flemish)	●	●		●	●	●
Bulgaria	●	●	●		●	●
Canada [2]	●	●	●	●	●	
Chile			●		●	
Chinese Taipei	●	●	●	●		●
Cyprus		●	●		●	●
Czech Republic	●		●		●	●
England	●	●				●
Finland	●	●	●	●		
Hong Kong, SAR	●	●	●	●	●	●
Hungary	●	●	●	●	●	
Indonesia		●	●	●	●	●
Iran, Islamic Rep.	●	●	●	●	●	●
Israel	●	●	●		●	
Italy		●		●	●	●
Japan		●	●	●	●	●
Jordan		●	●	●	●	●
Korea, Rep. of	●	●	●	●	●	●
Latvia (LSS)	●	●	●	●	●	●
Lithuania		●	●		●	
Macedonia, Rep. Of	●	●	●	●		●
Malaysia	●	●	●	●	●	●
Moldova		●	●		●	●
Morocco	●	●	●	●	●	●
Netherlands	●	●		●	●	●
New Zealand	●	●				●
Philippines		●	●	●	●	●
Romania	●	●	●	●	●	●
Russian Federation	●	●	●	●	●	●
Singapore	●	●	●	●	●	●
Slovak Republic	●		●		●	●
Slovenia	●	●	●	●		●
South Africa	●	●	●	●		●
Thailand	●	●	●	●	●	●
Tunisia		●	●	●	●	●
Turkey		●	●		●	●
United States [3]	+	+	+	+	+	+

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

● Country reported that method is used to support or monitor the implementation of the national/regional curriculum at grade 8

+ Not applicable nationally

Background data provided by National Research Coordinators.

* Other than public examinations and system-wide assessments described in Exhibits 5.3 and 5.4, respectively.

1 Australia: Results shown are for the majority of states/territories.

2 Canada: Results shown are for the majority of provinces.

3 United States: Methods are implemented by individual states and vary from state to state. As of 1998, 13 of 50 have policies on textbook/materials selection; 8 of 50 states have policies recommending textbook/materials.

What Countries Have Public Examinations in Mathematics?

5.3 Using public examinations as a way to select students for university or academic tracks in secondary school can be an important motivating factor for student achievement. Exhibit 5.3 shows information on public examinations and their purpose. Thirty-seven countries reported having public examinations or awards, at one or more grades, that included testing achievement in mathematics. Most countries held their examinations in the final year of schooling for certification and selection to higher education (often, university education). Certification also provides students not going on to full-time post-secondary education with evidence of educational attainment for prospective employers. In about one-third of the countries, public examinations were also reported to be used to select students for entry to different types of secondary school, or to assign them to different tracks or courses within secondary schools. Providing feedback to policy makers in the educational system, schools, or both was also an important use of assessments in some countries.

Belgium (Flemish) was the one country that reported having no public examinations in mathematics. This was the only country where decisions about promotion from one grade to the next, certification, and qualification for entrance to university were made at the school level without reliance on system-wide public examinations.

Exhibit 5.3 Public Examinations in Mathematics

TIMSS 1999 8th grade Mathematics

	Public Exams/ Awards	Grade(s)	Purpose/Consequences
Australia	Yes	12	Certification and selection for tertiary education
Belgium (Flemish)	No		
Bulgaria	Yes	7/8, 12	Candidates for profile schools (grade 7 or 8); certification and entrance to university -- not taken by all students (grade 12)
Canada [1]	Yes	3,6,8 (1 province); 10, 11(1 province); 12 (4 provinces)	Feedback to system and schools; certification (grade 12)
Chile	Yes	12	Entry to university
Chinese Taipei	Yes	9, 12	Entry to secondary school (grade 9); entry to university (grade 12)
Cyprus	Yes	12	Certification and entry to university (grade 12); a certification exam occurs on a local level for grade 9
Czech Republic	Yes	13	Certification (mathematics can be chosen as one of four subjects for leaving examination)
England	Yes	10, 12	Certification (grade 10), certification and entry to university (grade 12); feedback to system and schools
Finland	Yes	12	Certification and selection for tertiary education
Hong Kong, SAR	Yes	6, 11, 13	School placement (grade 6); certification and placement for 12th grade (grade 11); placement in tertiary institutions (grade 13)
Hungary	Yes	12	Certification and entry to university
Indonesia	Yes	6, 9, 12	Leaving exam and selection for junior secondary school (grade 6); selection for senior secondary school (grade 9); leaving exam (grade 12); system-level feedback, in some cases school- and classroom-level feedback
Iran, Islamic Rep.	Yes	11, 12	Certification (grade 11); entry to tertiary education (grade 12); in addition, provincial exams are administered at grade 8
Israel	Yes	11 or 12	Entry to higher education
Italy	Yes	13	Certification and entry to university
Japan	Yes	9, 12	Entry to prefectural and municipal upper secondary schools (grade 9); entry to national, prefectural and municipal universities (grade 12)
Jordan	Yes	12	Certification and entry to tertiary education
Korea, Rep. of	Yes	12	College entrance exam for selection of students
Latvia (LSS)	Yes	9, 12	Certification
Lithuania	Yes	9, 12	Graduation from Basic and Upper Secondary schools
Macedonia, Rep. Of	Yes	12	Certification and entry to university; the exam constitutes 40% of the required points for entry to university with the remaining points based on university entry exams
Malaysia	Yes	6, 9, 11, 13	Feedback to system and schools; achievement test (grade 6); entry to course tracks (grade 9); certification and end of secondary (grade 11); certification and entry to university (grade 13)
Moldova	Yes	9, 11/12	Certification and selection for high school (grade 9); graduation (grade 11 or 12 depending on school)
Morocco	Yes	6, 9, 10, 11, 12	Remedial test for retention purposes (grade 6); certification, selection to secondary, and selection to courses (grade 9); certification and entry to tertiary (grade 12); feedback to system and schools
Netherlands	Yes	10, 11, 12	End-of-track examinations; exams recommended at grades 6 and 8
New Zealand	Yes	10, 12	Certification and course selection (grade 10); entry to tertiary education (grade 12); feedback to system and schools; informal between-school comparisons
Philippines	Yes	6, 10	Feedback to system and schools
Romania	Yes	8, 12	Certification (grade 8); certification (grade 12; mathematics can be chosen as one of 7 subjects)
Russian Federation	Yes	9, 11	Certification
Singapore	Yes	6, 10, 12	Selection into courses; certification and entry to university; feedback to system and schools
Slovak Republic	Yes	12	Certification (mathematics can be chosen as one of four subjects for leaving exam)
Slovenia	Yes	8, 12	Entry to secondary school (grade 8); certification and entry to tertiary education (grade 12)
South Africa	Yes	12	Certification and selection for tertiary education
Thailand	Yes	12	Entry to university
Tunisia	Yes	6, 9, 13	Regional exam for promotion (grade 6); feedback to system and schools, selection for schools and courses, and promotion (grade 9); certification and entry to university (grade 13)
Turkey	Yes	8, 11	Placement in specialized schools for some students (grade 8); entry to university (grade 11)
United States [2]	Yes	varies	Primarily feedback to system and schools; in 8 states grade promotion is dependent on results; in 18 states graduation is dependent on results of grade 12 exams

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by National Research Coordinators.

1 Canada: Public examinations are administered in 5 of 10 provinces.

2 United States: As of 1997-1998, public examinations are administered in 47 of 50 states at grades 7-8 or 9-12.

What Countries Have System-Wide Assessment in Mathematics?

Although national public examinations can provide information of interest to national and regional policy makers, their main purpose is to make decisions about individual students. In comparison, system-wide assessments are designed primarily to inform policy makers about matters such as national standards of achievement of the intended curriculum objectives, strengths and weaknesses in the curriculum or how it is being implemented, and whether educational achievement is improving or deteriorating.

5.4 Exhibit 5.4 summarizes information about national assessments in mathematics. Such assessments were conducted in about two-thirds of the participating countries. Half of these countries assessed all students in the grade, and the other half a sample of students from the grade. Most countries tested two or three grades, with Hong Kong (nine grades) and Korea (seven grades) testing the most grades.

Generally, the purpose of the system-wide assessments was to provide feedback to government policy makers and the public. Feedback to individual schools was a feature reported by some countries whose methodology, namely assessment of the entire grade level, allowed for this type of reporting. In Singapore, the 20 schools found to provide the greatest value-added measures received monetary rewards, as did teachers of the top 25 percent of classes in Chile.

In addition to collecting information about examinations and assessments, questionnaires and interviews were used to determine whether, and to what extent, explicit achievement standards were a feature of
R2.1 R intended curricula (see Exhibit R2.1 in the reference section). Twenty-two countries reported that such standards were incorporated in their curricula or related documents. However, the term "achievement standards" means different things in different countries and was unfamiliar to some. Some countries regard them as learning objectives, and others include in this category performance indicators that describe levels of required or desired performance. Exhibit R2.1 includes countries that reported learning objectives or performance objectives as a component of their curriculum documents.

Exhibit 5.4 System-Wide Assessments in Mathematics

TIMSS 1999 8th grade Mathematics

	System-Wide Assessments[1]	Grades		Purpose/Consequences
		Entire Grade Level	Sample from Grade Level	
Australia [2]	Yes	3, 5 (all states) 7 (four states)		System-level, school-level, and individual student-level feedback
Belgium (Flemish)	No			
Bulgaria	Yes		4, 8	System-level feedback, administered only in 1998
Canada [3]	Yes	3, 6, 9 (5 provinces); 5, 8, 11 (1 province); 4, 7, 10 (1 province); 12 (1 province)	Ages 13 and 16 nationally (most provinces)	System- and school-level feedback
Chile	Yes	4, 8, 10		System-level, school-level, class-level feedback; top 25% of teachers are given monetary rewards; usually one grade level assessed each year
Chinese Taipei	No			
Cyprus	No			
Czech Republic	No			
England	Yes	1, 5, 8		School-level feedback; course selection and placement for grade 9
Finland	Yes		4, 6, 9	System-level feedback
Hong Kong, SAR	Yes		1 - 9	System-level feedback
Hungary	Yes		4, 6, 8, 10, 12	System-level, school-level, and individual-level feedback
Indonesia	Yes		various grades	System-level feedback, assessments given irregularly at different primary grades
Iran, Islamic Rep.	No			
Israel	Yes		4, 8	System-level feedback
Italy	Yes		6, 8, 10, 13	System-level feedback; first administered in 1999 with a grade 4 assessment instituted in 2000
Japan	Yes		5, 6, 7, 8, 9	System-level feedback
Jordan	Yes		4, 5, 8, 10	System-level feedback; monitoring reform impact; curricular revisions
Korea, Rep. of	Yes	4, 5, 6, 7, 8, 10, 11		System-level feedback
Latvia (LSS)	No			
Lithuania	No			
Macedonia, Rep. Of	Yes		4, 5, 6, 7, 8	System-level feedback and research purposes (projects and curriculum development)
Malaysia	Yes	6, 9, 11, 13		System- and school-level feedback; "good schools" publicized
Moldova	No			
Morocco	Yes	6, 9, 10, 11, 12		System- and school-level feedback
Netherlands	Yes	10, 11, 12	6	System-level feedback
New Zealand	Yes		3, 7	System-level feedback
Philippines	Yes	6, 10		System- and school-level feedback (the assessment was sample-based up until 1999)
Romania	No			
Russian Federation	Yes		various grades	Irregularly for research purposes
Singapore	Yes	6,10,12		System- and school-level feedback; selection into courses, certification and entry to university
Slovak Republic	No			
Slovenia	No			Assessments administered in grades 1-8 from 1991-1996
South Africa	No			
Thailand	Yes	6, 9, 12		System-level feedback
Tunisia	Yes	4, 6, 9, 13		System- and school-level feedback; may lead to redistribution of teachers in the regions; assessments at grades 4 and 6 developed regionally
Turkey	Yes		5, 8, 11	System- and school-level feedback
United States	Yes		4, 8, 12	National and state-level feedback

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by National Research Coordinators.

1 Public examinations are also used for system-wide assessment purposes in these countries: Malaysia, Morocco, Netherlands, Philippines, Singapore, Tunisia and Turkey.

2 Australia: System-wide assessments are administered in 3 of 8 states/territories.

3 Canada: System-wide assessments are administered in 5 of 10 provinces.

How Much Instructional Time Is Recommended for Mathematics?

The different percentages of time devoted to mathematics instruction at different grades highlight one of the difficulties in investigating the relationship between achievement and instructional time across countries. If instructional time is measured only for the eighth grade, the total time for which students in a country have been exposed to instruction in mathematics during their schooling may be under- or over-estimated. These data for grades 4, 6, and 8 provide a better estimate of students' intended instructional time for mathematics across the school years.

5.5 Percentages of instructional time designated for mathematics specified in the intended curricula for grades 4, 6, and 8 are shown in Exhibit 5.5. The pattern across countries shows that the percentage of time remains the same or decreases from grade 4 to grade 6 and again from grade 6 to grade 8, with 18 countries reporting a decrease in instructional time in mathematics from grade 6 to grade 8. Interestingly, the reverse pattern holds for science.[1] Average percentages of time for mathematics instruction across all countries were 17 percent, 16 percent, and 13 percent for grades 4, 6, and 8, respectively. An opposite trend was found for Morocco and Tunisia, where instructional time for mathematics increased in the eighth grade. Cyprus data show a sharp drop from 17 percent in each of grades 4 and 6 to nine percent in grade 8. Percentages of total instructional time specified for mathematics ranged from eight percent at each of grades 4, 6, and 8 for Thailand to 20 percent or more for six countries at grade 4, two at grade 6, and one (Morocco) at grade 8. Schools' and teachers' reports of the percentage of instructional time actually devoted to the sciences at grade 8, shown in Exhibit 6.4 in the next chapter, generally correspond with the intended percentages reported in Exhibit 5.5.

1 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.

Exhibit 5.5 Overleaf

Exhibit 5.5 Instructional Time for Mathematics

	Instructional Time Specified for Mathematics			Comments
	Grade 4	Grade 6	Grade 8	
Australia	N/S	N/S	N/S	At primary level, English and mathematics are given about the same amount of instructional time. The proportion of time decreases in secondary school. Some students do not study mathematics in their final year of secondary school.
Belgium (Flemish)	18%	18%	15%	Instructional time varies from 10% to 16% in grades 9-10, and from 6% to 25% in grades 11-12.
Bulgaria	16%	13%	13%	At grade 1, 18% of instructional time is devoted to mathematics. This decreases slightly to 15% at 5th grade and is 13% from grades 6-9. Instructional time ranges from 11-14% in grades 10-12.
Canada	15%	15%	15%	For three provinces, there is no change in emphasis as students progress through school. For two provinces, the proportion of time dedicated to mathematics decreases and in one province it increases after grade 6.
Chile	17%	17%	17%	The primary school curriculum states that 5 of 30 classes per week must be devoted to mathematics.
Chinese Taipei	12%	18%	11%	
Cyprus	17%	17%	9%	
Czech Republic	20%	15%	13%	
England	N/S	N/S	N/S	The national curriculum does not specify instructional time fo mathematics. The proposed curriculum assumes 126 hours per year for grade 4 (year 5), and 90 hours per year for grades 6 and 8 (years 7 and 9).
Finland	16%	16%	10%	The curriculum framework indicates the minimum amount of instructional time on average for grade spans 1-6 and 7-9. Schools decide on instructional time for specific grades.
Hong Kong, SAR	15%	15%	15%	Total instructional time on mathematics increases to 17.5% at grade 9 and 11-20% at grades 12 and 13.
Hungary	–	–	–	
Indonesia	14%	14%	14%	
Iran, Islamic Rep.	14%	14%	11%	
Israel	15%	14%	13%	
Italy	N/S	10-15%	10-15%	The curriculum indicates 20% instructional time be devoted to mathematics and science as one subject. The exact distribution of time for each of these subjects is decided by the teacher.
Japan	17%	17%	13%	Time devoted to mathematics is less in lower secondary school, especially at grade 7 where it is only 10%. However, mathematics instructional time at grade 8 is the same as Japanese language and social sciences.
Jordan	18%	15%	13%	At grade 1 about 20% of instructional time is devoted to mathematics. This decreases slightly in other grades and is about 13% from grades 8 -10.
Korea, Rep. of	14%	13%	12%	
Latvia (LSS)	20%	16%	16%	
Lithuania	17-22%	14-17%	13%	Mathematics is usually treated as an important subject since it is one of the two basic school exit exams at grade 10.
Macedonia, Rep. of	20%	17%	13%	
Malaysia	20%	20%	13%	From grade 8 through secondary school, the instructional time specified for mathematics remains about the same. The mathematics curriculum emphasizes understanding concepts and mastering processes (calculating, measuring, computing, communicating mathematically, and problem solving). Emphasis for the higher-level processes increases as students progress through school.
Moldova	17%	17%	16%	
Morocco	15%	15%	20%	
Netherlands	N/S	N/S	10%	Students can choose to stop taking mathematics after grade 9, depending on their course of study.
New Zealand	N/S	N/S	N/S	All schools are required to teach mathematics as part of a "balanced curriculum." Schools decide on instructional time. In general, in primary school, mathematics is allocated the second highest proportion of instructional time, after language (which includes reading). Time for mathematics, science, and English are about the same in secondary school.
Philippines	12%	11%	10%	To supplement the regular mathematics program, enrichment topics and activities are included in mathematics for grade 7, especially in the special science classes/schools.
Romania	17%	17%	15%	
Russian Federation	18%	17%	15%	Mathematics is given less emphasis than philology in grades 1-7. Emphasis on mathematics in grades 8-9 is still less than philology and is equal or slightly less than science and social science.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by National Research Coordinators.

All data rounded to the nearest whole number.

N/S indicates instructional time not specified in the national/regional curriculum.

A dash (–) indicates data not available.

Exhibit 5.5: Instructional Time for Mathematics (Continued)

	Instructional Time Specified for Mathematics			Comments
	Grade 4	Grade 6	Grade 8	
Singapore	22%	20%	15%	Students are required to study mathematics, English and the mother-tongue language throughout primary and secondary school. Pupils who are planning to pursue further study in mathematics or a related discipline are offered an additional mathematics subject in grade 9.
Slovak Republic	–	–	–	
Slovenia	23%	16%	16%	Instructional time for mathematics is relatively equal to instructional time for other subjects.
South Africa	N/S	N/S	N/S	
Thailand	8%	8%	8%	There is no change in content, but there is change in depth.
Tunisia	15%	15%	16%	Mathematics is given the most instructional time after the mother tongue, Arabic. Time devoted to mathematics remains constant, but the amount of instructional time for mathematics compared to other subjects increases in grades 4 and up.
Turkey	13%	13%	13%	There is a tendency to enhance student-centered teaching and learning activities.
United States	N/S	N/S	N/S	States do not generally specify; it is largely a local decision.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

How Do Countries Deal with Individual Differences?

The challenge of maximizing opportunity to learn for students with widely differing abilities and interests is met differently in different countries. Exhibit 5.6 summarizes questionnaire and interview data on how countries dealt with this issue in organizing the intended curricula.

5.6

Some countries indicated using more than one method of dealing with individual differences among students, and in these cases the category describing the main method was reported. The most common approach, found in 24 countries, was to have the same intended curriculum for all students, but to recommend that teachers adapt the level and scope of their teaching to the abilities and needs of their students. Adaptations for individuals and classes were also recommended in the intended curricula of some countries with different levels of curricula or different curricula for different groups.

In the Czech Republic, England, and Israel, mathematics topics were taught at different levels with different groups. The Czech Republic had four levels, Israel three, and England nine. In England's curriculum, the levels were defined in terms of progressively more complex performance to be demonstrated. Among the countries with different curricula for different groups of students, Belgium (Flemish) and the Russian Federation each provided two different levels, Singapore three, and the Netherlands four.

National Research Coordinators from seven countries reported that their official mathematics curricula did not address the issue of differentiating instruction for grade 8 students with different abilities or interests, but this does not necessarily mean that schools and teachers in those countries did not make allowance for individual differences. Schools' reports on how they organize to accommodate students with different abilities or interests are shown in Exhibit R2.2 in the reference section. Substantial percentages of students in many countries were in schools that offered remedial mathematics, including several of the countries without specific curricular statements about differentiation.

R2.2 R

Exhibit 5.6 Differentiation of Instruction for Students with Different Abilities or Interests

TIMSS 1999 8th grade Mathematics

	Curriculum Addresses Differentiation	Approaches to Addressing Students with Different Abilities or Interests at Grade 8			
		Same Curriculum for All Students, and Teachers Adapt to Students' Needs	Same Curriculum with Different Levels for Different Groups	Different Curricula for Different Groups	Number of Curriculum Levels
Australia	Yes	Yes	No	No	1
Belgium (Flemish)	Yes	No	No	Yes	2
Bulgaria	Yes	Yes	No	No	1
Canada	Yes	Yes	No	No	1
Chile	No				
Chinese Taipei	Yes	Yes	No	No	1
Cyprus	Yes	Yes	No	No	1
Czech Republic	Yes	No	Yes	No	4
England [1]	Yes	No	Yes	No	9
Finland	Yes	Yes	No	No	1
Hong Kong, SAR	Yes	Yes	No	No	1
Hungary	Yes	Yes	No	No	1
Indonesia	No				
Iran, Islamic Rep.	Yes	Yes	No	No	1
Israel	Yes	No	Yes	No	3
Italy	No				
Japan	No				
Jordan	Yes	Yes	No	No	1
Korea, Rep. of	Yes	Yes	No	No	1
Latvia (LSS)	No				
Lithuania	No				
Macedonia, Rep. Of	Yes	Yes	No	No	1
Malaysia	Yes	Yes	No	No	1
Moldova	No				
Morocco	Yes	Yes	No	No	1
Netherlands	Yes	No	No	Yes	4
New Zealand	Yes	Yes	No	No	1
Philippines	Yes	Yes	No	No	1
Romania	Yes	Yes	No	No	1
Russian Federation	Yes	No	No	Yes	2
Singapore	Yes	No	No	Yes	3
Slovak Republic	Yes	Yes	No	No	1
Slovenia	Yes	Yes	No	No	1
South Africa	Yes	Yes	No	No	1
Thailand	Yes	Yes	No	No	1
Tunisia	Yes	Yes	No	No	1
Turkey	Yes	Yes	No	No	1
United States [2]	Yes	Yes	No	No	1

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by National Research Coordinators.

[1] England: While there is one "programme of study" for grades 6-8, the document identifies nine performance-levels describing the types and range of performance that pupils working at a particular level should demonstrate.

[2] United States: Most state standards are designed for all students.

What Are the Major Characteristics of the Intended Curriculum?

5.7 Exhibit 5.7 indicates the relative emphasis given to various aspects of mathematics instruction in the intended curriculum. As might be anticipated for students at this point in their schooling, major emphasis was most commonly placed on mastering basic skills and understanding mathematical concepts. Most countries moderately or strongly emphasized assessing student learning. Similarly, "real-life" applications of mathematics were encouraged in the curriculum of most countries, with 15 countries giving this approach major emphasis and 16 moderate emphasis. The Netherlands' intended curriculum was reported to emphasize this approach more than either mastering basic skills or understanding mathematics concepts. Communicating mathematically, an aspect of teaching and learning that has received increasing attention in recent years, was included in the curriculum of most countries and was accorded major emphasis in 13 countries. Similarly, recent efforts to improve students' abilities to apply their mathematical understandings have led to recommendations for more experience with novel problem-solving situations. Thirty-three countries reported at least moderate emphasis on solving non-routine problems.

The mathematical area with the greatest variation across countries' intended curricula was deriving formal proofs. It was given major emphasis in eight countries, moderate emphasis in 13, and minor or no emphasis in 16. Integration of mathematics with other subjects to some degree was a common aim across countries, and about half the countries placed some emphasis on a thematic approach. Working on mathematics projects was given minor or no emphasis in the intended curriculum of most countries, as was a multicultural approach.

Exhibit 5.7 Emphasis on Approaches and Processes

TIMSS 1999 8th grade Mathematics

	Mastering Basic Skills	Understanding Mathematics Concepts	Real-life Applications of Mathematics	Communicating Mathematically	Solving Non-Routine Problems	Deriving Formal Proofs	Working on Mathematics Projects	Integration of Mathematics with Other School Subjects	Thematic Approach	Multicultural Approach	Assessing Student Learning
Australia [1]	●	●	◉	●	◉	○	◉	○	○	○	●
Belgium (Flemish)	●	●	◉	●	◉	○	○	◉	○	○	●
Bulgaria	●	●	◉	◉	◉	●	○	○	○	○	●
Canada [2]	◉	●	●	◉	◉	○	●	●	●	○	●
Chile	●	●	○	○	○	○	○	○	○	○	○
Chinese Taipei	●	●	●	◉	◉	○	○	◉	◉	○	●
Cyprus	◉	◉	○	●	◉	○	○	○	◉	○	◉
Czech Republic	●	●	◉	●	◉	◉	○	◉	●	○	●
England	●	●	●	●	◉	○	○	○	○	◉	●
Finland	●	●	●	◉	◉	○	◉	◉	◉	○	◉
Hong Kong, SAR	●	●	●	●	◉	◉	○	○	○	○	●
Hungary	◉	●	○	●	●	●	○	○	○	○	◉
Indonesia	●	●	◉	◉	●	○	◉	◉	◉	○	●
Iran, Islamic Rep.	◉	●	◉	○	◉	◉	○	○	◉	○	◉
Israel	●	●	◉	○	◉	◉	○	–	–	◉	●
Italy	○	●	●	◉	◉	○	○	●	●	●	◉
Japan	●	●	◉	◉	●	●	◉	○	○	○	●
Jordan	●	●	◉	◉	◉	◉	○	○	●	●	●
Korea, Rep. Of	●	●	●	○	◉	●	◉	◉	◉	○	◉
Latvia (LSS)	●	●	◉	●	◉	◉	○	◉	●	○	●
Lithuania	●	○	◉	○	◉	●	○	◉	●	○	◉
Macedonia, Rep. Of	●	●	◉	◉	◉	●	○	◉	○	○	●
Malaysia	●	●	●	◉	◉	○	○	◉	◉	○	◉
Moldova	◉	●	○	◉	◉	●	○	◉	◉	○	–
Morocco	◉	●	●	◉	◉	◉	○	◉	◉	○	◉
Netherlands	◉	◉	●	●	◉	○	●	●	●	◉	◉
New Zealand	◉	●	●	●	●	○	◉	◉	○	◉	●
Philippines	●	●	●	●	◉	◉	◉	○	○	○	●
Romania	●	◉	○	○	◉	◉	○	○	○	○	◉
Russian Federation	●	●	◉	●	◉	●	○	◉	●	○	●
Singapore	●	●	●	●	●	◉	○	○	○	○	●
Slovak Republic	–	–	–	–	–	–	–	–	–	–	–
Slovenia	●	◉	●	◉	○	○	○	○	○	○	●
South Africa	●	●	●	◉	●	◉	●	◉	◉	◉	●
Thailand	●	●	◉	◉	○	○	○	◉	○	○	◉
Tunisia	●	◉	◉	◉	○	◉	○	◉	◉	○	◉
Turkey	●	●	○	◉	◉	◉	○	◉	○	○	●
United States	●	●	◉	◉	●	○	◉	◉	◉	◉	●

● Major Emphasis

◉ Moderate Emphasis

○ Minor/No Emphasis

– Data not available

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by National Research Coordinators.

1 Australia: Results shown are for the majority of states/territories.

2 Canada: Results shown are for the majority of provinces.

What Mathematics Content Do Teachers Emphasize at the Eighth Grade?

Teachers of the mathematics classes tested were asked what subject matter they emphasized most in their classes (e.g., geometry, algebra, various combinations of content, etc.). Their responses are presented in Exhibit 5.8.

5.8

More than a quarter of the students received instruction emphasizing mainly number in eight countries: Canada, Chile, Finland, Lithuania, Malaysia, the Philippines, Thailand, and the United States. Internationally on average, more than half the students were taught a combination of mathematics topics (i.e., combined algebra, geometry, number, etc.). However, there was considerable variation among countries, ranging from all students in England being given the combined emphasis to none in the Russian Federation. In the latter, 100 percent of the students were taught combined algebra and geometry. Internationally on average, about one-fifth of the students received the combined algebra and geometry emphasis.

Twenty percent or more of students were in mathematics classes that emphasized algebra in Korea, Morocco, Singapore, and the United States. Very few students were given an emphasis in geometry (three percent on average internationally), with Tunisia the only country where 20 percent or more of the students were in classes that emphasized geometry.

Exhibit 5.8 Subject Matter Emphasized Most in Mathematics Class

TIMSS 1999 8th grade Mathematics

	Percentage of Students Whose Teachers Report the Subject Matter Emphasized Most in Their Grade 8 Mathematics Class					
	Mainly Number	Combined Algebra, Geometry, Number, etc.	Combined Algebra and Geometry	Algebra	Geometry	Other
Australia	– –	– –	– –	– –	– –	– –
Belgium (Flemish)	10 (3.3)	65 (3.6)	17 (2.3)	3 (1.2)	2 (1.3)	3 (2.3)
Bulgaria	0 (0.0)	27 (4.2)	64 (4.7)	8 (3.2)	1 (0.8)	0 (0.0)
Canada r	26 (3.0)	53 (2.8)	6 (1.6)	6 (1.4)	1 (0.0)	9 (1.9)
Chile	72 (3.6)	15 (2.8)	4 (1.7)	0 (0.0)	3 (1.3)	6 (1.9)
Chinese Taipei	2 (1.1)	57 (4.2)	24 (3.6)	4 (1.7)	9 (2.6)	4 (1.6)
Cyprus r	1 (0.0)	71 (4.4)	21 (3.7)	7 (2.3)	0 (0.0)	0 (0.0)
Czech Republic	0 (0.2)	76 (3.9)	19 (3.9)	4 (1.2)	0 (0.0)	0 (0.0)
England s	0 (0.0)	100 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Finland	32 (4.3)	46 (4.6)	12 (3.2)	3 (1.3)	4 (1.4)	3 (1.5)
Hong Kong, SAR	7 (2.4)	60 (4.8)	11 (2.8)	13 (3.3)	4 (1.8)	5 (2.1)
Hungary	11 (2.6)	75 (3.1)	8 (1.9)	5 (1.6)	0 (0.0)	0 (0.0)
Indonesia	10 (3.0)	71 (4.9)	10 (2.5)	5 (2.2)	4 (2.7)	0 (0.4)
Iran, Islamic Rep.	17 (4.1)	57 (4.3)	14 (3.1)	6 (2.1)	6 (2.1)	0 (0.0)
Israel r	1 (0.4)	35 (4.0)	42 (4.1)	19 (3.4)	1 (0.6)	2 (1.3)
Italy	2 (1.0)	67 (3.8)	22 (3.3)	5 (1.8)	4 (1.4)	1 (0.0)
Japan	7 (2.0)	30 (4.1)	35 (4.0)	16 (3.1)	9 (2.5)	4 (1.6)
Jordan	20 (3.6)	71 (3.9)	3 (1.5)	3 (1.4)	2 (1.2)	1 (1.0)
Korea, Rep. of	6 (1.9)	51 (4.0)	20 (3.1)	20 (3.4)	2 (1.1)	2 (0.9)
Latvia (LSS)	1 (0.6)	71 (3.7)	20 (3.1)	7 (2.5)	0 (0.0)	0 (0.0)
Lithuania ‡	42 (3.9)	0 (0.0)	28 (3.7)	17 (3.2)	1 (1.0)	11 (2.6)
Macedonia, Rep. of r	8 (2.5)	51 (4.5)	37 (4.1)	4 (2.4)	1 (0.5)	0 (0.0)
Malaysia	34 (4.3)	61 (4.4)	1 (0.0)	3 (1.4)	1 (0.0)	1 (0.6)
Moldova	x x	x x	x x	x x	x x	x x
Morocco	10 (2.1)	34 (2.7)	20 (2.9)	20 (2.4)	13 (1.9)	3 (1.0)
Netherlands	4 (3.2)	77 (4.6)	13 (2.9)	2 (1.1)	1 (0.8)	3 (1.6)
New Zealand	1 (0.0)	98 (1.3)	0 (0.0)	0 (0.0)	1 (0.9)	1 (0.0)
Philippines	42 (4.4)	47 (4.6)	2 (1.3)	3 (1.7)	1 (0.9)	4 (1.9)
Romania	4 (1.9)	72 (4.1)	21 (3.3)	2 (1.4)	1 (0.0)	0 (0.0)
Russian Federation	0 (0.0)	0 (0.0)	100 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Singapore	8 (2.3)	46 (4.5)	12 (2.9)	29 (3.7)	0 (0.0)	5 (1.7)
Slovak Republic	12 (3.0)	74 (4.0)	7 (2.0)	4 (1.9)	0 (0.0)	4 (1.8)
Slovenia	5 (1.9)	77 (3.8)	14 (3.0)	2 (1.1)	0 (0.0)	1 (1.1)
South Africa	3 (1.2)	59 (4.4)	25 (3.8)	10 (2.6)	3 (1.4)	1 (0.8)
Thailand	44 (3.5)	47 (3.7)	4 (1.6)	2 (1.0)	0 (0.0)	2 (1.4)
Tunisia	8 (2.5)	41 (4.4)	21 (3.3)	8 (2.4)	22 (3.4)	1 (0.7)
Turkey	– –	– –	– –	– –	– –	– –
United States	28 (3.0)	32 (3.4)	6 (1.6)	27 (2.7)	1 (0.8)	6 (1.4)
International Avg.	14 (0.4)	55 (0.6)	19 (0.5)	8 (0.4)	3 (0.2)	2 (0.2)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

Are There National or Regional Policies on Using Calculators?

5.9

For the TIMSS 1999 countries, official policies on calculator use are summarized in Exhibit 5.9. The data indicate wide variation across countries, ranging from encouraging unrestricted use, through use with restrictions, to banning calculator use entirely. Official documents of 23 countries included an explicit policy on the use of calculators. Seven of these reported that their curriculum policy allowed unrestricted use of calculators, and 14 restricted use. In Canada and the United States, policy varied across provinces and states, respectively.

Several countries commented that calculators were not permitted in lower grades of their primary school systems, and others that the use of calculators in these grades was limited so that students could master basic computational skills, both mentally and using pencil and paper. During preparation of the original TIMSS tests, the question whether students should be permitted to use calculators in the test was considered, but for equity reasons TIMSS decided not to permit the use of calculators at the middle school grades.

Exhibit 5.9 Policy On Calculator Usage*

TIMSS1999 8th grade Mathematics

	Curriculum Contains Recommendations About Use of Calculators	Type of Policy	Comments
Australia	Yes	Unrestricted Use	Calculators are unrestricted as a teaching/learning tool. Computational skills like mental arithmetic are also promoted.
Belgium (Flemish)	Yes	Restricted Use	Calculators are permitted on a limited basis so that students can master the basic skills of computation and mental calculation. Calculator usage increases and is compulsory after grade 9.
Bulgaria	No		
Canada	Yes	Unrestricted, 2 provinces, Restricted, 8 provinces	In general, calculator use is encouraged, except in lower grades in some provinces.
Chile	No		
Chinese Taipei	Yes	Restricted Use	Calculators are not allowed on entrance exams so teachers limit their use in the classroom.
Cyprus	Yes	Restricted Use	Calculators are not permitted in final exams until grade 10.
Czech Republic	Yes	Restricted Use	Computational skills are practiced without calculators.
England	Yes	Restricted Use	Calculator use increases as students progress through school. The emphasis is on pupils having a range of skills: calculator, pencil and paper, and mental computation. Graphic calculators are required at higher levels.
Finland	Yes	Unrestricted Use	Although permitted at the lower levels, policy indicates that the use of calculators is more appropriate at the upper levels (grades 7 - 9).
Hong Kong, SAR	Yes	Unrestricted Use	Calculators may be used for exploration only from grades 1 to 6. No restrictions are set on the use of calculators for students from grade 7 onwards.
Hungary	Yes	Restricted Use	Calculator use considered appropriate in higher grades.
Indonesia	Yes	Restricted Use	Calculators are not permitted in lower grades.
Iran, Islamic Rep.	No		
Israel	Yes	Unrestricted Use	Calculators are permitted through all school levels (grades 1-12).
Italy	No		
Japan	Yes	Unrestricted Use	Calculators are not permitted until grade 5.
Jordan	Yes	Restricted Use	The curriculum does not contain an explicit policy on classroom use of calculators, but policy does indicate that calculator usage is prohibited during tests.
Korea, Rep. of	Yes	Restricted Use	Currently, calculators are not used in class. However, the new curriculum, to be implemented in 2000/1, recommends the wide use of calculators.
Latvia (LSS)	No		
Lithuania	No		
Macedonia, Rep. Of	No		
Malaysia	No		Calculators are used as learning aids. At the secondary level, calculators may be used in public exams when calculation and computational skills are not being assessed.
Moldova	Yes	Restricted Use	For specific problems, a calculator is acceptable.
Morocco	No		
Netherlands	Yes	Unrestricted Use	Calculators are compulsory at national exam level. In grades 11-12 the graphic calculator is compulsory for mathematics students.
New Zealand	Yes	Unrestricted Use	The policy assumes that calculators will be available and used "appropriately" at all levels.
Philippines	No		In the high school, calculators are used mainly for statistics and trigonometry.
Romania	No		
Russian Federation	Yes	Restricted Use	There is some use of calculators in elementary school. Recommended use of calculators on a level with oral and written calculations in secondary school. Students are not allowed to use calculators on public exams in grades 9 and 11.
Singapore	Yes	Restricted Use	In primary school, students are not allowed to use calculators in mathematics. In secondary school, the use of calculators is allowed from grade 7, though the use is restricted.
Slovak Republic	–	–	
Slovenia	No		
South Africa	Yes	Restricted Use	As students progress through school, the policy becomes less restricted. For grades 8-12, the policy restriction indicates that students may not use a programmable calculator.
Thailand	No		
Tunisia	Yes	Restricted Use	Calculators are not permitted until grade 8.
Turkey	No		
United States	Yes	Varies from state to state	

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by National Research Coordinators.

A dash (–) indicates data are not available.

* The use of calculators on TIMSS was not allowed in 1995 or in 1999.

What Mathematics Topics Are Included in the Intended Curriculum?

In the course of their meetings on planning and implementation of TIMSS 1999, the National Research Coordinators developed a list of mathematics topics that they agreed covered most of the content in the intended mathematics curriculum in their respective countries. This list of topics,
5.10
presented in Exhibit 5.10, built on the topics covered in the TIMSS 1995 mathematics test and included in the teacher questionnaire. It represents a comprehensive list of the topics likely to have been included in the curricula of the participating countries up to and including eighth grade. From the following choices, the National Research Coordinators indicated the percentage of students in their own countries expected to have been taught each topic:

- All or almost all students (at least 90 percent)
- About half of the students
- Only the more able students (top track – about 25 percent)
- Only the most advanced students (10 percent or less).

5.11
Exhibit 5.11 summarizes the data according to the percentage of topics intended to be taught to all or almost all students (at least 90 percent) in each country, across the entire list of topics and for each content area. On average across countries, curricular guidelines called for nearly all students to have been taught three-fourths of the topics overall. Internationally on average, the greatest percentage of topics intended to be taught to 90 percent or more of the students was in fractions and number sense (86 percent) and in measurement (83 percent).

About two-thirds of the topics in geometry (67 percent) and algebra (68 percent), internationally on average, were expected to have been taught to nearly all students. In eight countries, including high-performing Japan, Korea, and Singapore, countries reported that 10 or more of the 11 algebra topics were intended to be taught to at least 90 percent of the students. Information on specific topics in the intended curricula for each
R2.3–R2.7 R
content area is presented in Exhibits R2.3 through R2.7 in the reference section of this report.

The least agreement between the intended curricula and the topic areas was in data representation, analysis, and probability, with an international average of 60 percent of the topics intended to be taught. Only seven countries intended for all five topics listed for this content area to be taught to nearly all students: Australia, Canada, Moldova, New Zealand, the Russian Federation, Turkey, and the United States.

It should be noted that some countries reported having different curricula or different levels of curriculum for different groups of students, as detailed in Exhibit 5.6. Not surprisingly, then, these countries often reported that about half, only the more able (25 percent), or the top 10 percent of students were expected to have been taught substantial percentages of the topics, in particular those in geometry and algebra. The three countries with the lowest percentages of topics overall intended to be taught to nearly all students have differentiated curricula – England, Israel, and the Netherlands.

In addition, if content within a topic area required different responses, National Research Coordinators chose the response that best represented the entire topic area and noted the discrepancy (see Exhibit A.11 in the appendix for details).

Exhibit 5.10 Mathematics Topics Included in the TIMSS Questionnaires

Fractions and Number Sense

- ■ Whole numbers - including place values, factorization and operations (+, -, x, ÷)
- ■ Understanding and representing common fractions
- ■ Computations with common fractions
- ■ Understanding and representing decimal fractions
- ■ Computations with decimal fractions
- ■ Relationships between common and decimal fractions, ordering of fractions
- ■ Rounding whole numbers and decimal fractions
- ■ Estimating the results of computations
- ■ Number lines
- ◆ Whole number powers of integers
- ■ Computations with percentages and problems involving percentages
- ■ Simple computations with negative numbers
- ■ Square roots (of perfect squares less than 144), small integer exponents
- ◆ Prime factors, highest common factor, lowest common multiple, rules for divisibility
- ◆ Sets, subsets, union, intersection, Venn diagrams
- ◆ Rate problems
- ■ Concepts of ratio and proportion; ratio and proportion problems

Measurement

- ■ Units of measurement; standard metric units
- ■ Reading measurement instruments
- ■ Estimates of measurement; accuracy of measurement
- ◆ Conversions of units between measurement systems
- ■ Perimeter and area of simple shapes – triangles, rectangles and circles
- ■ Perimeter and area of combined shapes
- ■ Volume of rectangular solids – i.e., Volume = length x width x height
- ◆ Volume of other solids (e.g., pyramids, cylinders, cones, spheres)
- ◆ Computing with measurements (+, -, x, ÷)
- ■ Scales applied to maps and models

Data Representation, Analysis, and Probability

- ◆ Collecting and graphing data from a survey
- ■ Representation and interpretation of data in graphs, charts, and tables
- ■ Arithmetic mean
- ◆ Median and mode
- ■ Simple probabilities – understanding and calculations

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

■ Topics included in the curriculum and teacher questionnaires (intended and implemented curriculum).

◆ Topics also included in the curriculum questionnaire (intended curriculum).

Geometry

- ■ Cartesian coordinates of points in a plane
- ■ Coordinates of points on a given straight line
- ■ Simple two dimensional geometry – angles on a straight line, parallel lines, triangles and quadrilaterals
- ■ Congruence and similarity
- ◆ Angles – (acute, right, supplementary, etc.)
- ◆ Pythagorean theorem (without proof)
- ■ Symmetry and transformations (reflection and rotation)
- ■ Visualization of three-dimensional shapes
- ◆ Geometric constructions with straight-edge and compass
- ◆ Regular polygons and their properties – names (e.g., hexagon and octagon), sum of angles, etc.
- ◆ Proofs (formal deductive demonstrations of geometric relationships)
- ◆ Sine, cosine, and tangent in right-angle triangles
- ◆ Nets of solids

Algebra

- ■ Number patterns and simple relations
- ◆ Writing expressions for general terms in number pattern sequence
- ◆ Translating from verbal descriptions to symbolic expressions
- ■ Simple algebraic expressions
- ◆ Evaluating simple algebraic expressions by substitution of given value of variables
- ■ Representing situations algebraically; formulas
- ■ Solving simple equations
- ■ Solving simple inequalities
- ◆ Solving simultaneous equations in two variables
- ◆ Interpreting linear relations
- ◆ Using the graph of a relationship to interpolate/extrapolate

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

■ Topics included in the curriculum and teacher questionnaires (intended and implemented curriculum).

◆ Topics also included in the curriculum questionnaire (intended curriculum).

Exhibit 5.11 Mathematics Topics in the Intended Curriculum for At Least 90% of Students, Up to and Including Eighth Grade

TIMSS 1999 8th grade Mathematics

	Percentage of Topics Intended to Be Taught to All or Almost All (at least 90%) Students					
	Overall	Fractions and Number Sense	Measurement	Data Representation, Analysis, and Probability	Geometry	Algebra
Australia	89	94	100	100	85	73
Belgium (Flemish)	80	100	90	80	62	64
Bulgaria	82	88	100	40	77	82
Canada	82	94	90	100	77	55
Chile	61	76	80	80	54	18
Chinese Taipei	59	82	50	40	46	55
Cyprus	63	82	70	0	54	64
Czech Republic	77	94	90	80	69	45
England	25	29	30	40	23	9
Finland	57	65	80	60	31	55
Hong Kong, SAR	79	94	80	40	77	73
Hungary	77	94	60	60	69	82
Indonesia	86	94	100	60	85	73
Iran, Islamic Rep.	80	88	100	40	77	73
Israel	41	47	40	60	23	45
Italy	91	100	80	80	92	91
Japan	89	82	100	80	85	100
Jordan	89	100	100	80	85	73
Korea, Rep. of	80	82	100	80	54	91
Latvia (LSS)	70	82	80	20	54	82
Lithuania	80	94	100	40	69	73
Macedonia, Rep. of	59	59	60	0	69	73
Malaysia	80	94	90	40	85	64
Moldova	95	94	90	100	92	100
Morocco	59	82	90	40	54	9
Netherlands	46	53	40	60	54	27
New Zealand	80	100	70	100	69	64
Philippines	71	94	90	80	23	73
Romania	93	100	100	20	100	100
Russian Federation	75	88	60	100	62	73
Singapore	89	94	100	80	77	91
Slovak Republic	–	–	–	–	–	–
Slovenia	91	100	100	40	92	91
South Africa	73	88	100	0	69	64
Thailand	73	88	90	40	54	73
Tunisia	79	100	90	60	62	64
Turkey	91	88	90	100	85	100
United States	93	100	100	100	85	82
International Avg.	75	86	83	60	67	68

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by National Research Coordinators according to the national curriculum. NRCs indicated the percentage of students who should have been taught each of the topics listed in Exhibit 5.10. The response categories were: all or almost all of the students (at least 90%); about half of the students; only the more able students (top track - about 25%); only the most advanced students (10% or less); not included in curriculum through grade 8. (See reference exhibits R2.3-R2.7 for detail by topic.)

A dash (–) indicates data are not available.

Have Students Been Taught the Topics Tested by TIMSS?

In interpreting the achievement results, it is important to consider how extensively the topics tested are taught in the participating countries. As shown in Exhibits 5.12 through 5.16, the five major mathematics content areas assessed in TIMSS 1999 were represented by 34 topic areas. For each area, teachers indicated whether their students had been taught the topics before this year, one to five periods this year, more than five periods this year; whether the topics had not yet been taught; or whether the teacher did not know. Exhibits 5.12 through 5.16 show the percentages of students in each country reported to have been taught each topic before or during the year of the testing.

According to their teachers, nearly all of the students in all of the countries had been taught the topics in fractions and number sense, as shown in Exhibit 5.12. The international average for each topic exceeded 90 percent of students, with the exception of "square roots (of perfect squares less than 144), small integer exponents" and "concepts of ratio and proportions; ratio and proportion problems," with averages of 83 and 87 percent, respectively. Exhibit R2.8 in the reference section indicates that many students had instruction in these topics before the eighth grade.

5.12

R2.8 R

Similarly, instructional coverage was high for the measurement topics presented in Exhibit 5.13. At least 87 percent of students, on average internationally, were taught five of the six topics. The topic with the lowest international average was "scales applied to maps and models." Two topics, "units of measurement; standards metric units" and "perimeter and area of simple shapes – triangles, rectangles, and circles," were taught to 96 percent of the students on average, internationally. As indicated by Exhibit R2.9 in the reference section, measurement topics received less emphasis in the eighth grade than fractions and number sense topics (see Exhibit R2.8). As with fractions and number sense, substantial percentages of students had studied the measurement topics before the eighth grade.

5.13

R2.9 R

Corresponding to the reports for the intended curricula, teachers reported lower average percentages internationally across the data representation, analysis, and probability topic areas, shown in Exhibit 5.14. Teachers were asked about three topics in this content area, including "representation and interpretation of data in graphs, charts, and tables." Most of the test items in this content area dealt with interpretation of graphs and tables, and the international average for students who were taught this topic was 75 percent. The average percentages of

5.14

students taught the other two topics in this content area were 70 percent for "arithmetic mean" and 43 percent for "simple probabilities." In 22 countries, teachers indicated that less than half the students were taught the latter topic. For most students, the topics in this content area were
R2.10 receiving moderate attention at the eighth grade, and few students had been taught them at earlier grades (see Exhibit R2.10).

Teachers reported a range of instructional coverage across topics in geom-
5.15 etry, presented in Exhibit 5.15. "Simple two dimensional geometry – angles on a straight line, parallel lines, triangles and quadrilaterals" was reported to have been taught internationally on average to 95 percent of the students, and "visualization of three-dimensional shapes" was taught to only 57 percent. The two topics showing the greatest variation across countries were "symmetry and transformations" and "visualization of three-dimensional shapes." In more than nine countries, these topics were reported to be taught to less than 50 percent of the students, and in at least 15 countries to 70 percent or more of the students. As shown in
R2.11 Exhibit R2.11 in the reference section, only small percentages of students had completed instruction in the geometry topics before the eighth grade. According to their teachers, most were receiving moderate emphasis on the geometry topics in the eighth grade. On average internationally, 22 percent of students had not yet been taught 50 percent or more of the geometry topics.

Teachers across countries reported that most students had studied the
5.16 algebra topics. The international average percentage of students taught each of these topics exceeded 85 percent, with the exception of "solving simple inequalities," with an average of 66 percent. Four of the five topics were taught to 70 percent or fewer of the students in three countries, Chile, Finland, and the Philippines. In contrast, substantial percentages of students (90 percent or more) had been introduced to all algebra topics before or during the eighth grade in ten countries, including high-performing Japan, Korea, and Singapore. For many countries, however,
R2.12 teachers reported presenting algebra topics during the eighth grade for substantial percentages of students (see Exhibit R2.12).

Exhibits 5.12–5.16 Overleaf

Exhibit 5.12 Percentages of Students Taught Fractions and Number Sense Topics*

	Whole numbers - including place values, factorization and operations (+, –, x, ÷)	Understanding and representing common fractions	Computations with common fractions	Understanding and representing decimal fractions	Computations with decimal fractions	Relationships between common and decimal fractions, ordering of fractions	Rounding whole numbers and decimal fractions
Australia	100 (0.0)	100 (0.3)	100 (0.3)	100 (0.0)	100 (0.3)	100 (0.0)	99 (0.6)
Belgium (Flemish)	95 (3.1)	99 (1.2)	97 (2.4)	88 (2.9)	83 (2.2)	89 (4.1)	90 (3.5)
Bulgaria	s 99 (0.9)	s 99 (0.6)	s 99 (0.9)	s 99 (0.6)	s 99 (0.9)	s 99 (0.9)	s 99 (0.6)
Canada	r 99 (0.6)	r 100 (0.3)	r 100 (0.3)	r 99 (0.5)	r 98 (0.8)	r 99 (0.4)	r 100 (0.3)
Chile	100 (0.0)	100 (0.4)	100 (0.0)	99 (0.5)	99 (0.5)	98 (1.0)	92 (2.2)
Chinese Taipei	100 (0.0)	100 (0.3)	100 (0.3)	100 (0.3)	99 (0.7)	100 (0.3)	98 (1.1)
Cyprus	s 96 (2.7)	r 100 (0.0)	r 100 (0.0)	r 100 (0.0)	r 99 (0.8)	r 99 (0.8)	r 94 (2.6)
Czech Republic	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
England	s 100 (0.1)	s 99 (0.5)	s 93 (2.0)	s 97 (0.9)	s 95 (1.1)	s 94 (1.1)	s 97 (0.9)
Finland	98 (1.3)	94 (2.6)	88 (3.3)	100 (0.5)	99 (0.8)	90 (3.0)	89 (2.9)
Hong Kong, SAR	98 (1.1)	99 (0.8)	99 (0.8)	99 (0.8)	100 (0.0)	99 (0.8)	100 (0.4)
Hungary	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
Indonesia	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
Iran, Islamic Rep.	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.4)	99 (0.9)	99 (0.9)	98 (1.4)
Israel	97 (1.3)	99 (0.6)	99 (0.5)	98 (1.0)	98 (0.9)	98 (1.0)	r 96 (1.6)
Italy	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.5)	100 (0.0)	100 (0.0)	100 (0.4)
Japan	99 (1.0)	98 (1.4)	100 (0.0)	98 (1.4)	100 (0.0)	99 (1.0)	92 (2.7)
Jordan	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
Korea, Rep. of	92 (2.1)	96 (1.5)	96 (1.6)	97 (1.4)	96 (1.6)	96 (1.7)	94 (2.0)
Latvia (LSS)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	99 (0.7)
Lithuania ‡	– –	– –	– –	– –	– –	– –	– –
Macedonia, Rep. of	90 (2.4)	87 (2.8)	87 (2.8)	87 (2.8)	88 (2.5)	88 (2.6)	87 (2.6)
Malaysia	98 (1.0)	99 (0.9)	99 (0.9)	97 (1.3)	97 (1.5)	95 (1.5)	96 (1.7)
Moldova	– –	– –	– –	– –	– –	– –	– –
Morocco	– –	– –	– –	– –	– –	– –	– –
Netherlands	r 74 (5.8)	100 (0.3)	100 (0.3)	r 96 (3.2)	r 96 (3.3)	r 96 (3.3)	100 (0.0)
New Zealand	100 (0.0)	96 (1.5)	94 (1.7)	98 (0.8)	98 (0.8)	96 (1.3)	96 (1.2)
Philippines	100 (0.0)	100 (0.0)	100 (0.0)	98 (1.2)	99 (0.7)	99 (0.8)	97 (1.5)
Romania	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	99 (1.0)
Russian Federation	– –	– –	– –	– –	– –	– –	– –
Singapore	100 (0.0)	100 (0.0)	100 (0.0)	99 (0.9)	100 (0.0)	100 (0.0)	100 (0.0)
Slovak Republic	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
Slovenia	100 (0.0)	100 (0.0)	99 (0.9)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
South Africa	– –	– –	– –	– –	– –	– –	– –
Thailand	94 (1.8)	97 (1.3)	99 (0.6)	98 (1.1)	99 (0.9)	99 (0.6)	94 (2.0)
Tunisia	99 (0.8)	r 93 (2.4)	r 97 (1.6)	94 (2.2)	99 (0.8)	r 91 (2.7)	r 46 (5.3)
Turkey	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.2)
United States	100 (0.2)	100 (0.0)	100 (0.0)	98 (0.8)	98 (0.8)	98 (0.8)	99 (0.7)
International Avg.	98 (0.3)	99 (0.2)	98 (0.2)	98 (0.2)	98 (0.2)	98 (0.2)	95 (0.3)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

* Taught before or during this school year.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

	Estimating the results of computations	Number lines	Computations with percentages and problems involving percentages	Simple computations with negative numbers	Square roots (of perfect squares less than 144), small integer exponents	Concepts of ratio and proportions; ratio and proportion problems
Australia	96 (1.4)	99 (0.9)	97 (1.5)	99 (1.0)	94 (2.2)	86 (3.6)
Belgium (Flemish)	r 94 (2.0)	96 (2.5)	93 (2.1)	89 (2.6)	80 (2.2)	70 (2.8)
Bulgaria	s 98 (1.2)	r 47 (5.3)	s 97 (1.7)	s 99 (1.3)	r 38 (4.3)	r 98 (1.0)
Canada	r 100 (0.3)	r 100 (0.1)	r 98 (0.8)	r 97 (1.6)	r 96 (1.2)	r 95 (1.3)
Chile	88 (2.7)	99 (0.9)	80 (3.1)	77 (3.2)	57 (3.7)	88 (2.3)
Chinese Taipei	95 (2.0)	99 (0.8)	94 (1.9)	100 (0.3)	96 (1.6)	90 (2.6)
Cyprus	r 96 (2.1)	s 100 (0.0)	r 100 (0.0)	r 100 (0.0)	s 100 (0.0)	r 100 (0.0)
Czech Republic	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.2)
England	s 96 (1.7)	s 97 (1.3)	s 96 (1.3)	s 96 (1.3)	s 87 (2.0)	s 79 (2.7)
Finland	86 (3.6)	96 (1.9)	48 (4.3)	98 (1.6)	20 (3.1)	14 (3.1)
Hong Kong, SAR	r 94 (2.2)	92 (2.6)	95 (1.9)	99 (0.8)	98 (1.2)	91 (2.5)
Hungary	100 (0.0)	95 (1.6)	100 (0.0)	100 (0.0)	99 (0.8)	98 (1.0)
Indonesia	97 (2.0)	100 (0.0)	100 (0.0)	99 (0.4)	98 (1.3)	92 (2.9)
Iran, Islamic Rep.	r 86 (3.2)	100 (0.0)	99 (1.1)	100 (0.0)	100 (0.0)	100 (0.0)
Israel	r 94 (1.5)	99 (0.5)	92 (2.1)	99 (0.4)	r 83 (2.9)	r 35 (4.5)
Italy	94 (2.0)	99 (0.8)	96 (1.6)	98 (1.1)	100 (0.0)	99 (0.8)
Japan	r 89 (3.3)	100 (0.0)	100 (0.0)	100 (0.0)	14 (3.0)	97 (1.6)
Jordan	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	99 (0.5)
Korea, Rep. of	89 (2.5)	98 (1.2)	92 (2.0)	95 (1.8)	64 (4.1)	90 (2.3)
Latvia (LSS)	r 91 (2.5)	30 (4.3)	100 (0.0)	100 (0.0)	98 (0.7)	98 (1.1)
Lithuania ‡	– –	– –	– –	– –	– –	– –
Macedonia, Rep. of	82 (3.2)	r 83 (3.1)	92 (2.3)	88 (2.7)	91 (2.5)	r 97 (1.9)
Malaysia	98 (1.1)	100 (0.0)	96 (1.5)	99 (0.6)	98 (1.0)	97 (1.3)
Moldova	– –	– –	– –	– –	– –	– –
Morocco	– –	– –	– –	– –	– –	– –
Netherlands	r 99 (1.0)	99 (0.9)	98 (1.2)	98 (1.4)	92 (3.1)	r 80 (5.8)
New Zealand	97 (0.9)	97 (1.5)	93 (2.1)	96 (1.5)	86 (2.8)	67 (3.8)
Philippines	91 (2.3)	94 (2.1)	97 (1.5)	87 (3.2)	65 (4.1)	92 (2.4)
Romania	99 (0.9)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
Russian Federation	– –	– –	– –	– –	– –	– –
Singapore	100 (0.4)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
Slovak Republic	99 (0.6)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
Slovenia	98 (1.3)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
South Africa	– –	– –	– –	– –	– –	– –
Thailand	94 (2.1)	98 (1.0)	100 (0.0)	98 (1.1)	94 (2.3)	99 (0.8)
Tunisia	s 35 (4.5)	r 54 (4.4)	81 (3.6)	92 (2.5)	20 (3.7)	r 35 (4.3)
Turkey	x x	80 (2.8)	97 (1.6)	99 (0.7)	96 (1.2)	99 (0.4)
United States	100 (0.2)	99 (0.5)	96 (1.4)	97 (1.1)	82 (3.7)	93 (1.8)
International Avg.	93 (0.4)	92 (0.3)	95 (0.3)	97 (0.2)	83 (0.4)	87 (0.4)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Exhibit 5.13 Percentages of Students Taught Measurement Topics*

	Units of measurement, standard metric units	Reading measurement instuments	Estimates of measurement, accuracy of measurement	Perimeter and area of simple shapes - triangles, rectangles, and circles	Perimeter and area of combined shapes	Volume of rectangular solids - i.e., volume=length × width × height	Scales applied to maps and models
Australia	99 (1.0)	r 96 (2.0)	94 (2.2)	98 (1.2)	97 (1.4)	85 (3.2)	73 (4.4)
Belgium (Flemish)	95 (1.8)	r 83 (3.8)	r 85 (4.1)	98 (1.2)	r 85 (3.9)	89 (3.5)	88 (2.2)
Bulgaria	s 98 (1.2)	s 87 (3.1)	s 92 (2.7)	s 98 (1.3)	s 84 (4.2)	s 94 (2.6)	s 87 (3.0)
Canada	r 99 (0.5)	r 97 (1.2)	r 97 (1.0)	r 97 (0.9)	r 96 (1.3)	r 68 (2.7)	r 92 (2.1)
Chile	87 (2.7)	74 (3.6)	67 (3.9)	88 (2.7)	74 (3.8)	45 (4.4)	49 (4.0)
Chinese Taipei	96 (1.7)	95 (2.0)	90 (2.7)	100 (0.3)	92 (2.3)	99 (0.7)	74 (3.8)
Cyprus	s 100 (0.0)	x x	x x	s 100 (0.0)	s 100 (0.0)	r 67 (3.7)	r 43 (5.0)
Czech Republic	100 (0.2)	r 99 (0.6)	97 (1.2)	100 (0.0)	90 (3.2)	100 (0.0)	98 (1.2)
England	s 98 (0.9)	s 96 (1.3)	s 86 (2.8)	s 98 (1.0)	s 96 (1.1)	s 93 (1.4)	s 76 (2.6)
Finland	98 (0.9)	r 88 (3.0)	r 77 (4.0)	65 (4.2)	51 (4.5)	58 (4.3)	20 (3.7)
Hong Kong, SAR	98 (1.2)	96 (1.9)	92 (2.5)	100 (0.0)	99 (0.8)	98 (1.5)	91 (2.7)
Hungary	100 (0.0)	100 (0.2)	100 (0.2)	99 (0.6)	97 (1.2)	98 (1.1)	90 (2.5)
Indonesia	96 (1.6)	94 (2.1)	87 (3.5)	100 (0.0)	98 (1.1)	87 (3.6)	94 (2.1)
Iran, Islamic Rep.	91 (2.7)	86 (2.6)	86 (3.0)	100 (0.0)	97 (1.6)	97 (1.7)	81 (4.1)
Israel	r 90 (2.5)	s 77 (4.3)	s 81 (3.9)	r 84 (3.1)	r 62 (4.0)	r 47 (4.7)	s 43 (5.0)
Italy	100 (0.0)	96 (1.6)	90 (2.3)	99 (0.8)	96 (1.3)	95 (1.4)	91 (2.2)
Japan	90 (2.5)	r 84 (3.3)	r 66 (4.2)	99 (0.7)	78 (3.3)	98 (1.4)	84 (3.1)
Jordan	100 (0.0)	100 (0.0)	97 (1.6)	100 (0.0)	99 (0.9)	99 (0.5)	88 (3.1)
Korea, Rep. of	85 (2.7)	84 (2.7)	93 (2.1)	98 (1.2)	95 (1.8)	98 (1.0)	73 (3.4)
Latvia (LSS)	99 (0.7)	92 (2.7)	71 (4.5)	96 (1.8)	72 (4.6)	81 (3.9)	94 (2.4)
Lithuania ‡	– –	– –	– –	– –	– –	– –	– –
Macedonia, Rep. of	88 (2.7)	r 81 (3.7)	r 82 (3.4)	92 (2.8)	r 91 (3.0)	r 95 (1.5)	s 70 (4.4)
Malaysia	96 (1.7)	93 (2.0)	93 (2.0)	97 (2.0)	95 (2.3)	91 (2.4)	86 (3.0)
Moldova	– –	– –	– –	– –	– –	– –	– –
Morocco	– –	– –	– –	– –	– –	– –	– –
Netherlands	r 93 (4.7)	s 54 (8.4)	r 78 (6.3)	98 (1.2)	84 (4.9)	89 (4.9)	88 (5.3)
New Zealand	99 (0.8)	95 (1.6)	85 (2.9)	95 (1.8)	92 (2.1)	92 (1.8)	66 (4.1)
Philippines	88 (2.8)	83 (3.4)	82 (3.3)	92 (2.3)	83 (3.1)	76 (3.7)	40 (4.4)
Romania	100 (0.0)	100 (0.0)	96 (1.7)	100 (0.0)	99 (0.9)	99 (0.9)	98 (1.3)
Russian Federation	– –	– –	– –	– –	– –	– –	– –
Singapore	100 (0.0)	r 98 (1.2)	98 (1.3)	100 (0.0)	100 (0.0)	100 (0.0)	96 (1.6)
Slovak Republic	99 (1.2)	r 77 (4.2)	r 93 (2.7)	100 (0.0)	99 (0.8)	97 (1.5)	99 (1.2)
Slovenia	100 (0.0)	91 (2.7)	93 (2.2)	100 (0.0)	100 (0.0)	97 (1.3)	97 (1.7)
South Africa	– –	– –	– –	– –	– –	– –	– –
Thailand	91 (2.5)	86 (3.0)	88 (2.7)	95 (1.8)	78 (3.7)	99 (0.7)	85 (3.0)
Tunisia	94 (2.2)	r 74 (3.9)	r 53 (4.6)	98 (1.3)	89 (2.6)	89 (2.5)	r 47 (5.2)
Turkey	89 (2.6)	88 (2.4)	90 (2.2)	92 (2.2)	79 (3.1)	56 (3.8)	r 60 (3.6)
United States	96 (1.0)	r 92 (1.7)	r 91 (1.2)	95 (1.4)	90 (1.6)	83 (2.0)	r 84 (2.5)
International Avg.	96 (0.3)	89 (0.5)	87 (0.5)	96 (0.3)	89 (0.5)	87 (0.5)	77 (0.6)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

* Taught before or during this school year.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

Exhibit 5.14 Percentages of Students Taught Data Representation, Analysis, and Probability Topics*

TIMSS 1999 8th grade Mathematics

	Representation and interpretation of data in graphs, charts, and tables	Arithmetic mean	Simple probabilities – understanding and calculations
Australia	92 (2.4)	74 (3.5)	52 (4.3)
Belgium (Flemish)	86 (4.1)	93 (2.1)	r 24 (3.0)
Bulgaria	r 71 (6.6)	r 39 (5.5)	r 10 (2.6)
Canada	r 91 (2.4)	r 81 (2.7)	r 72 (3.3)
Chile	49 (3.8)	49 (3.5)	35 (3.6)
Chinese Taipei	11 (2.3)	12 (2.7)	4 (1.6)
Cyprus	r 1 (0.1)	r 6 (2.2)	r 0 (0.0)
Czech Republic	49 (5.6)	88 (3.4)	7 (2.8)
England	s 99 (0.4)	s 93 (2.3)	s 90 (2.4)
Finland	65 (3.5)	62 (4.3)	14 (3.3)
Hong Kong, SAR	65 (4.5)	30 (4.1)	10 (2.8)
Hungary	99 (0.8)	92 (2.4)	56 (3.5)
Indonesia	93 (2.1)	93 (2.4)	95 (1.9)
Iran, Islamic Rep.	94 (3.8)	92 (3.8)	r 45 (5.0)
Israel	r 62 (4.4)	r 71 (3.8)	s 28 (3.8)
Italy	84 (3.0)	62 (3.6)	49 (3.8)
Japan	43 (4.7)	38 (4.5)	3 (1.4)
Jordan	93 (2.6)	93 (2.6)	95 (1.8)
Korea, Rep. of	95 (1.7)	78 (3.2)	99 (0.6)
Latvia (LSS)	98 (1.3)	99 (0.6)	40 (4.3)
Lithuania ‡	– –	– –	– –
Macedonia, Rep. of	r 76 (4.5)	82 (3.4)	r 45 (5.0)
Malaysia	56 (3.8)	38 (3.5)	33 (3.7)
Moldova	– –	– –	– –
Morocco	– –	– –	– –
Netherlands	87 (4.7)	77 (5.7)	r 46 (6.5)
New Zealand	87 (3.0)	77 (3.4)	61 (3.9)
Philippines	60 (4.2)	34 (4.3)	29 (4.2)
Romania	95 (2.2)	100 (0.0)	95 (1.7)
Russian Federation	– –	– –	– –
Singapore	97 (1.7)	88 (3.2)	s 17 (4.2)
Slovak Republic	72 (4.7)	98 (1.2)	30 (4.7)
Slovenia	97 (1.4)	94 (2.2)	r 40 (4.4)
South Africa	– –	– –	– –
Thailand	90 (2.9)	57 (4.3)	44 (4.2)
Tunisia	38 (4.4)	28 (4.0)	6 (2.3)
Turkey	79 (2.6)	93 (2.2)	78 (4.0)
United States	96 (1.2)	93 (1.6)	79 (2.3)
International Avg.	75 (0.6)	70 (0.6)	43 (0.6)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

* Taught before or during this school year.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

Exhibit 5.15 Percentages of Students Taught Geometry Topics*

	Cartesian coordinates of points in a plane	Coordinates of points on a given straight line	Simple two dimensional geometry - angles on a straight line, parallel lines, triangles and quadrilaterals	Congruence and similarity	Symmetry and transformations (reflection and rotation)	Visualization of three-dimensional shapes
Australia	92 (2.4)	80 (3.7)	96 (1.7)	61 (4.2)	64 (3.8)	r 75 (4.2)
Belgium (Flemish)	78 (3.0)	r 54 (3.9)	91 (4.1)	79 (2.5)	87 (2.9)	57 (4.0)
Bulgaria	92 (2.5)	r 91 (3.9)	100 (0.5)	81 (3.6)	82 (3.4)	r 24 (4.7)
Canada	r 81 (2.5)	r 84 (2.6)	r 94 (1.8)	r 84 (2.7)	r 78 (2.4)	r 63 (3.2)
Chile	59 (3.7)	65 (3.9)	96 (1.5)	69 (3.8)	26 (3.0)	47 (4.3)
Chinese Taipei	100 (0.0)	99 (0.9)	78 (3.5)	60 (4.3)	29 (3.7)	42 (4.1)
Cyprus	r 6 (2.5)	r 20 (4.3)	r 100 (0.0)	r 16 (4.0)	r 23 (4.7)	r 40 (5.1)
Czech Republic	94 (2.6)	88 (4.9)	100 (0.0)	86 (3.7)	98 (1.1)	73 (5.2)
England	s 94 (1.3)	s 79 (3.1)	s 95 (1.6)	s 54 (4.1)	s 88 (2.6)	s 75 (3.0)
Finland	93 (1.9)	64 (4.0)	88 (2.8)	36 (3.8)	37 (4.0)	30 (4.0)
Hong Kong, SAR	98 (1.3)	95 (1.9)	97 (1.6)	89 (2.8)	r 31 (4.6)	r 29 (4.7)
Hungary	100 (0.3)	92 (2.3)	99 (0.7)	82 (3.1)	97 (1.2)	70 (3.6)
Indonesia	100 (0.0)	100 (0.0)	94 (2.5)	66 (3.9)	56 (4.2)	28 (4.1)
Iran, Islamic Rep.	97 (1.4)	100 (0.0)	98 (1.0)	97 (1.5)	95 (1.7)	77 (4.0)
Israel	87 (3.1)	r 83 (3.4)	91 (2.5)	53 (4.0)	r 21 (3.3)	r 11 (2.6)
Italy	93 (1.9)	79 (3.0)	98 (1.2)	91 (2.0)	65 (3.8)	89 (2.4)
Japan	100 (0.0)	99 (1.0)	97 (1.4)	98 (1.2)	98 (1.3)	82 (2.9)
Jordan	95 (1.9)	93 (2.5)	98 (1.1)	99 (0.5)	27 (4.0)	99 (1.1)
Korea, Rep. of	98 (1.1)	99 (0.7)	99 (0.7)	99 (0.7)	71 (3.7)	52 (4.2)
Latvia (LSS)	99 (1.1)	99 (0.9)	99 (0.8)	72 (4.0)	11 (2.4)	7 (1.9)
Lithuania ‡	– –	– –	– –	– –	– –	– –
Macedonia, Rep. of	95 (1.5)	91 (2.7)	90 (2.6)	r 95 (1.5)	90 (2.6)	r 74 (4.3)
Malaysia	x x	x x	96 (1.4)	71 (3.1)	68 (3.7)	70 (3.5)
Moldova	– –	– –	– –	– –	– –	– –
Morocco	– –	– –	– –	– –	– –	– –
Netherlands	r 97 (1.5)	r 97 (1.5)	98 (1.1)	49 (5.8)	78 (5.3)	r 60 (6.2)
New Zealand	83 (2.9)	69 (3.6)	97 (1.6)	49 (4.2)	76 (3.1)	70 (3.7)
Philippines	49 (4.4)	57 (4.3)	77 (3.8)	50 (4.1)	26 (3.8)	31 (3.7)
Romania	99 (0.6)	99 (0.6)	100 (0.0)	100 (0.0)	86 (2.7)	97 (1.7)
Russian Federation	– –	– –	– –	– –	– –	– –
Singapore	91 (2.6)	93 (2.4)	96 (1.8)	96 (1.9)	84 (3.4)	r 72 (4.4)
Slovak Republic	74 (4.1)	73 (4.4)	95 (2.3)	28 (3.7)	41 (5.0)	r 43 (5.0)
Slovenia	99 (0.9)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	86 (2.9)
South Africa	– –	– –	– –	– –	– –	– –
Thailand	91 (2.7)	88 (3.1)	90 (2.9)	92 (2.6)	53 (4.5)	74 (4.1)
Tunisia	14 (3.2)	78 (3.3)	86 (2.9)	r 8 (2.6)	30 (4.0)	50 (4.4)
Turkey	90 (2.6)	99 (0.6)	97 (1.3)	97 (1.3)	86 (3.0)	37 (3.5)
United States	r 83 (2.4)	82 (2.5)	89 (2.0)	r 80 (2.6)	r 62 (2.9)	r 61 (2.7)
International Avg.	85 (0.4)	84 (0.5)	95 (0.3)	72 (0.6)	63 (0.6)	57 (0.7)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

* Taught before or during this school year.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

Exhibit 5.16 Percentages of Students Taught Algebra Topics*

TIMSS1999 8th grade Mathematics

	Number patterns and simple relations	Simple algebraic expressions	Representing situations algebraically; formulas	Solving simple equations	Solving simple inequalities
Australia	100 (0.0)	100 (0.0)	96 (1.6)	94 (1.8)	45 (3.9)
Belgium (Flemish)	r 86 (2.9)	84 (1.9)	84 (3.1)	85 (2.8)	r 9 (2.1)
Bulgaria	r 98 (1.1)	r 99 (0.7)	98 (1.3)	100 (0.5)	99 (0.7)
Canada	r 98 (1.0)	r 98 (0.8)	r 92 (2.1)	r 94 (2.3)	r 50 (3.2)
Chile	66 (3.7)	68 (3.5)	56 (3.9)	84 (2.6)	69 (3.9)
Chinese Taipei	92 (2.5)	99 (0.8)	99 (0.8)	98 (1.2)	43 (4.2)
Cyprus	r 84 (3.3)	r 89 (3.9)	r 100 (0.0)	s 100 (0.0)	r 100 (0.0)
Czech Republic	r 99 (1.2)	100 (0.0)	97 (1.9)	96 (2.0)	32 (5.2)
England	s 98 (0.6)	s 96 (1.1)	s 89 (1.8)	s 93 (1.5)	s 39 (3.7)
Finland	49 (4.8)	73 (3.9)	47 (4.3)	52 (4.3)	4 (1.6)
Hong Kong, SAR	r 87 (3.0)	100 (0.0)	100 (0.0)	100 (0.0)	27 (4.0)
Hungary	94 (2.1)	100 (0.3)	98 (1.3)	100 (0.0)	99 (0.8)
Indonesia	61 (4.2)	92 (2.6)	91 (2.5)	97 (1.8)	96 (2.0)
Iran, Islamic Rep.	99 (0.7)	100 (0.0)	96 (1.7)	100 (0.0)	r 24 (3.8)
Israel	100 (0.2)	97 (1.2)	88 (3.0)	99 (0.9)	92 (1.8)
Italy	98 (1.2)	100 (0.4)	95 (1.7)	95 (1.7)	27 (2.9)
Japan	r 94 (2.4)	100 (0.0)	98 (1.2)	100 (0.0)	99 (0.7)
Jordan	35 (4.1)	99 (0.9)	96 (1.7)	100 (0.0)	60 (4.2)
Korea, Rep. of	95 (1.3)	99 (0.7)	96 (1.6)	99 (0.7)	99 (1.0)
Latvia (LSS)	92 (2.6)	100 (0.0)	100 (0.0)	100 (0.0)	96 (1.8)
Lithuania ‡	– –	– –	– –	– –	– –
Macedonia, Rep. of	81 (3.7)	94 (2.5)	r 97 (1.5)	r 99 (0.7)	97 (1.5)
Malaysia	98 (1.2)	99 (0.9)	98 (1.1)	99 (1.0)	72 (3.4)
Moldova	– –	– –	– –	– –	– –
Morocco	– –	– –	– –	– –	– –
Netherlands	87 (4.9)	r 86 (4.9)	81 (6.0)	76 (5.3)	r 39 (6.4)
New Zealand	99 (0.8)	97 (1.2)	91 (2.5)	90 (2.5)	38 (4.3)
Philippines	70 (3.6)	78 (3.3)	66 (4.0)	69 (4.2)	45 (4.3)
Romania	100 (0.0)	100 (0.0)	99 (1.0)	100 (0.0)	99 (0.9)
Russian Federation	– –	– –	– –	– –	– –
Singapore	98 (1.4)	100 (0.0)	100 (0.0)	100 (0.0)	93 (2.3)
Slovak Republic	99 (0.9)	100 (0.1)	97 (1.5)	100 (0.0)	93 (2.5)
Slovenia	98 (1.1)	100 (0.0)	99 (0.6)	100 (0.0)	92 (2.5)
South Africa	– –	– –	– –	– –	– –
Thailand	75 (4.1)	75 (4.3)	74 (4.2)	99 (0.5)	97 (1.3)
Tunisia	r 71 (4.0)	85 (3.3)	r 61 (4.7)	72 (4.0)	21 (3.7)
Turkey	91 (2.0)	93 (2.2)	94 (2.0)	99 (1.0)	99 (0.7)
United States	97 (1.1)	98 (0.9)	96 (1.1)	98 (0.6)	83 (2.3)
International Avg.	88 (0.5)	94 (0.4)	90 (0.4)	94 (0.3)	66 (0.5)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

* Taught before or during this school year.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

Can Meaningful Comparisons Be Made Between the Intended and Implemented Curriculum?

The TIMSS 1999 results indicate some discrepancies in a number of countries between the intended curriculum in mathematics and the implemented curriculum as reported by teachers. There are many cases of topics intended to be taught to all, or almost all, students in a country for which teachers reported lower coverage. For example, curricular goals and aims in 25 countries included "visualization of three-dimensional shapes" for all or almost all students, but teachers in only eight countries reported that at least 75 percent of the students had been taught this topic. Interestingly, there are also cases for which teachers reported greater topic coverage than would be expected from the intended curriculum. Substantial percentages of students in several countries had been taught "simple probabilities" even when this topic was not included in the official curriculum. Such discrepancies are consistent with previous IEA studies.[2] However, considering the broad nature of the topics, care should be taken in interpreting the results. Further analysis will need to be done within each country to strengthen the match between the intended and implemented curricula.

2 Livingstone, I.D., (1986), *Second International Mathematics Study: Perceptions of the Intended and Implemented Mathematics Curriculum*, Washington, D.C., Center for Statistics, U.S. Department of Education.

CHAPTER 6

6

Teachers and Instruction

To provide information about mathematics teachers and instruction, Chapter 6 presents teachers' reports on their background and training and their instructional practices. Information also is presented about the materials used in instruction, the activities students do in class, the use of calculators and computers in mathematics lessons, the role of homework, and the reliance on different types of assessment approaches.

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.

To collect information about mathematics instruction, TIMSS administered a two-part questionnaire in which teachers were asked to provide information about their background and training and their instructional practices. Information was also collected about the materials used in instruction, the activities students do in class, the use of calculators and computers in mathematics lessons, the role of homework, and the reliance on different types of assessment approaches. Chapter 6 presents teachers' responses to some of these questions.

Because the sampling for the teacher questionnaires was based on participating students, teachers' responses do not necessarily represent all eighth-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. 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 1999 test. 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. Thus, the information about 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 70 to 84 percent of the students, an “r” is included next to its data. Where teacher responses are available for 50 to 69 percent of students, an “s” is included. Where teacher responses are available for less than 50 percent, an “x” replaces the data.

What Preparation Do Teachers Have for Teaching Mathematics?

This section presents information about background characteristics of mathematics teachers, including age and gender, major area of study, and certification. Teachers' confidence in teaching various mathematics topics is also discussed.

As shown in Exhibit 6.1, the majority of the eighth-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. Internationally on average, only 16 percent of students were taught by teachers younger than age 30. The three countries with the most students (about one-third) taught by younger teachers were Hong Kong, Iran, and Singapore. Although 21 percent of the students internationally were taught by teachers age 50 or older, the teaching force was relatively older in a number of countries. About one-third or more of the students (from 32 to 47 percent) in Chile, the Czech Republic, Finland, Italy, Macedonia, Moldova, Romania, and the Slovak Republic had teachers at least 50 years of age. 6.1

Internationally on average, 60 percent of eighth-grade students were taught mathematics by females and 40 percent by males, and similar percentages were found in a number of countries. However, at least 75 percent of students had female teachers in Bulgaria, Hungary, Israel, Italy, Latvia (LSS), Lithuania, Moldova, the Philippines, the Russian Federation, Singapore, the Slovak Republic, and Slovenia. By contrast, in no country were as many as three-fourths of the students taught mathematics by male teachers. The three countries with the most students taught by male teachers were Iran (70 percent), Japan (73 percent), and the Netherlands (72 percent).

Exhibit 6.2 presents teachers' reports about their major areas of study and certification. Teachers' undergraduate and graduate studies provide some indication of their preparation to teach mathematics. On average internationally, 84 percent of students were taught by teachers having mathematics and/or mathematics education as a major area of study. Teachers can have dual majors, or different majors at the undergraduate and graduate level. Exhibit R3.1 in the reference section provides detail for each of the following major areas of study: mathematics, mathematics education, science or science education, education (other than mathematics or science education), and other, which includes majors in any other areas. 6.2 R3.1 R

text continued page 190

Exhibit 6.1 Age and Gender of Teachers

TIMSS 1999 8th grade Mathematics

		Percentage of Students by Age of Teachers					Percentage of Students by Gender of Teachers	
		29 Years or Under	30 -39 Years	40-49 Years	50 Years or Older		Female	Male
Australia		23 (4.0)	25 (3.3)	36 (4.1)	16 (3.0)		42 (4.3)	58 (4.3)
Belgium (Flemish)		20 (2.7)	15 (2.4)	38 (3.0)	27 (3.1)		66 (4.8)	34 (4.8)
Bulgaria		8 (2.4)	33 (5.7)	38 (4.8)	21 (4.1)		87 (2.8)	13 (2.8)
Canada		17 (2.4)	33 (2.7)	25 (3.1)	26 (3.0)		53 (3.0)	47 (3.0)
Chile		3 (1.1)	17 (2.7)	47 (3.6)	33 (3.5)		45 (3.9)	55 (3.9)
Chinese Taipei		10 (2.6)	34 (4.0)	30 (4.0)	26 (3.4)		51 (4.1)	49 (4.1)
Cyprus		3 (1.0)	42 (4.1)	33 (3.5)	23 (3.4)		67 (4.4)	33 (4.4)
Czech Republic		7 (2.5)	29 (4.8)	22 (5.0)	43 (5.6)		73 (4.0)	27 (4.0)
England	s	20 (2.9)	23 (3.5)	35 (3.6)	22 (2.7)	s	48 (3.8)	52 (3.8)
Finland		10 (2.8)	15 (2.8)	30 (3.6)	45 (4.4)		59 (4.4)	41 (4.4)
Hong Kong, SAR		32 (4.2)	38 (4.5)	19 (3.3)	11 (2.6)		44 (4.1)	56 (4.1)
Hungary		8 (2.3)	20 (3.2)	46 (4.1)	26 (3.2)		80 (3.2)	20 (3.2)
Indonesia		23 (3.8)	50 (3.9)	20 (3.3)	8 (2.6)		44 (4.7)	56 (4.7)
Iran, Islamic Rep.		36 (4.8)	23 (3.1)	39 (4.8)	2 (1.2)		30 (3.8)	70 (3.8)
Israel		21 (3.0)	26 (3.2)	36 (3.4)	17 (2.5)		78 (3.1)	22 (3.1)
Italy		0 (0.0)	8 (2.0)	58 (4.1)	34 (3.8)		76 (3.1)	24 (3.1)
Japan		21 (3.3)	39 (4.3)	33 (3.7)	7 (2.1)		27 (3.6)	73 (3.6)
Jordan		27 (3.7)	45 (4.6)	24 (3.2)	4 (1.5)		48 (4.5)	52 (4.5)
Korea, Rep. of		19 (3.0)	53 (3.7)	15 (2.5)	13 (2.8)		59 (3.4)	41 (3.4)
Latvia (LSS)		14 (3.2)	33 (4.4)	28 (4.4)	25 (4.2)		91 (2.6)	9 (2.6)
Lithuania ‡		5 (1.7)	34 (4.1)	32 (3.9)	29 (4.0)		90 (2.5)	10 (2.5)
Macedonia, Rep. of		1 (0.9)	29 (3.6)	23 (3.6)	47 (3.5)		50 (4.6)	50 (4.6)
Malaysia		28 (3.6)	39 (4.4)	27 (3.6)	6 (1.8)		68 (3.6)	32 (3.6)
Moldova		4 (1.7)	24 (4.0)	39 (4.0)	33 (4.3)		76 (3.6)	24 (3.6)
Morocco		4 (1.3)	34 (3.2)	58 (3.2)	4 (1.0)		39 (3.1)	61 (3.1)
Netherlands	r	15 (4.3)	17 (3.9)	41 (5.4)	26 (5.3)		28 (5.0)	72 (5.0)
New Zealand		16 (3.3)	19 (3.4)	35 (4.2)	30 (4.2)		44 (4.0)	56 (4.0)
Philippines		25 (3.6)	37 (4.1)	23 (3.2)	15 (2.7)		75 (3.9)	25 (3.9)
Romania		8 (2.1)	19 (3.6)	30 (4.2)	42 (4.2)		63 (4.1)	37 (4.1)
Russian Federation		8 (2.0)	32 (3.7)	29 (2.9)	31 (4.0)		93 (2.6)	7 (2.6)
Singapore		37 (4.4)	25 (4.0)	15 (3.2)	23 (3.6)		75 (4.1)	25 (4.1)
Slovak Republic		9 (2.4)	21 (3.9)	38 (4.8)	32 (4.3)		86 (3.3)	14 (3.3)
Slovenia		6 (1.6)	43 (4.3)	39 (4.2)	12 (2.7)		89 (2.8)	11 (2.8)
South Africa		29 (3.4)	55 (4.1)	13 (3.2)	3 (1.3)		39 (4.9)	61 (4.9)
Thailand		23 (3.2)	28 (3.6)	43 (3.7)	6 (2.1)		69 (3.7)	31 (3.7)
Tunisia		21 (3.0)	35 (3.9)	40 (4.2)	4 (1.7)		39 (4.3)	61 (4.3)
Turkey		23 (3.4)	15 (2.3)	56 (3.9)	5 (2.3)		41 (3.9)	59 (3.9)
United States		11 (2.0)	25 (3.5)	37 (3.9)	27 (2.9)		60 (3.0)	40 (3.0)
International Avg.		16 (0.5)	30 (0.6)	33 (0.6)	21 (0.5)		60 (0.6)	40 (0.6)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

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

Exhibit 6.2 Preparation to Teach Mathematics

TIMSS 1999 8th grade Mathematics

	Percent of Students Taught by Teachers Having Mathematics as the Major Area of Study in Their BA, MA or Teacher Training Program[1]	Percent of Students Taught by Certified Teachers[2]	Percent of Students Taught by Teachers Having Both Teacher Certification and Mathematics as the Major Area of Study[2]
Australia	72 (4.4)	100 (0.0)	72 (4.4)
Belgium (Flemish)	97 (1.0)	97 (2.0)	94 (2.3)
Bulgaria	98 (1.1)	99 (0.9)	97 (1.4)
Canada	28 (2.8)	95 (1.4)	25 (3.0)
Chile	78 (3.1)	99 (0.5)	77 (3.1)
Chinese Taipei	89 (2.8)	95 (1.9)	86 (3.0)
Cyprus	99 (0.6)	32 (4.2)	32 (4.2)
Czech Republic	95 (2.9)	96 (1.7)	92 (3.3)
England	s 90 (1.9)	s 94 (1.7)	s 85 (2.3)
Finland	75 (4.3)	91 (2.4)	68 (4.6)
Hong Kong, SAR	68 (4.3)	78 (3.6)	56 (4.3)
Hungary	99 (0.8)	100 (0.0)	99 (0.8)
Indonesia	92 (1.9)	47 (4.5)	44 (4.4)
Iran, Islamic Rep.	r 83 (3.3)	81 (3.4)	69 (4.1)
Israel	84 (2.5)	90 (2.3)	77 (2.8)
Italy [3]	23 (3.5)	– –	– –
Japan	93 (2.4)	100 (0.0)	93 (2.4)
Jordan	r 91 (2.7)	42 (3.7)	38 (3.7)
Korea, Rep. of	97 (1.2)	99 (0.6)	97 (1.4)
Latvia (LSS)	94 (2.3)	r 62 (4.4)	r 61 (4.5)
Lithuania [‡]	94 (2.0)	93 (2.1)	88 (2.8)
Macedonia, Rep. of	100 (0.0)	99 (0.9)	99 (0.9)
Malaysia	72 (3.9)	89 (2.5)	65 (3.9)
Moldova	r 88 (2.8)	39 (4.6)	34 (4.4)
Morocco	97 (0.9)	86 (1.9)	82 (2.0)
Netherlands	r 91 (2.9)	96 (3.2)	r 87 (3.3)
New Zealand	51 (4.1)	96 (1.3)	49 (4.1)
Philippines	87 (3.2)	93 (1.8)	81 (3.6)
Romania	97 (1.3)	91 (2.2)	91 (2.2)
Russian Federation	97 (1.7)	95 (1.8)	93 (2.2)
Singapore	84 (3.4)	100 (0.0)	84 (3.4)
Slovak Republic	97 (0.8)	r 47 (4.7)	r 46 (4.7)
Slovenia	89 (2.4)	88 (2.4)	81 (3.1)
South Africa	82 (3.5)	89 (2.1)	72 (3.9)
Thailand	65 (4.3)	90 (2.4)	59 (4.4)
Tunisia	r 85 (3.6)	90 (2.7)	r 76 (4.1)
Turkey	96 (1.4)	77 (3.0)	73 (3.2)
United States	61 (3.2)	– –	– –
International Avg.	84 (0.4)	85 (0.4)	73 (0.6)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

1 Teachers having mathematics as the major area of study are those who reported having a bachelor's degree (BA) or equivalent, master's degree (MA), or teacher training certificate in mathematics or mathematics education.

2 Includes teachers certified to teach any subject.

3 Italy: Teacher training certificate not required but teachers must excel on a national exam.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, at the beginning at 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 data are not available.

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

continued from
page 187

Eighty-five percent of students, on average internationally, were taught mathematics by teachers having a teaching certificate in any subject. In TIMSS 1995, detailed information collected about certification indicated a wide range of criteria across countries.[1] For example, the number of years of post-secondary education required for a teaching qualification ranged from two years in Iran to as many as six years in Canada; many countries reported four years. Almost all countries reported that teaching practice was required, and a large number reported that an evaluation or examination was required for certification. In some countries, such as the United States, the types of certification varied according to the policies of different states. Despite difficulties in interpretation illustrated by the 1995 data, however, it is interesting to note that in TIMSS 1999 the percentages of students taught by teachers reporting that they had a certificate ranged from 32 percent in Cyprus to 100 percent in Australia, Hungary, Japan, and Singapore. There was even more variation among countries when both certification and having had mathematics as a major were considered. The percentage of students taught by teachers both certified and having had mathematics or mathematics education as a major ranged from 25 percent in Canada to 99 percent in Hungary and Macedonia, with an international average of 73 percent.

To gauge teachers' confidence to teach mathematics topics, TIMSS constructed an index of teachers' confidence in their preparation to teach
6.3 mathematics (CPTM), presented in Exhibit 6.3. Teachers were asked how well prepared they felt to teach each of 12 mathematics topics (e.g., properties of geometric figures, solving linear equations and inequalities). Responses were given on a three-point scale; very well prepared was assigned a value of three, somewhat prepared two, and not well prepared one. Students were assigned to the high level of the index if their teachers reported that they felt very well prepared, on average across the 12 topics (2.75 or higher). The medium level indicates that teachers reported being somewhat to well prepared (averages from 2.25 to 2.75), and the low level that they reported being only somewhat prepared or less (averages less than 2.25).

The results show that average mathematics achievement is related to how well teachers felt they were prepared to teach mathematics, with higher achievement related to higher levels of teachers' confidence in their preparation. On average internationally, teachers reported relatively high degrees of confidence, with 63 percent of students taught by teachers who believed they were very well prepared. Countries where 85 percent or more of the students were taught by teachers who believed they were very well prepared were Macedonia, the United States, the Slovak Republic,

[1] 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.

Cyprus, Jordan, New Zealand, and the Czech Republic. Interestingly, countries with substantial percentages of students whose teachers reported a low level of confidence included both high- and low-performing countries. One-third or more of the students in Chile, Hungary, Japan, Slovenia, Thailand, and Tunisia were taught by teachers feeling only somewhat prepared or less.

The detail for the 12 topics included in the index is provided in Exhibit R3.2 in the reference section. On average across countries, the topics having the most students (from 79 to 82 percent) taught by teachers who felt very well prepared were fractions, decimals, and percentages; ratios and proportions; perimeter, area, and volume; evaluate and perform operations on algebraic expressions; and solving linear equations and inequalities. Teachers reported being least well prepared to teach understanding and calculations related to simple probabilities; just more than half the students internationally (55 percent on average) were taught by teachers who felt very well prepared to teach this topic. Exhibit R3.3 shows principals' opinions about the degree to which shortages of qualified mathematics teachers affect the capacity to provide instruction. On average internationally, principals reported that such shortages affect the quality of instruction some or a lot for one-third of the students. Bulgaria, Jordan, Moldova, Tunisia, and Turkey reported shortages affecting capacity to provide instruction a lot for more than half their students.

R3.2 R

R3.3 R

Teachers' beliefs about mathematics learning and instruction are to some degree related to their preparation. Exhibits R3.4 and R3.5 in the reference section show the percentages of eighth-grade students whose mathematics teachers reported certain beliefs about mathematics, the way mathematics should be taught, and the importance of various cognitive skills in achieving success in the discipline. In general, there was substantial agreement about the inherent nature of mathematical abilities. For example, in most countries 80 percent or more of students had teachers who agreed that some students have a natural talent for mathematics. There was also nearly complete agreement that more than one representation should be used in teaching a mathematics topic. The greatest variation in views pertained to the importance of being able to remember formulas and procedures; only about 10 percent of students in Slovenia were taught by teachers who believed this ability was very important for students' success in mathematics, while about 90 percent of students in the Philippines had teachers who believed that to be the case.

R3.4, R3.5 R

Exhibit 6.3 Index of Teachers' Confidence in Preparation to Teach Mathematics (CPTM)

Index of Teachers' Confidence in Preparation to Teach Mathematics

Index based on teachers' responses to 12 questions about how prepared they feel to teach different mathematics topics (see reference exhibit R3.2) based on a 3-point scale: 1 = not well prepared; 2 = somewhat prepared; 3 = very well prepared. Average is computed across the 12 items for items for which the teacher did not respond do not teach. High level indicates average is greater than or equal to 2.75. Medium level indicates average is greater than or equal to 2.25 and less than 2.75. Low level indicates average is less than 2.25.

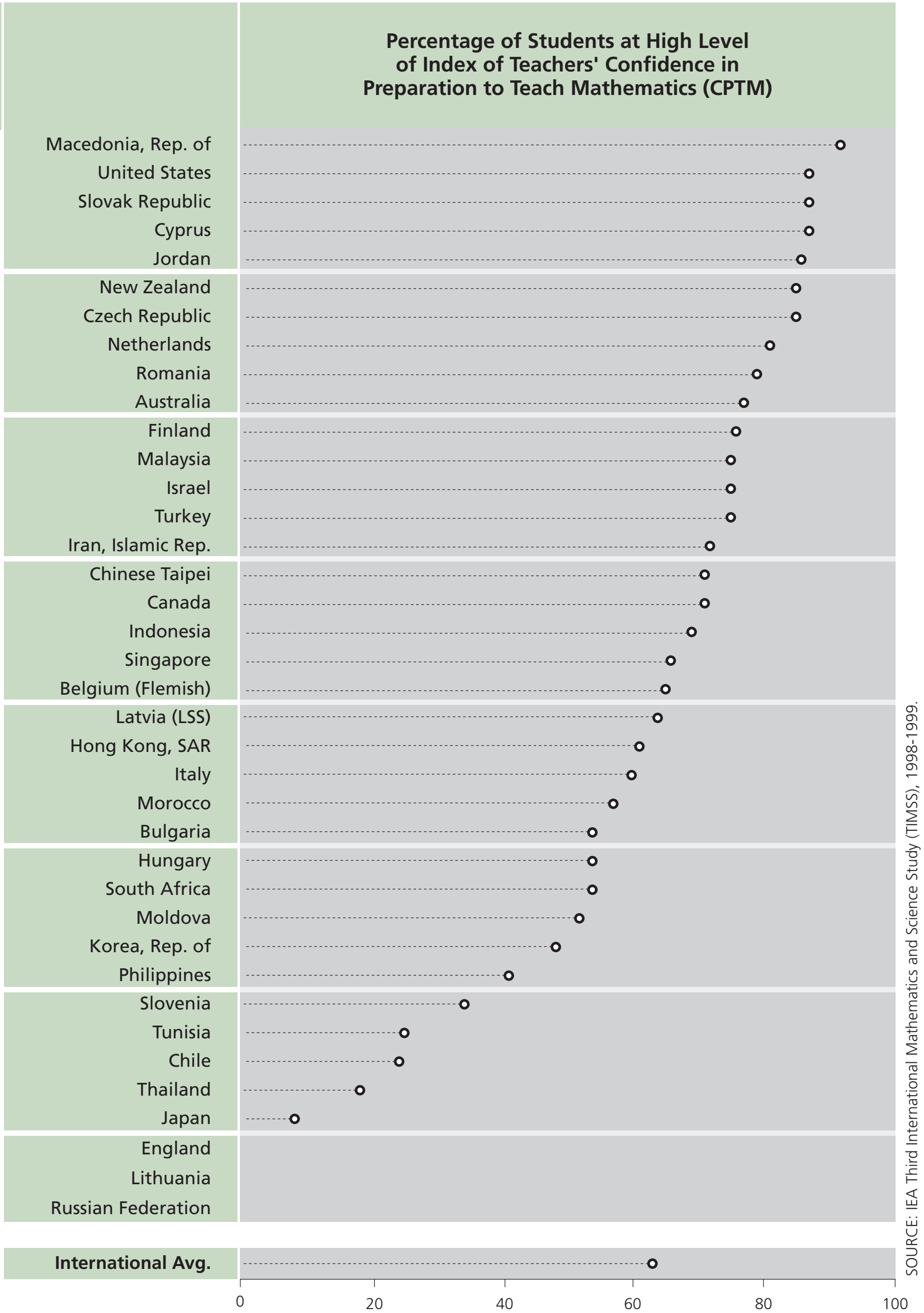
	High CPTM		Medium CPTM		Low CPTM	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Macedonia, Rep. of	92 (2.2)	447 (4.7)	8 (2.1)	435 (16.2)	1 (0.6)	~ ~
United States	87 (2.4)	505 (4.2)	11 (2.3)	489 (7.0)	2 (1.0)	~ ~
Slovak Republic	87 (3.2)	532 (3.8)	11 (3.1)	531 (14.1)	2 (1.3)	~ ~
Cyprus	87 (2.7)	478 (1.8)	13 (2.7)	468 (6.6)	0 (0.0)	~ ~
Jordan	86 (3.0)	429 (3.8)	11 (2.7)	418 (11.0)	3 (1.3)	400 (15.9)
New Zealand	85 (3.0)	496 (5.4)	10 (2.5)	460 (15.7)	5 (1.7)	459 (19.2)
Czech Republic	85 (3.6)	521 (5.1)	14 (3.8)	519 (9.5)	1 (1.3)	~ ~
Netherlands	81 (6.2)	542 (7.1)	10 (3.0)	514 (22.4)	9 (5.8)	514 (58.7)
Romania	79 (3.5)	478 (6.6)	20 (3.5)	453 (8.8)	1 (0.0)	~ ~
Australia	77 (4.1)	529 (5.7)	16 (3.4)	521 (9.8)	6 (2.3)	502 (23.9)
Finland	76 (3.0)	522 (3.2)	15 (3.0)	523 (7.0)	10 (1.9)	507 (7.8)
Malaysia	75 (3.9)	525 (5.1)	20 (3.3)	511 (10.3)	5 (2.3)	462 (28.2)
Israel	75 (2.8)	472 (5.5)	21 (2.4)	464 (7.7)	5 (1.8)	448 (15.0)
Turkey	75 (3.1)	434 (5.5)	21 (2.9)	412 (7.6)	4 (1.4)	406 (9.1)
Iran, Islamic Rep.	72 (3.6)	425 (4.2)	25 (3.5)	420 (6.8)	3 (1.4)	388 (8.8)
Chinese Taipei	71 (3.6)	586 (4.5)	15 (3.1)	587 (10.9)	14 (2.7)	572 (6.8)
Canada	71 (2.7)	537 (3.3)	21 (3.0)	530 (6.6)	8 (1.8)	515 (14.6)
Indonesia	69 (4.7)	411 (5.9)	27 (4.5)	377 (8.8)	4 (1.7)	447 (21.5)
Singapore	66 (4.2)	603 (7.1)	24 (3.7)	619 (12.0)	10 (2.8)	578 (20.8)
Belgium (Flemish)	65 (3.2)	559 (5.8)	32 (3.1)	561 (5.6)	3 (1.4)	558 (27.1)
Latvia (LSS)	64 (4.3)	508 (4.8)	28 (4.4)	504 (6.8)	8 (2.3)	489 (11.1)
Hong Kong, SAR	61 (4.3)	579 (5.5)	28 (3.9)	591 (8.2)	11 (2.7)	571 (12.0)
Italy	60 (3.9)	479 (5.5)	27 (3.5)	481 (7.2)	13 (2.3)	479 (12.4)
Morocco	57 (2.9)	336 (3.7)	37 (2.8)	338 (4.4)	7 (1.3)	340 (8.7)
Bulgaria	54 (5.4)	517 (9.7)	29 (4.6)	515 (9.4)	17 (5.8)	488 (10.0)
Hungary	54 (4.1)	531 (5.2)	12 (2.8)	526 (12.1)	34 (3.7)	533 (6.6)
South Africa	54 (4.0)	290 (10.5)	33 (3.6)	256 (9.2)	14 (2.7)	266 (14.2)
Moldova	52 (4.5)	465 (5.1)	27 (3.8)	473 (8.1)	21 (3.6)	471 (11.4)
Korea, Rep. of	48 (3.9)	585 (3.2)	31 (3.8)	590 (4.1)	21 (3.0)	588 (3.5)
Philippines	41 (3.8)	355 (8.8)	44 (3.9)	341 (8.7)	14 (2.9)	326 (13.1)
Slovenia	34 (3.5)	530 (4.3)	32 (3.7)	530 (4.9)	34 (4.0)	530 (5.0)
Tunisia	25 (3.7)	447 (4.7)	42 (4.1)	447 (3.5)	34 (3.7)	449 (4.8)
Chile	24 (3.2)	405 (9.1)	31 (3.2)	385 (5.5)	45 (3.7)	391 (7.5)
Thailand	18 (3.5)	487 (15.6)	26 (3.8)	468 (10.6)	55 (4.4)	461 (6.1)
Japan	8 (2.1)	584 (6.1)	24 (3.6)	589 (4.2)	68 (4.0)	573 (2.6)
England	– –	– –	– –	– –	– –	– –
Lithuania ‡	– –	– –	– –	– –	– –	– –
Russian Federation	– –	– –	– –	– –	– –	– –
International Avg.	63 (0.6)	489 (1.1)	23 (0.6)	481 (1.7)	14 (0.5)	473 (2.9)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available. A tilde (~) indicates insufficient data to report achievement.



SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

How Much School Time Is Devoted to Mathematics Instruction?

6.4

Exhibit 6.4 presents information about the amount of mathematics instruction given to eighth-grade students in the TIMSS 1999 countries. Since different systems have school years of different lengths (see reference Exhibit R3.6) 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. Countries providing 150 or more hours per year were Indonesia, Morocco, Thailand, Chile, and Canada. Countries providing fewer than 100 hours were Bulgaria, Turkey, the Netherlands, Finland, Macedonia, and Cyprus. The percentage of instructional time at the eighth grade that was devoted to mathematics ranged from 17 percent in Indonesia and the Russian Federation to nine percent in Chinese Taipei, Cyprus, and the Netherlands (see Exhibit R3.7 for details on the total instructional time in each country). For most countries, the percentages of time devoted to mathematics reported by teachers correspond with the percentages targeted in the intended curriculum (see Exhibit 5.5).

R3.6 R

R3.7 R

6.5

As shown in Exhibit 6.5, teachers of about half the students, on average internationally, reported that mathematics classes meet for at least two hours per week but fewer than three and a half. For another one-third of students, classes meet for at least three and a half hours but fewer than five. At least three and a half hours per week of mathematics instruction was reported for more than 50 percent of the students in Canada, Chile, the Czech Republic, Hong Kong, Indonesia, Israel, Italy, Latvia (LSS), Moldova, Morocco, New Zealand, the Russian Federation, the Slovak Republic, South Africa, Tunisia, and the United States. The data reveal no clear pattern between the number of in-class instructional hours and mathematics achievement either across or within countries. Common sense and research both support the idea that time on task is an important contributor to achievement, yet this time can be spent more or less efficiently. Time alone is not enough; it needs to be spent on high-quality mathematics instruction. Devoting extensive class time to remedial activities can deprive students of this. Also, instructional time can be spent out of school in various tutoring programs; low-performing students may be receiving additional instruction.

Exhibit 6.6 shows trends between 1995 and 1999 in the number of hours mathematics is taught weekly. On average internationally, the students receiving at least two hours of mathematics instruction per week but fewer than three and a half increased significantly by five percentage points, and those receiving three and a half to fewer than five hours decreased by seven percentage points. There was little change internationally in the percentage of students receiving five hours or more. The Czech Republic and the Slovak Republic showed a decrease in the weekly hours of mathematics instruction. Belgium (Flemish) and Singapore showed a significant increase in the percentage of students receiving five hours or more of instruction per week. 6.6

Videotapes of mathematics classes in the United States and Japan in TIMSS 1995 revealed that outside interruptions can affect the flow of the lesson and detract from instructional time.[2] As shown in Exhibit 6.7, on average internationally about one-fifth of the students (21 percent) tested in TIMSS 1999 were in mathematics classes that were interrupted pretty often or almost always. In comparison, 28 percent were in classes that were never interrupted; in Japan, Korea, and Tunisia, more than half the students were in such classes. 6.7

Across countries, students' mathematics teachers spent only about 60 percent of their formally scheduled school time teaching mathematics (see Exhibit R3.8 in the reference section). Of the remaining time, about 10 percent was spent teaching subjects other than mathematics, about 10 percent on curriculum planning, and about 20 percent on a various administrative and other duties. R3.8 R

2 Stigler, J.W., Gonzales, P., Kawanaka, T., Knoll, S., and Serrano, A., (1999), *The TIMSS Videotape Classroom Study: Methods and Findings from an Exploratory Research Project on Eighth-Grade Mathematics Instruction in Germany, Japan, and the United States,* NCES 1999-074, Washington DC: National Center for Education Statistics.

Exhibit 6.4 Mathematics Instructional Time at Grade 8

TIMSS 1999 8th grade Mathematics

Country		Students' Average Yearly Mathematics Instructional Time in Hours		Mathematics Instructional Time as a Percent of Total Instructional Time[1]
Indonesia	r	222 (9.3)	r	17 (0.9)
Morocco	s	207 (3.8)		x x
Thailand	s	177 (12.1)	s	14 (1.2)
Chile	r	161 (2.9)	s	15 (0.3)
Canada	r	150 (2.3)	r	15 (0.2)
Hong Kong, SAR	r	149 (5.4)	s	15 (0.5)
Philippines	s	148 (4.8)		x x
United States	s	144 (4.5)		x x
Russian Federation	r	142 (3.3)	s	17 (0.6)
Czech Republic		139 (2.4)		15 (0.2)
Australia	r	138 (3.3)	s	13 (0.3)
Slovak Republic	r	137 (3.3)	s	14 (0.4)
Latvia (LSS)	r	137 (2.6)	s	16 (0.5)
South Africa	s	136 (5.7)		x x
New Zealand	r	134 (1.9)	r	14 (0.2)
Tunisia	r	132 (2.8)	s	14 (0.3)
Italy		130 (3.2)		12 (0.3)
Malaysia		127 (4.0)		12 (0.4)
Moldova	r	127 (2.8)	s	13 (0.6)
Japan		127 (1.8)		12 (0.2)
Chinese Taipei		126 (1.9)		9 (0.1)
Singapore		126 (3.8)		15 (0.5)
Jordan		120 (3.6)	r	12 (0.3)
Korea, Rep. of		118 (3.5)		11 (0.3)
Hungary		117 (1.9)		13 (0.3)
Belgium (Flemish)		116 (3.5)		12 (0.4)
England	s	115 (2.7)	s	12 (0.3)
Slovenia		114 (1.6)		15 (0.2)
Romania		107 (3.6)	r	11 (0.4)
Iran, Islamic Rep.	s	105 (7.0)		x x
Bulgaria	r	99 (3.9)	s	10 (0.4)
Turkey	s	98 (4.6)		x x
Netherlands	s	94 (1.6)	s	9 (0.1)
Finland		93 (2.5)	r	10 (0.3)
Macedonia, Rep. of	r	75 (1.2)	s	10 (0.2)
Cyprus	r	73 (1.0)	r	9 (0.1)
Israel		x x		x x
Lithuania ‡		– –		– –
International Avg.		129 (0.7)		13 (0.1)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

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

1 Computed as the ratio of mathematics instructional time to total instructional time averaged across students.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, at the beginning at 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 data are not available.

An "r" indicates school and/or teacher response data available for 70-84% of students. An "s" indicates school and/or teacher response data available for 50-69% of students. An "x" indicates school and/or teacher response data available for <50% of students.

Exhibit 6.5 Number of Hours Mathematics Is Taught Weekly

TIMSS1999 8th grade Mathematics

		5 Hours or More		3.5 Hours to < 5		2 Hours to < 3.5		Less Than 2 Hours	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Australia		3 (1.7)	530 (46.0)	44 (4.4)	534 (7.7)	50 (4.6)	517 (6.7)	3 (1.4)	565 (30.5)
Belgium (Flemish)		4 (1.0)	590 (11.7)	40 (2.8)	595 (4.1)	43 (3.8)	544 (7.7)	13 (3.4)	502 (18.9)
Bulgaria		4 (3.0)	606 (29.5)	8 (2.3)	525 (27.0)	73 (4.6)	498 (5.0)	14 (3.3)	543 (9.0)
Canada	r	17 (2.2)	520 (6.4)	55 (3.2)	544 (3.9)	26 (2.7)	523 (6.1)	3 (0.9)	503 (6.3)
Chile		13 (2.4)	394 (13.7)	83 (2.8)	391 (5.0)	3 (1.3)	414 (12.7)	1 (0.7)	~ ~
Chinese Taipei		1 (1.1)	~ ~	48 (4.4)	592 (5.8)	51 (4.5)	577 (5.5)	0 (0.0)	~ ~
Cyprus		0 (0.0)	~ ~	0 (0.0)	~ ~	100 (0.0)	476 (1.8)	0 (0.0)	~ ~
Czech Republic		4 (2.1)	600 (28.1)	52 (4.4)	517 (5.3)	44 (4.4)	517 (6.4)	0 (0.0)	~ ~
England	s	2 (1.2)	~ ~	3 (1.4)	481 (10.2)	95 (2.0)	512 (5.3)	0 (0.2)	~ ~
Finland		1 (0.9)	~ ~	7 (2.4)	535 (14.0)	87 (2.9)	520 (2.9)	4 (1.5)	518 (12.2)
Hong Kong, SAR		9 (2.3)	579 (15.2)	71 (4.0)	583 (5.6)	17 (3.1)	587 (11.1)	3 (1.5)	553 (16.7)
Hungary		3 (1.1)	583 (34.4)	15 (2.7)	522 (12.6)	80 (2.9)	531 (3.9)	1 (0.8)	~ ~
Indonesia		21 (3.7)	384 (9.4)	76 (3.8)	408 (6.1)	1 (0.2)	~ ~	3 (1.2)	409 (27.4)
Iran, Islamic Rep.		12 (2.6)	419 (11.4)	14 (2.9)	413 (8.9)	50 (4.8)	423 (4.9)	24 (4.0)	429 (5.7)
Israel	r	4 (1.5)	470 (28.7)	65 (4.1)	464 (5.8)	29 (3.9)	481 (8.5)	2 (1.2)	~ ~
Italy		9 (2.1)	469 (11.5)	55 (3.8)	483 (5.3)	29 (4.0)	475 (7.4)	6 (1.8)	484 (10.3)
Japan		1 (1.3)	~ ~	2 (1.3)	~ ~	95 (2.0)	577 (2.1)	2 (0.9)	~ ~
Jordan		5 (1.9)	463 (21.0)	7 (2.2)	439 (20.1)	88 (2.8)	424 (3.7)	0 (0.0)	~ ~
Korea, Rep. of		2 (0.9)	~ ~	3 (1.1)	602 (9.6)	93 (1.8)	587 (2.1)	3 (1.1)	587 (11.7)
Latvia (LSS)		7 (2.5)	487 (17.2)	62 (3.9)	516 (4.6)	31 (4.2)	491 (5.6)	0 (0.0)	~ ~
Lithuania ‡		– –	– –	– –	– –	– –	– –	– –	– –
Macedonia, Rep. of		0 (0.0)	~ ~	2 (1.0)	~ ~	97 (1.2)	447 (4.4)	1 (0.6)	~ ~
Malaysia		0 (0.0)	~ ~	2 (1.2)	~ ~	93 (2.1)	520 (4.6)	5 (1.8)	533 (24.0)
Moldova		8 (2.4)	481 (17.9)	80 (3.3)	466 (4.5)	5 (1.5)	485 (18.0)	7 (1.9)	467 (19.7)
Morocco		96 (1.1)	337 (2.9)	0 (0.0)	~ ~	3 (1.0)	338 (10.5)	1 (0.6)	~ ~
Netherlands		0 (0.0)	~ ~	0 (0.0)	~ ~	100 (0.5)	537 (7.2)	0 (0.0)	~ ~
New Zealand		1 (0.0)	~ ~	56 (3.9)	494 (7.0)	41 (3.8)	488 (8.3)	2 (1.1)	~ ~
Philippines		11 (2.5)	326 (15.0)	8 (2.5)	384 (33.0)	78 (3.4)	343 (7.1)	3 (0.9)	361 (22.5)
Romania		9 (2.5)	477 (21.8)	12 (2.3)	483 (12.0)	70 (3.9)	471 (6.8)	10 (2.4)	481 (15.3)
Russian Federation		11 (2.5)	553 (13.4)	57 (4.1)	528 (7.7)	32 (3.8)	513 (8.5)	0 (0.0)	~ ~
Singapore		9 (2.3)	592 (24.7)	37 (3.8)	586 (11.2)	48 (4.0)	623 (7.5)	5 (2.0)	608 (20.0)
Slovak Republic		5 (2.1)	503 (15.2)	50 (4.8)	534 (5.3)	44 (4.7)	534 (6.1)	0 (0.0)	~ ~
Slovenia		0 (0.0)	~ ~	26 (4.1)	537 (4.5)	74 (4.1)	528 (3.3)	0 (0.0)	~ ~
South Africa		9 (2.6)	275 (24.4)	58 (4.2)	277 (8.8)	23 (3.5)	269 (13.3)	10 (2.4)	273 (17.2)
Thailand	r	30 (4.9)	483 (11.4)	9 (3.3)	448 (18.5)	58 (5.1)	461 (7.3)	2 (1.4)	~ ~
Tunisia		1 (1.0)	~ ~	86 (2.8)	448 (2.8)	12 (2.6)	441 (6.7)	1 (1.0)	~ ~
Turkey	r	5 (1.6)	418 (16.3)	5 (1.6)	415 (10.5)	77 (3.4)	429 (5.0)	13 (2.7)	427 (11.0)
United States		16 (2.2)	490 (9.2)	56 (3.4)	501 (4.9)	17 (2.6)	528 (11.6)	11 (2.3)	491 (14.5)
International Avg.		9 (0.3)	481 (3.5)	34 (0.5)	492 (2.3)	53 (0.5)	490 (1.9)	4 (0.3)	485 (4.7)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available. A tilde (~) indicates insufficient data to report achievement.

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

Exhibit 6.6 Trends in Number of Hours Mathematics Is Taught Weekly

TIMSS 1999 8th grade Mathematics

	5 Hours or More		3.5 Hours to < 5		2 Hours to < 3.5		Less Than 2 Hours	
	Percent of Students 1999	1995-1999 Difference	Percent of Students 1999	1995-1999 Difference	Percent of Students 1999	1995-1999 Difference	Percent of Students 1999	1995-1999 Difference
Australia	3 (1.7)	2 (1.8) ●	44 (4.4)	-1 (6.4) ●	50 (4.6)	-3 (6.7) ●	3 (1.4)	1 (1.7) ●
Belgium (Flemish) r	4 (1.0)	4 (1.0) ▲	40 (2.8)	-10 (5.3) ●	43 (3.8)	-7 (5.8) ●	13 (3.4)	13 (3.4) ▲
Canada	17 (2.2)	-1 (4.2) ●	55 (3.2)	6 (6.1) ●	26 (2.7)	-5 (5.2) ●	3 (0.9)	0 (1.5) ●
Cyprus	x x	x x	x x	x x	x x	x x	x x	x x
Czech Republic	4 (2.1)	1 (2.6) ●	52 (4.4)	-38 (5.2) ▼	44 (4.4)	38 (4.8) ▲	0 (0.0)	-1 (0.9) ●
England	2 (1.2)	2 (1.2) ●	3 (1.4)	-7 (3.1) ●	95 (2.0)	6 (3.4) ●	0 (0.2)	-1 (0.9) ●
Hong Kong, SAR	9 (2.3)	2 (3.6) ●	71 (4.0)	9 (6.8) ●	17 (3.1)	-9 (6.0) ●	3 (1.5)	-2 (2.8) ●
Hungary	3 (1.1)	2 (1.5) ●	15 (2.7)	-8 (4.6) ●	80 (2.9)	5 (4.8) ●	1 (0.8)	1 (0.8) ●
Iran, Islamic Rep.	– –	– –	– –	– –	– –	– –	– –	– –
Israel †	4 (1.7)	-2 (4.0) ●	63 (4.5)	16 (9.4) ●	30 (4.3)	-11 (9.7) ●	3 (1.5)	-4 (4.2) ●
Italy	9 (2.4)	-4 (4.5) ●	56 (4.9)	2 (7.1) ●	30 (4.9)	1 (6.6) ●	5 (2.0)	1 (2.7) ●
Japan	1 (1.3)	1 (1.3) ●	2 (1.3)	-2 (2.1) ●	95 (2.0)	4 (3.1) ●	2 (0.9)	-2 (2.0) ●
Korea, Rep. of	2 (0.9)	-3 (2.5) ●	3 (1.1)	-2 (2.0) ●	93 (1.8)	3 (3.3) ●	3 (1.1)	2 (1.2) ●
Latvia (LSS)	7 (2.5)	-1 (3.5) ●	62 (3.9)	0 (5.6) ●	31 (4.2)	2 (5.8) ●	0 (0.0)	-1 (0.1) ▼
Lithuania	– –	– –	– –	– –	– –	– –	– –	– –
Netherlands	0 (0.0)	– – ●	0 (0.0)	– – ●	100 (0.5)	3 (2.0) ●	0 (0.0)	-3 (1.9) ●
New Zealand	1 (0.0)	-3 (1.5) ●	56 (3.9)	6 (5.7) ●	41 (3.8)	-1 (5.6) ●	2 (1.1)	-3 (2.1) ●
Romania	9 (2.5)	6 (3.1) ●	12 (2.3)	3 (3.3) ●	70 (3.9)	-10 (5.2) ●	10 (2.4)	1 (3.5) ●
Russian Federation	11 (2.5)	-2 (4.8) ●	57 (4.1)	-12 (6.0) ●	32 (3.8)	15 (4.7) ▲	0 (0.0)	– – ●
Singapore	9 (2.3)	9 (2.3) ▲	37 (3.8)	-10 (6.0) ●	48 (4.0)	-4 (6.1) ●	5 (2.0)	5 (2.0) ●
Slovak Republic	5 (2.1)	-6 (3.6) ●	50 (4.8)	-36 (5.7) ▼	44 (4.7)	42 (4.9) ▲	0 (0.0)	– – ●
Slovenia	0 (0.0)	-1 (0.8) ●	26 (4.1)	13 (5.3) ●	74 (4.1)	-12 (5.3) ●	0 (0.0)	– – ●
Thailand †	x x	x x	x x	x x	x x	x x	x x	x x
United States	16 (2.2)	6 (3.3) ●	56 (3.4)	-2 (5.8) ●	17 (2.6)	-6 (4.6) ●	11 (2.3)	3 (3.2) ●
International Avg. §	6 (0.4)	1 (0.6) ●	34 (0.7)	-7 (1.1) ▼	56 (0.8)	5 (1.1) ▲	4 (0.4)	2 (0.5) ▲

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

Background data provided by teachers.

† Countries with unapproved sampling procedures at the classroom level in 1995.

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian-Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

Background data for Bulgaria and South Africa are unavailable for 1995.

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

A dash (–) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students, based on the lower response rate in either 1995 or 1999. An "x" indicates teacher response data available for <50% of students, based on the lower response rate in either 1995 or 1999.

Exhibit 6.7 Frequency of Outside Interruption During Mathematics Lessons

TIMSS 1999 8th grade Mathematics

	Never		Once in a While		Pretty Often		Almost Always	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Australia	11 (0.7)	523 (8.2)	66 (1.1)	534 (5.0)	16 (0.8)	510 (7.9)	7 (0.7)	485 (8.3)
Belgium (Flemish)	24 (1.1)	557 (5.9)	62 (1.1)	566 (2.9)	9 (0.7)	562 (6.8)	5 (0.8)	505 (20.3)
Bulgaria	19 (0.9)	511 (7.5)	64 (1.2)	522 (5.1)	10 (0.9)	506 (13.9)	7 (0.6)	456 (10.7)
Canada	9 (0.4)	528 (4.2)	64 (1.0)	540 (2.4)	18 (0.7)	517 (3.9)	9 (0.7)	502 (7.8)
Chile	18 (0.7)	395 (8.5)	49 (0.8)	407 (4.8)	17 (0.6)	384 (5.5)	16 (0.7)	362 (6.6)
Chinese Taipei	22 (1.1)	580 (6.1)	56 (1.0)	594 (4.4)	17 (0.9)	580 (5.4)	6 (0.6)	563 (9.0)
Cyprus	26 (1.0)	479 (3.9)	49 (1.0)	485 (2.2)	19 (0.9)	470 (4.9)	5 (0.5)	434 (8.6)
Czech Republic	33 (1.7)	520 (4.0)	59 (1.3)	524 (4.7)	4 (0.5)	517 (11.4)	4 (0.8)	472 (13.7)
England	10 (0.8)	508 (9.5)	66 (1.2)	509 (4.2)	19 (1.1)	474 (6.0)	6 (0.6)	437 (8.9)
Finland	34 (1.3)	526 (3.6)	57 (1.3)	523 (3.2)	6 (0.6)	502 (7.1)	3 (0.3)	473 (10.4)
Hong Kong, SAR	36 (1.0)	585 (4.4)	54 (0.8)	588 (4.0)	8 (0.6)	552 (8.9)	2 (0.2)	~ ~
Hungary	46 (1.5)	541 (4.3)	45 (1.3)	528 (4.3)	5 (0.4)	497 (7.8)	4 (0.4)	515 (13.5)
Indonesia	15 (1.0)	386 (8.2)	75 (1.1)	413 (4.6)	8 (0.6)	378 (9.6)	2 (0.2)	~ ~
Iran, Islamic Rep.	33 (1.2)	425 (4.2)	39 (1.0)	435 (4.2)	15 (0.8)	404 (6.4)	14 (0.6)	414 (6.2)
Israel	20 (1.0)	457 (7.7)	47 (1.3)	485 (3.7)	20 (0.8)	469 (5.2)	13 (0.7)	446 (7.3)
Italy	16 (1.0)	480 (5.5)	54 (1.2)	488 (4.0)	18 (1.0)	477 (5.3)	11 (0.8)	450 (7.6)
Japan	53 (1.4)	580 (2.7)	42 (1.3)	581 (2.5)	4 (0.3)	559 (5.9)	1 (0.2)	~ ~
Jordan	29 (1.0)	440 (5.2)	39 (0.9)	455 (4.3)	19 (0.7)	414 (4.8)	14 (0.8)	403 (6.8)
Korea, Rep. of	57 (0.9)	581 (2.0)	38 (0.8)	598 (3.0)	4 (0.2)	579 (7.5)	1 (0.1)	~ ~
Latvia (LSS)	39 (1.3)	501 (4.6)	52 (1.3)	513 (3.9)	5 (0.5)	491 (8.6)	3 (0.4)	481 (11.4)
Lithuania ‡	– –	– –	– –	– –	– –	– –	– –	– –
Macedonia, Rep. of	33 (1.3)	464 (4.5)	48 (1.1)	464 (5.2)	10 (0.6)	416 (7.0)	9 (0.6)	404 (9.2)
Malaysia	32 (1.1)	509 (5.2)	60 (1.0)	525 (4.4)	7 (0.5)	526 (7.8)	2 (0.2)	~ ~
Moldova	32 (1.5)	478 (5.9)	50 (1.5)	477 (4.3)	10 (0.6)	450 (6.2)	8 (0.6)	434 (7.4)
Morocco r	34 (1.3)	350 (4.7)	26 (1.1)	355 (4.2)	23 (0.8)	331 (5.9)	16 (0.8)	322 (8.7)
Netherlands	39 (1.3)	539 (7.7)	55 (1.3)	544 (8.3)	4 (0.5)	524 (14.0)	2 (0.4)	~ ~
New Zealand	7 (0.5)	474 (10.9)	53 (1.3)	515 (4.9)	27 (1.0)	481 (6.1)	13 (0.8)	440 (8.3)
Philippines	14 (0.6)	351 (8.3)	36 (1.1)	368 (7.2)	25 (0.7)	344 (7.7)	25 (1.1)	320 (7.2)
Romania	38 (1.7)	481 (5.7)	50 (1.6)	481 (5.8)	7 (0.6)	450 (11.0)	5 (0.5)	417 (13.0)
Russian Federation	17 (1.5)	538 (11.1)	64 (1.5)	533 (5.2)	10 (0.9)	506 (7.5)	9 (0.7)	497 (6.9)
Singapore	16 (0.8)	592 (8.9)	64 (1.0)	614 (5.9)	14 (0.6)	585 (7.4)	6 (0.4)	579 (9.5)
Slovak Republic	37 (1.3)	534 (4.7)	55 (1.1)	537 (4.3)	6 (0.7)	515 (13.0)	2 (0.3)	~ ~
Slovenia	9 (0.9)	504 (6.6)	58 (1.2)	541 (2.8)	20 (0.9)	530 (4.7)	12 (0.7)	506 (6.8)
South Africa	24 (1.2)	261 (6.2)	27 (1.2)	323 (10.4)	23 (0.6)	269 (10.0)	26 (0.9)	251 (6.3)
Thailand	23 (0.8)	453 (5.7)	65 (1.0)	478 (5.3)	9 (0.6)	447 (8.4)	3 (0.3)	427 (12.3)
Tunisia	63 (0.9)	451 (2.5)	23 (0.7)	451 (3.3)	7 (0.4)	433 (6.5)	7 (0.4)	432 (7.6)
Turkey	49 (1.4)	445 (4.1)	40 (1.0)	430 (5.0)	6 (0.4)	396 (7.7)	5 (0.5)	374 (11.1)
United States	10 (0.4)	494 (8.2)	59 (0.9)	522 (3.9)	20 (0.5)	488 (3.9)	11 (0.6)	455 (5.1)
International Avg.	28 (0.2)	487 (1.2)	52 (0.2)	499 (0.8)	13 (0.1)	474 (1.4)	8 (0.1)	442 (1.8)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available. A tilde (~) indicates insufficient data to report achievement.

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

What Activities Do Students Do in Their Mathematics Lessons?

Because it can affect pedagogical strategies, class size data are shown in
6.8 Exhibit 6.8. Teachers' reports about the size of their eighth-grade mathe-
matics class reveal that across countries the average class size was 31 stu-
dents, but there was considerable variation – from more than 50 students
in the Philippines and South Africa to fewer than 20 students in Belgium
(Flemish) and Finland. The relationship between class size and achieve-
ment is difficult to disentangle, given the variety of policies and practices
and the fact that smaller classes can be used for both advanced and reme-
6.9 dial learning. As shown in Exhibit 6.9, Cyprus, Korea, and Slovenia
significantly reduced the average size of their mathematics classes
between 1995 and 1999, and no countries showed increases.

6.10 Exhibit 6.10 presents a profile of the activities most commonly encoun-
tered in mathematics classes around the world, as reported by mathemat-
ics teachers. The two predominant activities, accounting for nearly half of
class time on average, were teacher lecture (23 percent of class time) and
6.11 teacher-guided student practice (22 percent). As shown in Exhibit 6.11,
most students (86 percent on average internationally) agreed with teach-
ers' reports, saying that their teachers frequently showed them how to do
mathematics problems. According to 55 to 59 percent of the students, dis-
cussing homework and working independently on worksheets or text-
books were also frequent activities in class. Students also reported that use
of the board was an extremely common presentational mode (see Exhibit
6.12 6.12). On average internationally, 92 percent of students reported that
teachers used the board at least pretty often, and 60 percent reported
that students used it at least pretty often. The use of an overhead projec-
tor was a popular presentational mode for teachers in some countries,
with more than 40 percent of the students in Canada, Finland, Singapore,
South Africa, and the United States reporting that their teachers use it at
least pretty often.

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 created an index of teachers'
emphasis on mathematics reasoning and problem-solving (EMRPS). As
6.13 shown in Exhibit 6.13, the index is based on teachers' responses about
how often they asked students to explain the reasoning behind an idea,
represent and analyze relationships using tables, charts, or graphs, work on
problems for which there was no immediate solution, and write equations
to represent relationships. Students were placed in the high category if, on

average, they were asked to do these activities in most of their lessons. The medium level represents students asked to do these activities in some to most lessons, and students in the low category did the activities only in some lessons or rarely.

Nearly half the Japanese students were at the high level, compared with the international average of 15 percent. Across countries, most students (61 percent on average) were in the medium category. Countries with more than 70 percent of their students in the medium category were Romania, Slovenia, Bulgaria, the Czech Republic, the Slovak Republic, Hungary, Moldova, and the Russian Federation. Emphasizing reasoning and problem-solving was related to performance, with students at the high and medium levels having higher average achievement than those at the low level, both internationally and for most countries.

R3.9 R

Exhibit R3.9 in the reference section shows the percentages of students asked in most or every lesson to engage in each of the activities included in the problem-solving index. For comparison purposes the percentages of students asked to practice computational skills in most or every lesson are also shown. According to their teachers, internationally on average, nearly three-fourths of the students (73 percent) were asked to practice their computational skills in most or every mathematics lesson. Nearly as many (70 percent) were asked to explain the reasoning behind an idea this frequently. The other three problem-solving activities occurred much less often. Forty-three percent of students, on average across countries, wrote equations representing relationships in most or every lesson, but only about one-fourth (26 percent) represented and analyzed relationships using tables or graphs, and about one-fifth (21 percent) worked on problems for which there was no immediately obvious method of solution.

6.14

Exhibit 6.14 shows trend data for the index of teachers' emphasis on mathematics reasoning and problem-solving. These data suggest increased emphasis on problem-solving activities since the first TIMSS assessment. Between 1995 and 1999, there was a small but significant increase (four percent) in the percentage of students at the high index level. Among countries, only Canada showed a significant increase, as the percentage of Canadian students in the high category rose from 4 to 13 percent. As shown in Exhibit R3.10 in the reference section, the international averages for the percentages of students asked to do the activities in most or every mathematics lesson increased for three of the activities (all except explain the rea-

R3.10 R

soning behind an idea, which already was very frequent). Interestingly, however, the percentage of students asked to practice their computational skills in most or every lesson also increased significantly between 1995 and 1999.

R3.11 Teachers were not asked about the emphasis placed on using things from everyday life in solving mathematics problems, but students were (see Exhibit R3.11). In most of the countries, students reported a moderate emphasis on doing these types of problems in mathematics class. Nearly two-thirds (65 percent), on average internationally, said these activities occurred once in a while or pretty often, and an additional 15 percent said they occurred almost always.

Exhibit 6.8 Mathematics Class Size

TIMSS 1999 8th grade Mathematics

		Overall Average Class Size	1 - 20 Students		21 - 35 Students		36 or More Students	
			Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Australia		27 (0.3)	9 (2.4)	477 (22.6)	91 (2.4)	531 (5.7)	0 (0.0)	~ ~
Belgium (Flemish)		19 (0.4)	58 (3.5)	541 (6.8)	42 (3.5)	582 (4.4)	0 (0.0)	~ ~
Bulgaria		22 (0.6)	35 (4.4)	489 (6.2)	63 (4.8)	527 (9.0)	2 (1.3)	~ ~
Canada		27 (0.3)	11 (2.1)	522 (6.7)	87 (2.3)	534 (2.9)	2 (1.0)	~ ~
Chile		34 (0.6)	6 (1.5)	347 (8.4)	48 (4.3)	389 (6.4)	46 (4.1)	398 (6.3)
Chinese Taipei		39 (0.5)	0 (0.0)	~ ~	14 (2.9)	578 (11.5)	86 (3.0)	586 (4.6)
Cyprus	r	29 (0.2)	0 (0.2)	~ ~	100 (0.2)	476 (2.2)	0 (0.0)	~ ~
Czech Republic	r	24 (0.4)	18 (4.2)	504 (6.9)	82 (4.2)	524 (6.0)	0 (0.0)	~ ~
England		x x	x x	x x	x x	x x	x x	x x
Finland		19 (0.3)	66 (3.7)	517 (3.7)	34 (3.7)	526 (3.7)	0 (0.0)	~ ~
Hong Kong, SAR		37 (0.5)	7 (1.8)	521 (20.0)	15 (3.0)	530 (10.5)	78 (3.4)	597 (4.3)
Hungary		21 (0.5)	48 (4.2)	524 (7.1)	51 (4.1)	537 (5.2)	1 (0.0)	~ ~
Indonesia	r	45 (0.9)	1 (0.3)	~ ~	10 (2.3)	385 (16.4)	89 (2.4)	409 (6.5)
Iran, Islamic Rep.		33 (0.5)	5 (1.6)	394 (9.6)	57 (4.2)	429 (4.6)	38 (4.2)	417 (6.6)
Israel	r	26 (0.7)	31 (3.2)	458 (7.8)	50 (4.0)	478 (7.0)	19 (3.3)	477 (10.7)
Italy		20 (0.3)	55 (3.9)	472 (5.3)	44 (3.9)	489 (6.5)	1 (0.0)	~ ~
Japan		36 (0.2)	1 (0.0)	~ ~	41 (3.4)	572 (2.9)	58 (3.3)	582 (2.3)
Jordan		36 (0.7)	4 (1.3)	415 (39.1)	43 (3.4)	420 (6.1)	53 (3.2)	432 (5.0)
Korea, Rep. of		42 (0.5)	0 (0.0)	~ ~	12 (2.2)	584 (6.7)	88 (2.2)	587 (2.1)
Latvia (LSS)	r	22 (0.5)	45 (4.2)	497 (5.7)	55 (4.2)	516 (4.8)	0 (0.0)	~ ~
Lithuania ‡		23 (0.3)	32 (2.8)	461 (7.2)	68 (2.8)	493 (5.2)	0 (0.0)	~ ~
Macedonia, Rep. of		28 (0.4)	10 (2.5)	412 (13.0)	84 (3.4)	450 (5.2)	6 (2.2)	478 (13.7)
Malaysia		38 (0.6)	1 (0.0)	~ ~	26 (3.7)	525 (8.4)	73 (3.6)	518 (5.5)
Moldova	r	26 (0.4)	15 (3.0)	481 (13.2)	83 (3.3)	469 (5.0)	2 (1.6)	~ ~
Morocco	r	33 (0.8)	12 (2.4)	341 (9.3)	49 (3.4)	338 (3.6)	39 (3.6)	337 (5.3)
Netherlands	r	25 (0.5)	13 (4.1)	459 (18.8)	87 (4.1)	546 (8.2)	0 (0.0)	~ ~
New Zealand		25 (0.4)	17 (2.9)	437 (10.2)	82 (2.8)	504 (5.4)	1 (0.0)	~ ~
Philippines	r	50 (0.6)	0 (0.0)	~ ~	5 (1.5)	313 (17.7)	95 (1.5)	349 (6.4)
Romania		24 (0.4)	30 (2.9)	456 (10.1)	65 (3.2)	475 (8.5)	5 (1.9)	523 (13.5)
Russian Federation		24 (0.5)	19 (3.2)	492 (10.0)	81 (3.2)	534 (5.9)	0 (0.0)	~ ~
Singapore		37 (0.3)	1 (0.4)	~ ~	32 (3.8)	602 (11.6)	68 (3.8)	607 (6.4)
Slovak Republic		25 (0.4)	15 (2.6)	505 (9.4)	85 (2.6)	537 (4.7)	0 (0.2)	~ ~
Slovenia		22 (0.3)	29 (3.2)	530 (5.9)	71 (3.2)	531 (3.1)	0 (0.0)	~ ~
South Africa	r	50 (1.4)	2 (0.8)	~ ~	14 (2.6)	293 (18.0)	85 (2.7)	278 (8.6)
Thailand	r	42 (0.9)	3 (1.0)	402 (22.3)	23 (3.9)	444 (9.8)	75 (3.7)	479 (6.9)
Tunisia		34 (0.4)	3 (1.5)	471 (13.7)	56 (3.9)	446 (3.3)	42 (4.1)	450 (4.4)
Turkey	s	43 (1.3)	2 (1.1)	~ ~	28 (3.9)	433 (9.4)	70 (3.9)	428 (5.2)
United States	r	26 (0.7)	21 (2.6)	507 (8.4)	73 (3.0)	504 (4.9)	6 (1.4)	488 (26.2)
International Avg.		31 (0.1)	17 (0.4)	468 (2.4)	53 (0.6)	488 (1.4)	30 (0.4)	471 (4.3)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 tilde (~) indicates insufficient data to report achievement.

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

Exhibit 6.9 Trends in Mathematics Class Size

TIMSS 1999 8th grade Mathematics

		Overall Average Class Size		1 - 20 Students		21 - 35 Students		36 or More Students	
		Average	1995-1999 Difference	Percent of Students 1999	1995-1999 Difference	Percent of Students 1999	1995-1999 Difference	Percent of Students 1999	1995-1999 Difference
Australia	r	27 (0.3)	1 (0.5) ●	9 (2.4)	-4 (3.3) ●	91 (2.4)	5 (3.4) ●	0 (0.0)	-1 (0.8) ●
Belgium (Flemish)		19 (0.4)	-1 (0.5) ●	58 (3.5)	9 (5.0) ●	42 (3.5)	-9 (5.0) ●	0 (0.0)	– – ●
Canada	r	27 (0.3)	0 (0.5) ●	11 (2.1)	0 (3.0) ●	87 (2.3)	0 (3.3) ●	2 (1.0)	0 (1.4) ●
Cyprus	r	29 (0.2)	-2 (0.5) ▼	0 (0.2)	-1 (0.7) ●	100 (0.2)	1 (0.7) ●	0 (0.0)	– – ●
Czech Republic	r	24 (0.4)	-1 (0.6) ●	18 (4.2)	5 (5.3) ●	82 (4.2)	-5 (5.3) ●	0 (0.0)	– – ●
England		x x	x x	x x	x x	x x	x x	x x	x x
Hong Kong, SAR		37 (0.5)	-1 (0.8) ●	7 (1.8)	3 (2.6) ●	15 (3.0)	7 (4.3) ●	78 (3.4)	-10 (4.9) ●
Hungary		21 (0.5)	-1 (0.7) ●	48 (4.2)	11 (6.1) ●	51 (4.1)	-10 (6.2) ●	1 (0.0)	-1 (1.1) ●
Iran, Islamic Rep.	r	33 (0.5)	-3 (1.3) ●	5 (1.6)	4 (1.8) ●	57 (4.2)	5 (7.2) ●	38 (4.2)	-9 (7.2) ●
Israel †	r	25 (0.8)	-4 (1.5) ●	34 (3.7)	21 (5.6) ▲	48 (4.4)	-13 (8.8) ●	18 (3.5)	-8 (7.9) ●
Italy		20 (0.4)	1 (0.6) ●	53 (4.8)	-11 (6.9) ●	47 (4.7)	10 (6.8) ●	1 (0.0)	1 (0.0) ▲
Japan		36 (0.2)	-1 (0.4) ●	1 (0.0)	0 (0.0) ▲	41 (3.4)	8 (5.3) ●	58 (3.3)	-9 (5.3) ●
Korea, Rep. of		42 (0.5)	-8 (0.9) ▼	0 (0.0)	-2 (1.4) ●	12 (2.2)	10 (2.6) ▲	88 (2.2)	-7 (2.9) ●
Latvia (LSS)	r	22 (0.5)	0 (1.0) ●	45 (4.2)	4 (7.1) ●	55 (4.2)	1 (7.3) ●	0 (0.0)	-5 (2.1) ●
Lithuania	r	23 (0.3)	2 (0.6) ●	32 (2.8)	-11 (5.8) ●	68 (2.8)	11 (5.8) ●	0 (0.0)	– – ●
Netherlands	r	25 (0.5)	0 (0.8) ●	13 (4.1)	-3 (6.4) ●	87 (4.1)	3 (6.4) ●	0 (0.0)	– – ●
New Zealand		25 (0.4)	-1 (0.6) ●	17 (2.9)	6 (4.0) ●	82 (2.8)	-7 (4.0) ●	1 (0.0)	1 (0.0) ▲
Romania		24 (0.4)	-2 (0.9) ●	30 (2.9)	7 (5.2) ●	65 (3.2)	-1 (5.4) ●	5 (1.9)	-5 (3.6) ●
Russian Federation		24 (0.5)	-1 (0.6) ●	19 (3.2)	4 (4.2) ●	81 (3.2)	-3 (4.3) ●	0 (0.0)	-1 (0.2) ▼
Singapore		37 (0.3)	0 (0.5) ●	1 (0.4)	0 (0.8) ●	32 (3.8)	-1 (5.8) ●	68 (3.8)	1 (5.8) ●
Slovak Republic		25 (0.4)	-1 (0.5) ●	15 (2.6)	0 (3.8) ●	85 (2.6)	0 (3.9) ●	0 (0.2)	0 (0.8) ●
Slovenia	r	22 (0.3)	-2 (0.4) ▼	29 (3.2)	13 (4.4) ●	71 (3.2)	-13 (4.4) ●	0 (0.0)	– – ●
Thailand †		x x	x x	x x	x x	x x	x x	x x	x x
United States	s	26 (0.7)	1 (1.0) ●	21 (2.6)	-4 (4.3) ●	73 (3.0)	3 (4.7) ●	6 (1.4)	1 (2.3) ●
International Avg. §		27 (0.1)	-1 (0.2) ▼	21 (0.6)	2 (0.9) ●	63 (0.7)	0 (1.1) ●	16 (0.4)	-1 (0.6) ●

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

Background data provided by teachers.

† Countries with unapproved sampling procedures at the classroom level in 1995.

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian-Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

Background data for Bulgaria and South Africa are unavailable for 1995.

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

A dash (–) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students, based on the lower response rate in either 1995 or 1999. An "s" indicates teacher response data available for 50-69% of students, based on the lower response rate in either 1995 or 1999. An "x" indicates teacher response data available for <50% of students, based on the lower response rate in either 1995 or 1999.

Exhibit 6.10 Time Spent on Various Activities in Mathematics Class

TIMSS1999 8th grade Mathematics

	Average Percentage of Class Time Spent in a Typical Month of Lessons							
	Administrative Tasks	Homework Review	Lecture-Style Presentation by Teacher	Teacher-Guided Student Practice	Re-teaching and Clarification of Content/ Procedures	Student Independent Practice	Tests and Quizzes	Other
Australia	4 (0.4)	9 (0.5)	19 (1.3)	22 (0.9)	12 (0.6)	22 (1.3)	8 (0.3)	3 (0.4)
Belgium (Flemish)	4 (0.3)	7 (0.4)	24 (1.1)	29 (1.0)	10 (0.4)	14 (0.9)	10 (0.3)	2 (0.4)
Bulgaria	2 (0.4)	7 (0.4)	37 (1.7)	18 (1.1)	10 (0.5)	14 (1.3)	12 (0.6)	1 (0.3)
Canada	r 5 (0.2)	r 14 (0.4)	r 20 (0.9)	r 18 (0.8)	r 10 (0.3)	r 20 (0.7)	r 10 (0.3)	r 3 (0.6)
Chile	6 (0.7)	14 (0.6)	24 (1.2)	18 (0.9)	19 (0.8)	8 (0.5)	12 (0.6)	3 (0.5)
Chinese Taipei	3 (0.6)	12 (0.5)	39 (1.3)	15 (0.5)	11 (0.6)	9 (0.5)	10 (0.5)	2 (0.4)
Cyprus	r 3 (0.4)	r 21 (0.8)	r 17 (1.0)	r 25 (1.0)	r 12 (0.5)	r 10 (1.0)	r 9 (0.7)	r 2 (0.3)
Czech Republic	3 (0.3)	5 (0.4)	23 (0.7)	29 (1.2)	10 (0.5)	19 (1.0)	9 (0.6)	3 (0.4)
England	s 3 (0.2)	s 6 (0.5)	s 18 (0.9)	s 27 (1.2)	s 11 (0.4)	s 24 (1.5)	s 8 (0.4)	s 3 (0.7)
Finland	2 (0.3)	16 (0.6)	15 (0.7)	25 (1.1)	10 (0.4)	24 (1.4)	7 (0.3)	2 (0.3)
Hong Kong, SAR	5 (0.7)	12 (0.7)	32 (1.6)	18 (0.8)	8 (0.4)	14 (0.8)	8 (0.4)	3 (0.4)
Hungary	2 (0.2)	11 (0.5)	14 (0.7)	29 (1.0)	13 (0.5)	15 (0.7)	9 (0.4)	3 (0.4)
Indonesia	7 (0.5)	15 (1.2)	11 (1.0)	24 (1.3)	13 (0.6)	15 (0.8)	16 (0.9)	4 (0.4)
Iran, Islamic Rep.	6 (0.9)	19 (2.6)	25 (2.4)	21 (2.6)	22 (2.6)	16 (2.8)	22 (2.6)	9 (1.2)
Israel	r 4 (0.6)	r 15 (0.8)	r 19 (0.8)	r 21 (1.2)	r 14 (0.8)	r 22 (1.1)	r 10 (0.5)	r 3 (0.5)
Italy	2 (0.2)	14 (0.5)	25 (0.7)	22 (0.7)	13 (0.4)	12 (0.5)	12 (0.5)	1 (0.2)
Japan	2 (0.5)	5 (0.4)	34 (1.6)	26 (1.3)	16 (0.9)	9 (0.7)	7 (0.5)	2 (0.3)
Jordan	8 (1.0)	18 (1.2)	18 (1.4)	22 (1.5)	14 (1.1)	16 (1.3)	15 (1.2)	6 (0.9)
Korea, Rep. of	3 (0.6)	6 (0.3)	33 (1.4)	22 (0.8)	14 (0.8)	14 (0.8)	7 (0.3)	3 (0.4)
Latvia (LSS)	3 (0.2)	11 (0.7)	16 (0.9)	33 (1.6)	13 (0.8)	10 (0.9)	7 (0.4)	7 (0.8)
Lithuania ‡	2 (0.2)	8 (0.4)	22 (0.7)	26 (1.0)	10 (0.3)	14 (0.6)	13 (0.5)	2 (0.3)
Macedonia, Rep. of	5 (0.3)	8 (0.4)	41 (1.2)	18 (0.8)	7 (0.4)	11 (0.5)	7 (0.4)	3 (0.3)
Malaysia	7 (0.7)	17 (1.0)	19 (1.1)	27 (1.3)	13 (0.8)	11 (0.9)	10 (0.5)	4 (0.5)
Moldova	5 (1.1)	15 (1.0)	21 (1.1)	20 (0.9)	11 (0.5)	18 (0.9)	9 (0.5)	5 (0.5)
Morocco	3 (0.3)	14 (0.6)	28 (1.1)	19 (1.0)	12 (0.8)	5 (0.6)	12 (0.7)	5 (0.7)
Netherlands	5 (0.4)	15 (1.5)	9 (1.2)	5 (1.0)	18 (1.1)	32 (2.0)	11 (0.6)	5 (1.0)
New Zealand	5 (0.3)	9 (0.4)	17 (0.9)	22 (1.1)	11 (0.6)	24 (1.2)	8 (0.3)	3 (0.5)
Philippines	8 (1.1)	12 (1.0)	24 (1.4)	19 (1.2)	13 (1.0)	18 (1.2)	18 (1.1)	4 (0.5)
Romania	4 (0.5)	12 (0.4)	26 (1.2)	16 (0.8)	12 (0.6)	12 (0.5)	14 (0.7)	4 (0.4)
Russian Federation	2 (0.1)	10 (0.4)	25 (0.6)	17 (0.7)	11 (0.4)	17 (0.6)	12 (0.6)	5 (0.4)
Singapore	6 (0.6)	13 (0.7)	28 (1.5)	20 (1.2)	9 (0.3)	12 (0.8)	8 (0.4)	3 (0.3)
Slovak Republic	3 (0.3)	8 (0.3)	9 (0.8)	30 (1.1)	13 (0.5)	23 (1.1)	11 (0.5)	4 (0.5)
Slovenia	4 (0.3)	11 (0.5)	24 (1.0)	24 (0.8)	16 (0.7)	10 (0.7)	8 (0.3)	3 (0.4)
South Africa	13 (1.4)	26 (1.6)	23 (1.8)	26 (1.7)	21 (1.6)	21 (1.8)	22 (1.3)	7 (1.1)
Thailand	10 (1.1)	16 (1.2)	22 (1.5)	19 (1.1)	15 (1.0)	16 (1.3)	14 (1.1)	3 (0.5)
Tunisia	3 (0.3)	14 (0.8)	20 (1.7)	27 (1.4)	11 (0.7)	8 (0.7)	12 (0.7)	4 (0.4)
Turkey	4 (0.6)	9 (0.7)	49 (1.2)	14 (0.8)	13 (0.8)	8 (0.7)	9 (0.6)	4 (0.6)
United States	r 6 (0.3)	r 15 (0.4)	r 20 (0.7)	r 18 (0.4)	r 12 (0.5)	r 17 (0.9)	r 11 (0.4)	r 4 (0.5)
International Avg.	5 (0.1)	12 (0.1)	23 (0.2)	22 (0.2)	13 (0.1)	15 (0.2)	11 (0.1)	4 (0.1)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

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

Exhibit 6.11 Students Doing Various Activities in Mathematics Class

	Percentage of Students Reporting Almost Always or Pretty Often				
	We Discuss Our Completed Homework	Teacher Shows Us How to Do Mathematics	We Work on Worksheets or Textbooks on Our	We Work on Mathematics Projects	We Begin Our Homework
Australia	44 (1.8)	93 (0.7)	91 (1.2)	25 (1.7)	56 (1.6)
Belgium (Flemish)	43 (1.4)	69 (0.9)	64 (1.0)	16 (1.1)	20 (1.4)
Bulgaria	48 (1.9)	89 (1.0)	32 (1.2)	15 (1.0)	21 (1.4)
Canada	62 (1.4)	92 (0.5)	92 (0.5)	28 (1.1)	82 (1.2)
Chile	47 (1.3)	89 (0.9)	40 (1.1)	46 (1.6)	55 (1.2)
Chinese Taipei	55 (1.0)	91 (0.5)	59 (1.2)	55 (1.2)	34 (1.0)
Cyprus	72 (1.1)	92 (0.7)	67 (1.0)	29 (1.0)	52 (2.3)
Czech Republic	42 (1.8)	86 (1.1)	51 (2.4)	8 (0.6)	16 (1.6)
England	62 (1.5)	93 (0.7)	88 (1.5)	35 (1.4)	27 (1.6)
Finland	37 (1.3)	67 (1.3)	90 (1.0)	7 (0.8)	47 (2.0)
Hong Kong, SAR	35 (1.1)	91 (0.6)	69 (1.2)	67 (1.4)	40 (1.1)
Hungary	71 (1.5)	87 (1.0)	63 (1.7)	96 (0.4)	18 (1.2)
Indonesia	48 (1.0)	88 (0.6)	36 (1.5)	86 (0.9)	13 (0.7)
Iran, Islamic Rep.	56 (1.0)	82 (0.7)	45 (0.9)	30 (1.1)	34 (1.3)
Israel	64 (1.3)	90 (0.6)	72 (1.2)	20 (1.0)	65 (1.5)
Italy	64 (1.4)	80 (1.2)	34 (1.2)	22 (1.3)	39 (2.3)
Japan	19 (1.2)	88 (0.7)	38 (1.5)	6 (0.7)	20 (1.3)
Jordan	76 (0.9)	92 (0.6)	45 (1.1)	40 (1.4)	59 (1.1)
Korea, Rep. of	10 (0.5)	85 (0.8)	29 (0.7)	46 (1.2)	17 (0.7)
Latvia (LSS)	48 (1.8)	86 (1.0)	54 (1.2)	– –	28 (1.6)
Lithuania ‡	– –	– –	– –	– –	– –
Macedonia, Rep. of	72 (1.3)	86 (0.8)	66 (1.6)	37 (1.1)	30 (1.4)
Malaysia	61 (1.0)	92 (0.5)	13 (0.7)	68 (1.1)	67 (1.3)
Moldova	61 (1.3)	91 (0.8)	66 (1.7)	52 (1.6)	32 (1.6)
Morocco	r 69 (0.8)	86 (0.6)	r 53 (1.0)	r 49 (1.1)	r 53 (1.2)
Netherlands	68 (3.7)	70 (2.7)	92 (1.1)	3 (0.7)	89 (1.5)
New Zealand	55 (1.8)	92 (0.6)	89 (1.0)	33 (1.5)	43 (1.7)
Philippines	78 (0.8)	87 (0.8)	64 (1.0)	56 (1.2)	49 (1.1)
Romania	62 (1.4)	83 (0.9)	49 (1.1)	38 (2.0)	27 (1.6)
Russian Federation	53 (1.4)	78 (1.2)	62 (1.3)	19 (0.9)	10 (0.8)
Singapore	61 (1.0)	97 (0.4)	75 (0.9)	15 (1.1)	60 (1.9)
Slovak Republic	59 (1.9)	81 (1.0)	53 (1.6)	11 (0.8)	39 (1.9)
Slovenia	60 (1.7)	76 (1.5)	57 (1.8)	19 (0.9)	28 (1.9)
South Africa	72 (0.8)	83 (0.7)	67 (1.2)	59 (1.4)	69 (1.1)
Thailand	29 (1.2)	91 (0.7)	52 (1.1)	19 (1.0)	80 (0.9)
Tunisia	63 (1.2)	85 (0.9)	57 (1.0)	77 (0.7)	32 (1.1)
Turkey	35 (1.1)	84 (0.7)	38 (0.9)	22 (0.8)	21 (1.2)
United States	79 (1.2)	94 (0.6)	86 (0.7)	29 (1.3)	74 (1.6)
International Avg.	55 (0.2)	86 (0.2)	59 (0.2)	36 (0.2)	42 (0.2)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

Exhibit 6.12 Presentational Modes Used in Mathematics Class

TIMSS 1999 8th grade Mathematics

	Percentage of Students Reporting Almost Always or Pretty Often				
	Teacher Uses the Board	Teacher Uses an Overhead Projector	Teacher Uses a Computer to Demonstrate Ideas in Mathematics	Students Use the Board	Students Use an Overhead Projector
Australia	96 (0.8)	10 (1.5)	4 (0.4)	15 (1.4)	3 (0.4)
Belgium (Flemish)	96 (0.7)	11 (1.7)	2 (0.5)	42 (1.8)	2 (0.8)
Bulgaria	93 (0.6)	10 (1.1)	4 (0.6)	79 (2.1)	7 (0.7)
Canada	91 (0.9)	42 (2.7)	5 (0.5)	25 (1.2)	7 (0.8)
Chile	96 (0.6)	10 (0.8)	10 (0.9)	79 (1.5)	6 (0.6)
Chinese Taipei	96 (0.4)	4 (0.4)	2 (0.2)	48 (1.6)	2 (0.3)
Cyprus	97 (0.3)	12 (0.7)	7 (0.6)	92 (0.6)	8 (0.5)
Czech Republic	97 (0.4)	9 (1.6)	2 (0.4)	91 (1.7)	4 (0.5)
England	94 (1.5)	19 (2.6)	6 (0.8)	13 (1.0)	3 (0.6)
Finland	94 (1.4)	42 (2.9)	2 (0.4)	52 (2.6)	5 (0.7)
Hong Kong, SAR	96 (0.4)	9 (0.8)	3 (0.4)	46 (1.7)	3 (0.4)
Hungary	96 (0.6)	6 (0.7)	3 (0.4)	62 (1.7)	3 (0.4)
Indonesia	93 (0.5)	6 (0.5)	2 (0.5)	45 (1.4)	4 (0.4)
Iran, Islamic Rep.	94 (0.5)	8 (0.6)	0 (0.1)	89 (0.7)	5 (0.4)
Israel	90 (0.6)	19 (1.1)	11 (0.9)	40 (1.6)	13 (0.9)
Italy	94 (0.5)	8 (0.9)	5 (0.6)	84 (1.1)	7 (0.6)
Japan	99 (0.2)	4 (0.8)	1 (0.4)	50 (2.5)	1 (0.3)
Jordan	91 (0.6)	23 (1.0)	12 (1.2)	80 (0.9)	19 (1.0)
Korea, Rep. of	93 (0.5)	10 (0.8)	7 (0.9)	38 (1.7)	3 (0.3)
Latvia (LSS)	83 (1.3)	7 (1.1)	5 (0.7)	83 (1.7)	4 (0.5)
Lithuania ‡	– –	– –	– –	– –	– –
Macedonia, Rep. of	95 (0.7)	22 (1.5)	6 (0.8)	89 (1.1)	14 (0.9)
Malaysia	96 (0.5)	6 (1.0)	1 (0.2)	52 (1.4)	3 (0.3)
Moldova	83 (0.9)	37 (1.8)	13 (1.1)	85 (0.8)	31 (1.6)
Morocco	r 87 (0.7)	s 32 (1.1)	s 9 (1.0)	r 71 (1.2)	s 24 (1.0)
Netherlands	90 (1.6)	7 (1.4)	2 (0.3)	9 (1.2)	2 (0.3)
New Zealand	95 (0.8)	32 (2.7)	7 (0.7)	24 (1.5)	7 (0.7)
Philippines	89 (0.7)	35 (1.4)	19 (1.5)	63 (1.1)	30 (1.4)
Romania	94 (0.4)	12 (0.9)	2 (0.3)	92 (0.7)	9 (0.8)
Russian Federation	96 (0.4)	7 (1.0)	1 (0.2)	92 (0.6)	4 (0.5)
Singapore	96 (1.3)	75 (2.1)	11 (1.2)	52 (2.0)	21 (1.1)
Slovak Republic	89 (1.2)	10 (1.4)	2 (0.3)	95 (0.6)	3 (0.4)
Slovenia	95 (0.5)	29 (2.2)	5 (0.6)	72 (2.1)	7 (0.7)
South Africa	86 (0.8)	45 (1.6)	– –	56 (1.7)	36 (1.5)
Thailand	93 (0.8)	7 (0.8)	6 (0.6)	33 (1.5)	4 (0.5)
Tunisia	84 (0.8)	13 (0.8)	1 (0.3)	71 (0.9)	8 (0.6)
Turkey	93 (0.4)	13 (0.8)	2 (0.3)	80 (0.9)	8 (0.6)
United States	80 (1.9)	59 (3.3)	9 (0.7)	37 (1.9)	16 (1.0)
International Avg.	92 (0.1)	19 (0.3)	5 (0.1)	60 (0.2)	9 (0.1)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

Exhibit 6.13 Index of Teachers' Emphasis on Mathematics Reasoning and Problem-Solving (EMRPS)

Index of Teachers' Emphasis on Mathematics Reasoning and Problem-Solving

Index based on teachers' responses to four questions about how often they ask students to: 1) explain the reasoning behind an idea; 2) represent and analyze relationships using tables, charts, or graphs; 3) work on problems for which there is no immediately obvious method of solution; 4) write equations to represent relationships (see reference exhibit R3.9). Average is computed across the four items based on a 4-point scale: 1 = never or almost never; 2 = some lessons; 3 = most lessons; 4 = every lesson. High level indicates average is greater than or equal to 3. Medium level indicates average is greater than or equal to 2.25 and less than 3. Low level indicates average is less than 2.25.

		High EMRPS		Medium EMRPS		Low EMRPS	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Japan		49 (4.1)	584 (2.6)	45 (4.1)	574 (2.5)	7 (2.1)	562 (6.2)
Italy		30 (3.1)	484 (6.9)	58 (3.6)	479 (5.7)	12 (2.6)	472 (8.7)
Turkey		26 (3.2)	422 (6.8)	63 (3.6)	431 (5.3)	11 (2.4)	424 (8.8)
Malaysia		23 (3.4)	521 (9.3)	55 (4.3)	516 (6.7)	22 (3.8)	525 (11.8)
Romania		22 (4.5)	458 (13.5)	73 (4.4)	480 (7.0)	4 (1.7)	440 (8.6)
Macedonia, Rep. of		22 (3.4)	465 (7.6)	65 (4.2)	446 (5.9)	13 (2.7)	417 (13.4)
Philippines		21 (3.7)	347 (12.9)	54 (4.1)	348 (8.3)	24 (3.3)	337 (9.6)
Slovenia		21 (3.6)	534 (5.6)	72 (3.9)	529 (3.2)	7 (2.0)	534 (11.2)
Bulgaria		21 (4.1)	536 (16.4)	72 (4.2)	507 (5.5)	6 (1.9)	475 (16.9)
Czech Republic		21 (4.2)	539 (8.4)	73 (4.6)	516 (5.6)	6 (2.6)	502 (10.3)
Korea, Rep. of		21 (3.0)	588 (4.0)	66 (3.3)	586 (2.6)	13 (2.4)	594 (4.6)
Israel		19 (2.9)	475 (10.8)	60 (3.3)	472 (5.0)	21 (2.7)	451 (9.7)
United States		18 (2.5)	519 (12.4)	57 (2.9)	502 (4.1)	24 (2.7)	489 (6.4)
Slovak Republic		18 (3.9)	529 (9.1)	71 (4.2)	536 (4.8)	10 (2.8)	514 (11.4)
South Africa		16 (3.1)	260 (12.8)	58 (3.8)	269 (7.6)	26 (2.9)	303 (15.6)
Iran, Islamic Rep.		16 (3.5)	409 (8.1)	45 (4.2)	421 (4.6)	39 (4.1)	429 (5.9)
Hungary		16 (3.0)	556 (10.6)	74 (3.3)	526 (4.4)	10 (2.3)	525 (15.3)
Moldova		13 (2.9)	468 (9.6)	79 (3.7)	467 (4.9)	8 (2.4)	475 (12.2)
Chile		13 (2.4)	392 (10.6)	52 (3.9)	397 (6.4)	35 (3.7)	387 (6.3)
Jordan		13 (2.8)	424 (10.3)	60 (4.6)	428 (4.7)	26 (4.1)	427 (9.4)
Cyprus	r	13 (3.5)	482 (6.8)	68 (4.9)	479 (3.0)	19 (3.8)	465 (6.0)
Chinese Taipei		13 (2.4)	571 (7.5)	58 (4.2)	594 (6.0)	29 (3.8)	573 (6.9)
Canada		13 (2.0)	550 (8.1)	62 (3.4)	537 (3.5)	26 (3.0)	518 (4.9)
Netherlands		12 (3.5)	561 (12.7)	60 (6.1)	528 (10.3)	28 (5.2)	547 (9.5)
Russian Federation		11 (2.5)	557 (12.8)	74 (3.9)	523 (6.6)	15 (3.6)	518 (10.5)
Indonesia		10 (2.6)	380 (19.1)	59 (4.1)	412 (7.3)	31 (3.8)	397 (10.6)
Lithuania	‡	9 (2.4)	517 (10.5)	67 (3.7)	484 (5.1)	23 (3.7)	462 (8.6)
Tunisia		8 (2.2)	435 (8.3)	58 (4.1)	450 (3.3)	34 (4.1)	448 (4.1)
Australia		7 (2.1)	532 (9.1)	54 (4.5)	538 (6.8)	39 (4.3)	508 (7.0)
Singapore		7 (2.1)	617 (25.9)	47 (4.0)	607 (8.8)	47 (4.4)	599 (8.2)
Morocco		7 (1.4)	330 (10.4)	51 (2.9)	339 (3.3)	42 (3.4)	336 (4.4)
Thailand		6 (1.6)	465 (25.5)	58 (4.7)	468 (6.9)	36 (4.5)	463 (7.0)
Hong Kong, SAR		6 (2.2)	597 (13.7)	56 (3.6)	591 (5.7)	38 (3.7)	570 (8.1)
Latvia (LSS)		6 (2.0)	531 (19.9)	64 (4.4)	504 (4.6)	30 (4.1)	503 (6.3)
New Zealand		5 (2.2)	536 (19.3)	48 (4.3)	506 (7.8)	47 (4.0)	470 (8.1)
Finland		5 (2.0)	538 (11.2)	66 (4.1)	520 (3.8)	29 (3.8)	520 (3.4)
England	s	3 (1.4)	533 (24.8)	66 (3.5)	519 (7.2)	31 (3.4)	490 (7.6)
Belgium (Flemish)		1 (0.4)	~ ~	39 (3.1)	592 (4.9)	61 (3.1)	540 (5.4)
International Avg.		15 (0.5)	493 (3.5)	61 (0.7)	490 (1.0)	24 (0.6)	479 (1.5)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 tilde (~) indicates insufficient data to report achievement.

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

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Exhibit 6.14 Trends in Index of Teachers' Emphasis on Mathematics Reasoning and Problem-Solving (EMRPS)

TIMSS1999 8th grade Mathematics

	High EMRPS Percent of Students			Medium EMRPS Percent of Students			Low EMRPS Percent of Students		
	1995	1999	1995-1999 Difference	1995	1999	1995-1999 Difference	1995	1999	1995-1999 Difference
Australia s	2 (1.1)	7 (2.1)	5 (2.4) ●	43 (3.8)	54 (4.5)	11 (5.9) ●	55 (3.9)	39 (4.3)	-16 (5.8) ●
Belgium (Flemish)	0 (0.0)	1 (0.4)	1 (0.4) ●	29 (3.3)	39 (3.1)	10 (4.5) ●	71 (3.3)	61 (3.1)	-11 (4.5) ●
Canada	4 (1.7)	13 (2.0)	9 (2.6) ▲	54 (5.0)	62 (3.4)	8 (6.0) ●	42 (5.1)	26 (3.0)	-16 (6.0) ●
Cyprus	20 (4.4)	13 (3.5)	-7 (5.6) ●	51 (6.0)	68 (4.9)	16 (7.7) ●	29 (5.6)	19 (3.8)	-9 (6.8) ●
Czech Republic	18 (4.1)	21 (4.2)	3 (5.8) ●	65 (5.9)	73 (4.6)	8 (7.5) ●	17 (5.0)	6 (2.6)	-11 (5.7) ●
England	4 (1.4)	3 (1.4)	-1 (2.0) ●	62 (3.2)	66 (3.5)	4 (4.7) ●	34 (3.1)	31 (3.4)	-4 (4.6) ●
Hong Kong, SAR	5 (2.4)	6 (2.2)	1 (3.2) ●	41 (5.5)	56 (3.6)	15 (6.6) ●	54 (5.4)	38 (3.7)	-16 (6.5) ●
Hungary	20 (3.1)	16 (3.0)	-4 (4.3) ●	71 (4.0)	74 (3.3)	3 (5.2) ●	10 (2.4)	10 (2.3)	1 (3.4) ●
Iran, Islamic Rep.	6 (2.1)	16 (3.5)	10 (4.0) ●	52 (5.3)	45 (4.2)	-7 (6.7) ●	42 (5.4)	39 (4.1)	-3 (6.8) ●
Israel †	13 (4.5)	17 (2.8)	4 (5.3) ●	58 (7.5)	62 (3.6)	4 (8.3) ●	29 (7.6)	21 (3.1)	-8 (8.2) ●
Italy	15 (3.4)	28 (3.8)	14 (5.1) ●	66 (4.7)	58 (4.5)	-8 (6.5) ●	19 (3.5)	14 (3.3)	-6 (4.8) ●
Japan	37 (4.1)	49 (4.1)	12 (5.9) ●	54 (4.1)	45 (4.1)	-9 (5.8) ●	10 (2.3)	7 (2.1)	-3 (3.1) ●
Korea, Rep. of	15 (3.2)	21 (3.0)	6 (4.4) ●	70 (4.2)	66 (3.3)	-4 (5.3) ●	15 (3.5)	13 (2.4)	-2 (4.3) ●
Latvia (LSS)	14 (3.8)	6 (2.0)	-8 (4.2) ●	60 (4.9)	64 (4.4)	4 (6.6) ●	26 (4.2)	30 (4.1)	4 (5.9) ●
Lithuania	6 (2.1)	9 (2.4)	4 (3.2) ●	66 (3.9)	67 (3.7)	1 (5.4) ●	28 (3.9)	23 (3.7)	-5 (5.4) ●
Netherlands	– –	– –	– –	– –	– –	– –	– –	– –	– –
New Zealand s	2 (1.2)	5 (2.2)	3 (2.5) ●	50 (4.1)	48 (4.3)	-2 (6.0) ●	49 (4.3)	47 (4.0)	-2 (5.9) ●
Romania	26 (3.6)	22 (4.5)	-3 (5.8) ●	69 (4.0)	73 (4.4)	5 (5.9) ●	6 (1.9)	4 (1.7)	-1 (2.5) ●
Russian Federation	5 (1.6)	11 (2.5)	6 (3.0) ●	78 (4.0)	74 (3.9)	-4 (5.6) ●	17 (3.6)	15 (3.6)	-2 (5.0) ●
Singapore s	2 (1.4)	7 (2.1)	5 (2.5) ●	48 (4.9)	47 (4.0)	-1 (6.3) ●	50 (4.8)	47 (4.4)	-3 (6.5) ●
Slovak Republic	12 (2.7)	18 (3.9)	6 (4.7) ●	80 (3.1)	71 (4.2)	-8 (5.3) ●	8 (2.2)	10 (2.8)	2 (3.6) ●
Slovenia	11 (2.9)	21 (3.6)	10 (4.6) ●	74 (4.3)	72 (3.9)	-3 (5.9) ●	14 (3.6)	7 (2.0)	-8 (4.1) ●
Thailand †	2 (0.3)	6 (1.6)	4 (1.6) ●	36 (5.4)	58 (4.7)	21 (7.1) ●	62 (5.5)	36 (4.5)	-25 (7.1) ▼
United States	10 (2.7)	18 (2.5)	8 (3.7) ●	52 (3.7)	57 (2.9)	5 (4.7) ●	38 (3.6)	24 (2.7)	-13 (4.5) ●
International Avg. §	11 (0.6)	15 (0.6)	4 (0.9) ▲	59 (1.0)	61 (0.9)	2 (1.3) ●	30 (0.9)	24 (0.7)	-6 (1.1) ▼

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

Background data provided by teachers.

† Countries with unapproved sampling procedures at the classroom level in 1995.

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian-Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

Background data for Bulgaria and South Africa are unavailable for 1995.

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

A dash (–) indicates data are not available.

An "s" indicates teacher response data available for 50-69% of students, based on the lower response rate in either 1995 or 1999.

How Are Calculators and Computers Used?

Exhibit 6.15 shows data on students' access to calculators for use in mathematics class and policies on their use for those with access. In 14 countries, teachers reported that nearly all students (more than 90 percent) had access to calculators in class. The countries with this high degree of access were Australia, Belgium (Flemish), Canada, the Czech Republic, England, Finland, Hong Kong, Israel, Lithuania, the Netherlands, New Zealand, Singapore, the Slovak Republic, and the United States. For students in classes with access to calculators, most teachers reported some type of restricted use (for about two-thirds of the students on average internationally). 6.15

TIMSS combined students' and teachers' reports on the frequency of calculator use to create an index of emphasis on calculators in mathematics class (ECMC), presented in Exhibit 6.16. Students were placed in the high category if they reported using calculators in class almost always or pretty often and their teachers reported calculator use of at least once or twice a week. At the other end of the spectrum, students were placed at the low level if they reported using calculators only once in a while or never and their teachers reported asking students to use calculators never or hardly ever. There was enormous variation in the results across countries. The Netherlands, Singapore, and Australia had more than four-fifths of their students (from 84 percent to 95 percent) in the high category. In contrast, a number of countries had half or more of their students in the low category, including Chinese Taipei, Iran, Korea, Japan, Malaysia, Romania, Thailand, and Turkey. Since several high-performing countries have restricted calculator use and large percentages of students are in the low-use category, the relationship between calculator use and performance is difficult to interpret. Although on average internationally the relationship is unclear, in most of the countries where emphasis on calculator use was high, there was a positive association between calculator use and mathematics achievement. 6.16

Exhibit R3.12 in the reference section shows the detailed results for students' reports on frequency of calculator use. In the Netherlands, 67 percent of the students reported almost always using calculators in their mathematics lessons. Countries with the next highest level of use included Canada, Israel, New Zealand, South Africa, and the United States (from 42 to 45 percent). Exhibit R3.13 shows the trends between 1995 and 1999. Internationally on average, there was a small but significant decrease in the percentage of students who reported that they almost always used calculators. Teachers were asked how often they asked stu- R3.12 R R3.13 R

dents to use calculators for a variety of activities. The percentages of students asked to use calculators for each activity at least once or twice a week are shown in Exhibit R3.14. According to teachers, they asked the most students to use calculators at least weekly for checking answers, performing routine computations, and solving complex problems (43 to 44 percent internationally each). About one-fourth of the students across countries were asked to explore number concepts and one-fifth to use calculators on their tests.

R3.14

Exhibit 6.17 shows trend data for the index of emphasis on calculators in mathematics class. There was a shift toward less frequent use of calculators between 1995 and 1999. Significantly fewer students were at the high level of the emphasis on calculators index in 1999 than in 1995 in five countries: the Czech Republic, England, Latvia (LSS), the Russian Federation, and the Slovak Republic. Two countries, Belgium (Flemish) and Thailand, had increased percentages of students in the high category. As shown in Exhibit R3.13, changes in students' reports on the frequency of calculator use from 1995 to 1999 show a significant decrease in the percentage of students in the almost always category in eight countries: Cyprus, the Czech Republic, England, Hong Kong, Latvia, Romania, the Russian Federation, and the Slovak Republic. The Netherlands and Singapore, however, showed increases in that category.

6.17

Students' reports on their frequency of computer use in mathematics class are presented in Exhibit 6.18. Across countries, the vast majority of students (80 percent on average internationally) reported never using computers in mathematics class. The trend data, however, show a small but statistically significant shift from the never to the once in a while category (see Exhibit 6.19). Significantly more students reported using computers in mathematics class once in a while in 1999 than in 1995 in six countries: Canada, Hong Kong, Korea, Singapore, Slovenia, and Thailand.

6.18

6.19

Because the Internet provides a wealth of opportunities for students to collect and analyze data, TIMSS began asking about students' access to the Internet and whether they used the World Wide Web to access information for mathematics projects. The data in Exhibit 6.20 indicate great variation across countries in Internet access. Still, the international averages show about one-quarter of the students with access to the Internet at school. The international average for using the Internet to access information for mathematics class on even a monthly basis was 10 percent (less than half those reporting access).

6.20

Exhibit 6.15 Calculator Use in Mathematics Class*

	Percentage of Students Having Access to Calculators in Class	Policy on Use of Calculators During Mathematics Lessons for Students Having Access					
		Unrestricted Use		Restricted Use		Calculators Not Permitted	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Australia	94 (2.2)	63 (4.3)	531 (6.3)	37 (4.3)	523 (9.4)	0 (0.0)	~ ~
Belgium (Flemish)	94 (2.6)	13 (2.3)	580 (8.7)	87 (2.4)	560 (5.6)	1 (0.4)	~ ~
Bulgaria	– –	25 (4.1)	512 (11.2)	54 (5.6)	512 (7.1)	21 (4.3)	510 (19.3)
Canada	96 (1.1)	40 (3.3)	537 (4.5)	60 (3.3)	531 (4.5)	0 (0.0)	~ ~
Chile	69 (3.2)	17 (3.7)	377 (12.2)	78 (3.9)	403 (5.9)	5 (2.0)	361 (19.9)
Chinese Taipei	51 (4.6)	13 (3.9)	576 (13.0)	85 (4.3)	577 (5.7)	3 (2.0)	599 (76.8)
Cyprus	r 65 (5.0)	r 5 (3.1)	449 (9.5)	60 (6.5)	476 (4.5)	35 (6.2)	477 (4.3)
Czech Republic	94 (2.4)	7 (2.7)	517 (13.4)	91 (3.1)	522 (4.7)	2 (1.5)	~ ~
England	s 100 (0.3)	s 14 (2.2)	547 (16.0)	86 (2.2)	504 (5.2)	0 (0.0)	~ ~
Finland	95 (1.9)	25 (4.0)	521 (5.2)	74 (4.1)	520 (3.4)	1 (0.0)	~ ~
Hong Kong, SAR	99 (0.5)	67 (4.3)	579 (5.2)	32 (4.2)	590 (6.6)	1 (0.0)	~ ~
Hungary	80 (3.1)	9 (2.6)	537 (16.9)	84 (3.1)	533 (5.0)	7 (2.3)	523 (12.7)
Indonesia	63 (4.9)	6 (2.4)	404 (17.9)	85 (3.5)	415 (8.1)	9 (2.8)	405 (28.2)
Iran, Islamic Rep.	44 (4.4)	5 (3.1)	438 (12.0)	53 (7.0)	436 (8.8)	42 (7.0)	423 (6.9)
Israel	98 (0.8)	78 (3.0)	474 (4.5)	21 (3.0)	451 (10.6)	1 (0.1)	~ ~
Italy	87 (2.0)	10 (2.6)	467 (12.0)	84 (3.1)	482 (4.6)	6 (1.6)	465 (16.9)
Japan	34 (4.3)	13 (3.9)	579 (5.4)	85 (4.4)	579 (5.1)	2 (0.2)	~ ~
Jordan	63 (4.4)	11 (3.3)	389 (13.2)	53 (5.1)	436 (7.7)	36 (5.3)	428 (9.3)
Korea, Rep. of	28 (3.4)	5 (3.3)	601 (9.0)	77 (6.3)	589 (4.6)	18 (5.7)	586 (9.0)
Latvia (LSS)	66 (3.7)	2 (0.1)	~ ~	68 (5.5)	507 (6.2)	30 (5.4)	506 (8.2)
Lithuania ‡	95 (1.9)	21 (3.5)	463 (9.0)	77 (3.6)	487 (4.9)	2 (0.9)	~ ~
Macedonia, Rep. of	54 (4.1)	10 (3.5)	439 (25.1)	75 (4.6)	446 (7.9)	15 (3.4)	479 (14.1)
Malaysia	34 (4.4)	0 (0.0)	~ ~	45 (7.7)	511 (12.1)	55 (7.7)	534 (13.3)
Moldova	80 (3.5)	28 (3.7)	483 (9.6)	61 (4.5)	463 (5.2)	11 (3.1)	461 (16.4)
Morocco	69 (2.5)	r 17 (2.7)	339 (6.9)	64 (3.9)	336 (5.2)	18 (2.9)	338 (6.1)
Netherlands	100 (0.0)	85 (4.1)	540 (7.8)	15 (4.1)	522 (18.5)	0 (0.0)	~ ~
New Zealand	95 (2.1)	60 (4.1)	491 (6.5)	40 (4.2)	485 (9.9)	1 (0.7)	~ ~
Philippines	44 (4.2)	16 (4.6)	318 (19.1)	66 (6.0)	358 (10.8)	18 (5.1)	347 (18.1)
Romania	37 (4.5)	4 (2.7)	474 (22.3)	80 (6.1)	495 (10.8)	16 (5.6)	521 (26.0)
Russian Federation	– –	12 (2.5)	547 (16.2)	78 (3.4)	520 (6.2)	10 (2.3)	546 (8.7)
Singapore	100 (0.0)	31 (4.7)	622 (11.0)	69 (4.7)	597 (6.2)	0 (0.0)	~ ~
Slovak Republic	96 (1.8)	8 (2.2)	542 (11.6)	91 (2.3)	532 (4.1)	1 (0.8)	~ ~
Slovenia	70 (4.3)	3 (2.0)	536 (17.2)	87 (3.6)	531 (3.8)	9 (3.1)	505 (13.9)
South Africa	85 (2.9)	28 (4.3)	280 (12.8)	61 (4.7)	274 (9.0)	11 (3.2)	299 (27.7)
Thailand	39 (4.1)	9 (3.0)	500 (5.8)	71 (5.9)	475 (9.8)	20 (5.3)	500 (18.7)
Tunisia	62 (4.1)	12 (3.7)	437 (8.5)	71 (5.4)	443 (3.3)	17 (4.2)	455 (8.7)
Turkey	40 (4.7)	2 (1.4)	~ ~	81 (3.8)	437 (7.7)	17 (3.9)	409 (8.9)
United States	96 (1.2)	34 (3.3)	524 (6.7)	66 (3.3)	493 (4.5)	0 (0.2)	~ ~
International Avg.	73 (0.5)	21 (0.5)	490 (2.2)	67 (0.7)	488 (1.2)	12 (0.6)	464 (3.5)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

* The use of calculators on TIMSS was not allowed in 1995 or in 1999.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available. A tilde (~) indicates insufficient data to report achievement.

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

Exhibit 6.16 Index of Emphasis on Calculators in Mathematics Class (ECMC)*

Index of Emphasis on Calculators in Mathematics Class

Index based on students' reports of the frequency of using calculators in mathematics lessons and teachers' reports of students' use of calculators in mathematics class for five activities: checking answers; tests and exams; routine computation; solving complex problems; and exploring number concepts (see reference exhibits R3.12-R3.14). High level indicates the student reported using calculators in mathematics lessons almost always or pretty often, and the teacher reported students use calculators at least once or twice a week for any of the tasks. Low level indicates the student reported using calculators once in a while or never, and the teacher reported students use calculators never or hardly ever for all of the tasks. Medium level includes all other possible combinations of responses.

		High ECMC		Medium ECMC		Low ECMC	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Netherlands		95 (1.1)	538 (7.2)	5 (1.1)	512 (23.5)	0 (0.0)	~ ~
Singapore		85 (1.6)	611 (6.3)	15 (1.6)	567 (7.1)	0 (0.0)	~ ~
Australia		84 (2.4)	531 (5.5)	12 (1.8)	515 (12.9)	4 (1.6)	484 (24.7)
England	s	80 (2.3)	524 (5.7)	19 (2.2)	462 (6.5)	1 (0.7)	~ ~
Canada	r	79 (1.9)	537 (3.0)	18 (1.7)	523 (4.7)	3 (0.9)	548 (6.8)
New Zealand		77 (2.8)	494 (5.5)	19 (2.2)	482 (9.9)	4 (1.7)	537 (28.2)
Hong Kong, SAR		75 (1.9)	586 (4.4)	25 (1.8)	577 (6.3)	0 (0.2)	~ ~
Israel	r	67 (2.4)	472 (4.3)	31 (2.3)	468 (8.4)	2 (0.7)	~ ~
United States	r	65 (3.2)	515 (4.5)	31 (2.9)	489 (6.4)	5 (1.2)	476 (10.8)
Italy		52 (2.4)	486 (4.6)	37 (2.3)	474 (5.7)	11 (1.8)	483 (12.0)
South Africa		51 (2.8)	280 (9.9)	40 (1.9)	266 (7.3)	10 (2.0)	314 (24.3)
Finland		46 (3.0)	520 (3.5)	47 (2.9)	523 (3.4)	6 (1.9)	517 (8.6)
Slovak Republic		41 (3.1)	541 (5.8)	55 (3.3)	527 (4.4)	3 (1.7)	521 (18.3)
Belgium (Flemish)		39 (2.7)	571 (6.3)	54 (2.7)	562 (6.9)	7 (2.6)	532 (27.9)
Czech Republic		35 (3.2)	528 (7.1)	60 (3.5)	517 (4.7)	5 (2.0)	507 (26.2)
Russian Federation		29 (2.3)	522 (9.3)	60 (2.1)	528 (6.3)	12 (2.4)	539 (13.3)
Hungary		28 (2.4)	535 (6.3)	53 (3.1)	530 (5.1)	19 (2.8)	527 (8.6)
Moldova		24 (1.6)	476 (5.4)	59 (2.1)	468 (5.0)	17 (2.6)	467 (10.2)
Morocco	s	18 (1.3)	321 (4.6)	59 (1.7)	343 (3.6)	22 (1.9)	350 (6.8)
Chile		18 (1.9)	404 (8.9)	55 (2.8)	395 (5.2)	27 (2.9)	389 (7.3)
Latvia (LSS)		16 (2.2)	514 (8.6)	53 (3.6)	502 (4.8)	31 (3.4)	505 (4.4)
Cyprus	r	14 (1.8)	468 (5.6)	56 (3.3)	477 (3.2)	30 (3.9)	483 (4.3)
Macedonia, Rep. of		14 (1.8)	465 (8.6)	47 (2.6)	455 (5.2)	39 (3.5)	448 (6.7)
Jordan		10 (1.4)	416 (10.8)	62 (3.1)	431 (5.0)	28 (3.5)	446 (6.7)
Slovenia		10 (1.6)	518 (8.6)	62 (3.4)	530 (3.8)	29 (3.9)	538 (4.3)
Bulgaria		8 (1.2)	501 (14.0)	68 (3.5)	518 (4.9)	24 (3.9)	503 (19.4)
Philippines		6 (1.1)	321 (16.1)	48 (2.9)	342 (7.2)	46 (3.4)	352 (8.1)
Indonesia		6 (1.0)	415 (13.7)	60 (4.1)	411 (7.0)	34 (4.3)	391 (9.2)
Tunisia		4 (0.7)	424 (8.2)	60 (3.5)	444 (2.7)	35 (3.6)	456 (4.4)
Romania		3 (0.7)	477 (17.5)	39 (3.8)	487 (9.3)	58 (4.1)	470 (5.6)
Turkey		3 (0.4)	411 (11.5)	42 (4.0)	428 (4.9)	55 (4.2)	433 (5.6)
Iran, Islamic Rep.		2 (0.5)	~ ~	42 (3.9)	425 (5.5)	56 (4.2)	422 (4.0)
Thailand		2 (0.3)	~ ~	39 (3.4)	478 (7.8)	59 (3.6)	459 (6.2)
Chinese Taipei		2 (0.4)	~ ~	48 (4.0)	576 (4.8)	50 (4.2)	598 (5.4)
Malaysia		1 (0.3)	~ ~	35 (4.1)	522 (8.8)	64 (4.2)	518 (6.1)
Korea, Rep. of		0 (0.3)	~ ~	29 (3.3)	587 (4.0)	71 (3.3)	587 (2.4)
Japan		0 (0.1)	~ ~	21 (3.2)	573 (6.4)	79 (3.2)	579 (2.2)
Lithuania ‡		– –	– –	– –	– –	– –	– –
International Avg.		32 (0.3)	481 (1.8)	42 (0.5)	484 (1.2)	26 (0.5)	481 (3.3)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

* The use of calculators on TIMSS was not allowed in 1995 or in 1999.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available. A tilde (~) indicates insufficient data to report achievement.

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

Exhibit 6.16: Index of Emphasis on Calculators in Mathematics Class (ECMC)* (Continued)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Exhibit 6.17 Trends in Index of Emphasis on Calculators in Mathematics Class (ECMC)*

TIMSS 1999 8th grade Mathematics

	High ECMC Percent of Students			Medium ECMC Percent of Students			Low ECMC Percent of Students		
	1995	1999	1995-1999 Difference	1995	1999	1995-1999 Difference	1995	1999	1995-1999 Difference
Australia	85 (2.5)	84 (2.4)	-1 (3.5) ●	11 (1.6)	12 (1.8)	1 (2.4) ●	4 (1.5)	4 (1.6)	0 (2.2) ●
Belgium (Flemish)	20 (3.2)	39 (2.7)	19 (4.2) ▲	43 (3.9)	54 (2.7)	11 (4.8) ●	37 (4.7)	7 (2.6)	-30 (5.4) ▼
Canada	70 (2.6)	79 (1.9)	9 (3.3) ●	26 (2.1)	18 (1.7)	-7 (2.6) ●	5 (2.6)	3 (0.9)	-2 (2.7) ●
Cyprus	23 (3.7)	14 (1.8)	-9 (4.1) ●	56 (3.9)	56 (3.3)	-1 (5.1) ●	21 (4.8)	30 (3.9)	9 (6.2) ●
Czech Republic	59 (3.8)	35 (3.2)	-24 (5.0) ▼	38 (3.7)	60 (3.5)	23 (5.1) ▲	3 (1.8)	5 (2.0)	1 (2.7) ●
England	90 (1.3)	80 (2.3)	-10 (2.7) ▼	10 (1.3)	19 (2.2)	9 (2.6) ▲	0 (0.0)	1 (0.7)	1 (0.7) ●
Hong Kong, SAR	76 (4.2)	75 (1.9)	-1 (4.6) ●	18 (3.5)	25 (1.8)	7 (3.9) ●	6 (2.4)	0 (0.2)	-5 (2.4) ●
Hungary	37 (3.2)	28 (2.4)	-8 (4.0) ●	44 (2.8)	53 (3.1)	9 (4.2) ●	20 (3.5)	19 (2.8)	-1 (4.5) ●
Iran, Islamic Rep. r	1 (0.4)	2 (0.5)	1 (0.6) ●	49 (4.7)	42 (3.9)	-7 (6.1) ●	50 (4.7)	56 (4.2)	6 (6.4) ●
Israel †	63 (5.7)	69 (2.8)	6 (6.3) ●	32 (5.1)	30 (2.7)	-3 (5.8) ●	5 (2.8)	1 (0.8)	-4 (2.9) ●
Italy	48 (3.9)	53 (3.1)	5 (5.0) ●	42 (3.6)	38 (2.8)	-5 (4.6) ●	10 (2.4)	10 (2.1)	0 (3.2) ●
Japan	0 (0.2)	0 (0.1)	0 (0.2) ●	23 (3.2)	21 (3.2)	-3 (4.5) ●	76 (3.3)	79 (3.2)	3 (4.6) ●
Korea, Rep. of	0 (0.1)	0 (0.3)	0 (0.3) ●	25 (3.7)	29 (3.3)	3 (4.9) ●	74 (3.7)	71 (3.3)	-3 (5.0) ●
Latvia (LSS)	49 (3.7)	16 (2.2)	-33 (4.4) ▼	42 (3.0)	53 (3.6)	11 (4.7) ●	9 (2.5)	31 (3.4)	22 (4.2) ▲
Lithuania	– –	– –	– –	– –	– –	– –	– –	– –	– –
Netherlands	89 (2.2)	95 (1.1)	6 (2.4) ●	11 (2.2)	5 (1.1)	-6 (2.4) ●	0 (0.0)	0 (0.0)	– – ●
New Zealand	70 (2.8)	77 (2.8)	7 (3.9) ●	23 (2.5)	19 (2.2)	-4 (3.3) ●	6 (1.9)	4 (1.7)	-2 (2.6) ●
Romania	5 (1.1)	3 (0.7)	-2 (1.3) ●	42 (3.3)	39 (3.8)	-3 (5.0) ●	54 (3.7)	58 (4.1)	5 (5.5) ●
Russian Federation	50 (3.0)	29 (2.3)	-21 (3.8) ▼	44 (2.8)	60 (2.1)	16 (3.5) ▲	7 (1.8)	12 (2.4)	5 (3.0) ●
Singapore	79 (2.2)	85 (1.6)	6 (2.7) ●	20 (2.1)	15 (1.6)	-5 (2.6) ●	1 (0.1)	0 (0.0)	-1 (0.1) ▼
Slovak Republic	68 (2.8)	41 (3.1)	-26 (4.2) ▼	32 (2.8)	55 (3.3)	24 (4.3) ▲	1 (0.6)	3 (1.7)	3 (1.8) ●
Slovenia	13 (2.1)	10 (1.6)	-3 (2.6) ●	55 (3.8)	62 (3.4)	7 (5.1) ●	32 (4.4)	29 (3.9)	-4 (5.8) ●
Thailand † r	1 (0.2)	2 (0.3)	1 (0.4) ▲	33 (5.2)	39 (3.4)	6 (6.2) ●	66 (5.2)	59 (3.6)	-7 (6.3) ●
United States	67 (3.4)	65 (3.2)	-2 (4.7) ●	27 (2.5)	31 (2.9)	4 (3.8) ●	7 (1.9)	5 (1.2)	-2 (2.2) ●
International Avg. §	47 (0.6)	43 (0.5)	-4 (0.8) ▼	33 (0.7)	36 (0.6)	3 (0.9) ▲	20 (0.6)	20 (0.6)	1 (0.8) ●

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

Background data provided by students and teachers.

* The use of calculators on TIMSS was not allowed in 1995 or in 1999.

† Countries with unapproved sampling procedures at the classroom level in 1995.

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian-Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

Background data for Bulgaria and South Africa are unavailable for 1995.

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

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

Exhibit 6.18 Frequency of Computer Use in Mathematics Class

TIMSS 1999 8th grade Mathematics

	Almost Always or Pretty Often		Once in a While		Never	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Australia	6 (1.1)	502 (15.1)	23 (2.3)	535 (6.0)	71 (3.0)	524 (5.7)
Belgium (Flemish)	1 (0.4)	~ ~	5 (1.2)	536 (17.4)	93 (1.3)	562 (3.1)
Bulgaria	3 (0.5)	473 (15.4)	4 (0.5)	486 (12.3)	93 (0.8)	517 (5.9)
Canada	8 (0.7)	507 (7.1)	25 (1.5)	534 (3.8)	67 (1.6)	534 (2.5)
Chile	8 (0.9)	362 (12.1)	11 (0.9)	388 (7.7)	81 (1.6)	399 (4.5)
Chinese Taipei	13 (0.6)	548 (7.5)	21 (0.6)	564 (5.2)	66 (0.9)	601 (3.8)
Cyprus	6 (0.4)	422 (6.0)	13 (0.7)	459 (5.3)	81 (0.8)	485 (2.2)
Czech Republic	2 (0.7)	~ ~	14 (2.4)	526 (8.4)	84 (2.6)	520 (3.8)
England	11 (1.7)	466 (10.4)	43 (2.2)	512 (5.1)	46 (2.7)	492 (5.2)
Finland	3 (0.9)	487 (10.8)	21 (2.2)	524 (4.4)	76 (2.7)	521 (3.1)
Hong Kong, SAR	8 (0.5)	561 (9.5)	18 (0.8)	577 (6.2)	75 (1.1)	587 (4.1)
Hungary	3 (0.5)	481 (18.9)	6 (1.0)	501 (11.3)	92 (1.2)	536 (3.6)
Indonesia	1 (0.3)	~ ~	4 (0.4)	389 (16.2)	95 (0.5)	407 (4.6)
Iran, Islamic Rep.	0 (0.2)	~ ~	4 (0.4)	413 (10.7)	96 (0.4)	426 (3.3)
Israel	14 (1.0)	429 (9.3)	19 (1.5)	470 (8.2)	67 (2.2)	479 (4.2)
Italy	11 (1.3)	464 (7.4)	17 (1.6)	489 (5.5)	72 (2.3)	482 (4.0)
Japan	2 (0.5)	~ ~	21 (2.3)	576 (3.7)	76 (2.7)	581 (2.0)
Jordan r	13 (1.2)	377 (5.9)	12 (0.8)	406 (7.3)	75 (1.6)	454 (4.2)
Korea, Rep. of	3 (0.3)	567 (7.9)	13 (0.7)	596 (3.9)	83 (0.8)	587 (2.2)
Latvia (LSS)	2 (0.3)	~ ~	3 (0.6)	475 (15.3)	95 (0.6)	507 (3.4)
Lithuania ‡	– –	– –	– –	– –	– –	– –
Macedonia, Rep. of	4 (0.6)	395 (12.8)	8 (0.5)	420 (8.8)	88 (0.8)	462 (3.7)
Malaysia	1 (0.2)	~ ~	6 (0.4)	524 (8.2)	93 (0.4)	520 (4.3)
Moldova	11 (0.9)	434 (7.3)	16 (1.2)	461 (5.9)	73 (1.7)	480 (4.4)
Morocco s	6 (0.8)	313 (15.8)	10 (0.8)	336 (11.9)	84 (1.2)	350 (4.0)
Netherlands	1 (0.2)	~ ~	19 (3.2)	543 (9.6)	80 (3.2)	541 (8.2)
New Zealand	6 (0.7)	426 (9.4)	21 (2.2)	517 (8.8)	73 (2.4)	491 (5.5)
Philippines	8 (1.0)	294 (9.5)	12 (0.7)	319 (11.3)	80 (1.3)	362 (5.8)
Romania	1 (0.3)	~ ~	5 (0.4)	447 (13.0)	93 (0.5)	481 (5.4)
Russian Federation	1 (0.2)	~ ~	3 (0.4)	513 (11.1)	97 (0.4)	530 (5.7)
Singapore	11 (0.8)	590 (11.0)	43 (2.5)	625 (6.8)	46 (2.7)	589 (6.1)
Slovak Republic	1 (0.2)	~ ~	4 (0.9)	536 (10.2)	95 (1.0)	535 (3.9)
Slovenia	5 (0.6)	473 (9.9)	15 (1.2)	516 (6.5)	81 (1.4)	537 (2.5)
South Africa	– –	– –	– –	– –	– –	– –
Thailand	5 (0.6)	431 (12.8)	10 (0.6)	471 (7.4)	85 (1.0)	470 (5.0)
Tunisia	1 (0.2)	~ ~	9 (0.5)	440 (5.3)	90 (0.6)	451 (2.4)
Turkey	2 (0.2)	~ ~	5 (0.5)	415 (11.2)	93 (0.6)	436 (4.3)
United States	12 (1.1)	463 (7.3)	27 (2.0)	520 (5.2)	61 (2.7)	506 (4.0)
International Avg.	5 (0.1)	455 (2.8)	14 (0.2)	488 (1.5)	80 (0.3)	498 (0.7)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available. A tilde (~) indicates insufficient data to report achievement.

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

Exhibit 6.19 Trends in Frequency of Computer Use in Mathematics Class

TIMSS 1999 8th grade Mathematics

Country		Almost Always or Pretty Often: Percent of Students 1999	Almost Always or Pretty Often: 1995-1999 Difference	Once in a While: Percent of Students 1999	Once in a While: 1995-1999 Difference	Never: Percent of Students 1999	Never: 1995-1999 Difference
Australia		6 (1.1)	1 (1.4) ●	23 (2.3)	5 (2.9) ●	71 (3.0)	-6 (3.6) ●
Belgium (Flemish)	r	1 (0.4)	0 (0.8) ●	5 (1.2)	1 (1.5) ●	93 (1.3)	-1 (1.7) ●
Canada		8 (0.7)	4 (0.8) ▲	25 (1.5)	12 (1.9) ▲	67 (1.6)	-15 (2.2) ▼
Cyprus		6 (0.4)	-5 (0.9) ▼	13 (0.7)	-3 (1.1) ●	81 (0.8)	8 (1.2) ▲
Czech Republic	s	2 (0.7)	-2 (1.9) ●	14 (2.4)	6 (3.1) ●	84 (2.6)	-5 (3.9) ●
England		11 (1.7)	2 (2.0) ●	43 (2.2)	-3 (3.2) ●	46 (2.7)	2 (3.8) ●
Hong Kong, SAR		8 (0.5)	4 (0.7) ▲	18 (0.8)	11 (0.9) ▲	75 (1.1)	-16 (1.3) ▼
Hungary		3 (0.5)	0 (0.6) ●	6 (1.0)	0 (1.3) ●	92 (1.2)	-1 (1.4) ●
Iran, Islamic Rep.	r	1 (0.3)	-4 (0.6) ▼	4 (0.3)	0 (0.5) ●	96 (0.5)	3 (1.0) ▲
Israel †		11 (1.0)	0 (3.1) ●	19 (1.7)	6 (3.1) ●	70 (2.4)	-6 (5.1) ●
Italy		11 (1.6)	1 (1.9) ●	15 (1.6)	1 (2.2) ●	74 (2.2)	-2 (3.1) ●
Japan	s	2 (0.5)	-2 (1.3) ●	21 (2.3)	2 (3.5) ●	76 (2.7)	0 (4.2) ●
Korea, Rep. of		3 (0.3)	2 (0.4) ▲	13 (0.7)	8 (0.8) ▲	83 (0.8)	-10 (1.0) ▼
Latvia (LSS)	s	2 (0.3)	-2 (0.5) ▼	3 (0.6)	-2 (1.1) ●	95 (0.6)	4 (1.3) ●
Lithuania		– –	– –	– –	– –	– –	– –
Netherlands	r	1 (0.2)	-1 (0.4) ●	19 (3.2)	1 (4.6) ●	80 (3.2)	-1 (4.7) ●
New Zealand		6 (0.7)	2 (0.9) ●	21 (2.2)	4 (3.1) ●	73 (2.4)	-5 (3.5) ●
Romania	r	1 (0.3)	-12 (0.9) ▼	5 (0.4)	-3 (0.8) ▼	93 (0.5)	15 (1.3) ▲
Russian Federation	r	1 (0.2)	-1 (0.4) ▼	3 (0.4)	-2 (0.7) ●	97 (0.4)	3 (0.9) ▲
Singapore		11 (0.8)	9 (1.0) ▲	43 (2.5)	35 (2.8) ▲	46 (2.7)	-44 (3.1) ▼
Slovak Republic	r	1 (0.2)	0 (0.3) ●	4 (0.9)	-1 (1.3) ●	95 (1.0)	1 (1.4) ●
Slovenia		5 (0.6)	1 (0.7) ●	15 (1.2)	7 (1.3) ▲	81 (1.4)	-9 (1.6) ▼
Thailand †		5 (0.6)	2 (0.8) ●	10 (0.6)	5 (0.9) ▲	85 (1.0)	-6 (1.4) ▼
United States		12 (1.1)	1 (1.8) ●	27 (2.0)	6 (2.7) ●	61 (2.7)	-8 (3.7) ●
International Avg. §		5 (0.2)	0 (0.2) ●	16 (0.4)	4 (0.5) ▲	79 (0.4)	-4 (0.6) ▼

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

Background data provided by students.

† Countries with unapproved sampling procedures at the classroom level in 1995.

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian-Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

Background data for Bulgaria and South Africa are unavailable for 1995.

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

A dash (–) indicates data are not available.

An “r” indicates a 70-84% student response rate, based on the lower response rate in either 1995 or 1999. An “s” indicates a 50-69% student response rate, based on the lower response rate in either 1995 or 1999.

Exhibit 6.20 Access to the Internet and Use of the Internet for Mathematics Projects

TIMSS 1999 8th grade Mathematics

	Percentage of Students				
	Have Access to the Internet			Use the Internet for Mathematics Projects at Least Once a Month	
	At Home	At School	Elsewhere	Use E-mail to Work with Students in Other Schools	Use the World Wide Web to Access Information
Australia	38 (1.4)	80 (2.3)	69 (0.9)	6 (0.5)	11 (0.8)
Belgium (Flemish)	27 (0.9)	44 (2.7)	64 (1.1)	5 (0.5)	9 (0.9)
Bulgaria	8 (1.1)	7 (1.5)	43 (1.8)	8 (0.6)	9 (0.6)
Canada	57 (1.3)	87 (1.5)	84 (0.8)	8 (0.4)	12 (0.5)
Chile	7 (0.8)	12 (1.8)	40 (1.2)	8 (0.5)	9 (0.5)
Chinese Taipei	32 (1.1)	61 (3.2)	41 (0.8)	10 (0.4)	12 (0.5)
Cyprus	27 (0.8)	3 (0.4)	50 (1.0)	13 (0.7)	17 (0.7)
Czech Republic	7 (0.7)	16 (2.6)	39 (1.6)	3 (0.4)	5 (0.4)
England	36 (1.1)	65 (3.1)	53 (1.3)	8 (0.7)	18 (0.9)
Finland	43 (1.6)	75 (2.3)	87 (0.8)	5 (0.5)	4 (0.5)
Hong Kong, SAR	34 (1.1)	26 (2.2)	34 (0.8)	10 (0.6)	11 (0.6)
Hungary	7 (0.6)	35 (3.2)	36 (1.2)	4 (0.4)	5 (0.5)
Indonesia	2 (0.3)	0 (0.3)	12 (0.9)	5 (0.6)	4 (0.5)
Iran, Islamic Rep.	– –	– –	– –	– –	– –
Israel	42 (1.6)	47 (2.8)	54 (1.2)	12 (0.7)	13 (0.7)
Italy	13 (0.7)	20 (2.2)	27 (1.1)	7 (0.6)	8 (0.7)
Japan	r 13 (0.9)	6 (1.6)	s 2 (0.3)	8 (0.8)	7 (0.8)
Jordan	7 (0.5)	1 (0.5)	30 (1.2)	17 (1.0)	15 (0.8)
Korea, Rep. of	23 (0.7)	6 (1.2)	36 (1.0)	4 (0.3)	6 (0.3)
Latvia (LSS)	3 (0.4)	35 (3.4)	51 (1.4)	6 (0.6)	6 (0.6)
Lithuania ‡	7 (0.8)	13 (1.6)	46 (1.5)	x x	x x
Macedonia, Rep. of	7 (0.5)	1 (0.4)	34 (1.4)	12 (0.7)	12 (0.7)
Malaysia	14 (0.9)	5 (1.3)	r 40 (1.5)	15 (0.9)	16 (0.8)
Moldova	3 (0.5)	2 (0.7)	22 (1.4)	7 (0.6)	6 (0.6)
Morocco	6 (0.4)	0 (0.2)	r 38 (0.9)	15 (0.7)	18 (0.7)
Netherlands	41 (1.8)	53 (5.4)	74 (1.8)	6 (0.7)	6 (0.9)
New Zealand	34 (1.1)	62 (2.7)	64 (1.1)	8 (0.8)	10 (0.6)
Philippines	– –	– –	– –	– –	– –
Romania	3 (0.3)	1 (0.7)	21 (1.2)	5 (0.5)	5 (0.4)
Russian Federation	3 (0.3)	1 (0.4)	17 (0.9)	3 (0.3)	4 (0.4)
Singapore	47 (1.9)	48 (3.2)	39 (0.9)	9 (0.7)	15 (0.8)
Slovak Republic	5 (0.5)	5 (1.2)	36 (1.6)	2 (0.3)	3 (0.4)
Slovenia	23 (0.9)	49 (2.9)	61 (1.0)	9 (0.7)	10 (0.7)
South Africa	5 (0.5)	4 (1.1)	23 (1.5)	12 (0.9)	10 (0.7)
Thailand	3 (0.5)	8 (1.5)	22 (0.9)	8 (0.5)	8 (0.5)
Tunisia	8 (0.7)	1 (0.6)	46 (1.2)	14 (0.7)	15 (0.7)
Turkey	3 (0.3)	1 (0.6)	r 16 (1.0)	5 (0.4)	4 (0.4)
United States	59 (1.7)	76 (3.2)	81 (0.9)	13 (0.5)	17 (0.8)
International Avg.	19 (0.2)	27 (0.4)	43 (0.2)	8 (0.1)	10 (0.1)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

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 6.21 presents the index of teachers' emphasis on mathematics homework (EMH). Students in the high category had teachers who reported giving relatively long homework assignments (more than 30 minutes) on a relatively frequent basis (at least once or twice a week). Those in the low category had teachers who gave short assignments (less than 30 minutes) relatively infrequently (less than once a week or never). The medium level includes all other possible combinations of responses. The detailed results from teachers' reports about the length and frequency of their homework assignments are found in the reference section in Exhibit R3.15.

6.21
R3.15

The results show substantial variation across countries in the emphasis placed on homework. More than 70 percent of the students in Iran, Italy, Romania, Thailand, and Malaysia were in the high category. For the majority of countries, most students were in the medium category. Very few students were in the low category. One notable exception is Japan (34 percent in the low category), where students were more likely to spend extra time in tutoring and special schools than doing homework.[3] There was little relationship between amount of homework assigned and students' performance. Again, lower-performing students may need more homework assignments for remedial reasons. The comparison between 1995 and 1999 data in Exhibit 6.22 shows little change in teachers' reports on the emphasis given to mathematics homework.

6.22

Since problem-solving activities will potentially be more beneficial if they can be extended to out-of-class-situations and stretched over a longer time, TIMSS asked teachers how often they assigned homework based on projects and investigations. The data in Exhibit R3.16 in the reference section show that most students (82 percent on average internationally) had teachers that never or rarely give such homework.

R3.16

One theme in recommendations for educational reform is to make assessment a continuous process that relies on a variety of sources of data and methods, rather than a few high-stakes tests. Exhibit 6.23 shows teachers' reports about the weight given to various types of assessment, which varied greatly from country to country. Internationally, the least weight reportedly was given to external standardized tests, teacher-made objective tests, and projects or practical exercises. On average across countries, about two-fifths of the students (from 37 to 42 percent) had mathematics teachers who reported giving quite a lot or a great deal of weight to such

6.23

3 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.

assessments. The most heavily weighted assessment was students' responses in class. On average internationally, this was given quite a lot or a great deal of weight for 77 percent of the students. Teachers reported that the next heaviest weight was given to teacher-made tests requiring explanations (67 percent of students on average internationally) and to observations of students (64 percent).

As shown in Exhibit R3.17 in the reference section, eighth-grade students reported substantial variation in the frequency of testing in mathematics class. On average internationally, students were split about in half, with 57 percent reporting having a quiz or test in class almost always or pretty often and 43 percent reporting such testing only once in a while or never. At least three-fourths of the students reported frequent testing in Belgium (Flemish), Canada, Chile, Cyprus, the Russian Federation, Tunisia, and the United States. In contrast, at least three-fourths of the students reported infrequent testing in Hungary, Korea, Latvia (LSS), and Turkey. There was a tendency for the most frequent testing to be associated with lower-achieving students. One could argue that these students can least afford time diverted from their instructional program. However, teachers may provide shorter lessons and follow-up quizzes for lower-achieving students to monitor their grasp of the subject matter more closely. R3.17

Exhibit 6.21 Index of Teachers' Emphasis on Mathematics Homework (EMH)

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 students (see reference exhibit R3.15). High level indicates the assignment of more than 30 minutes of homework at least once or twice a week. Low level indicates the assignment of less than 30 minutes of homework less than once a week or never assigning homework. Medium level includes all other possible combinations of responses.

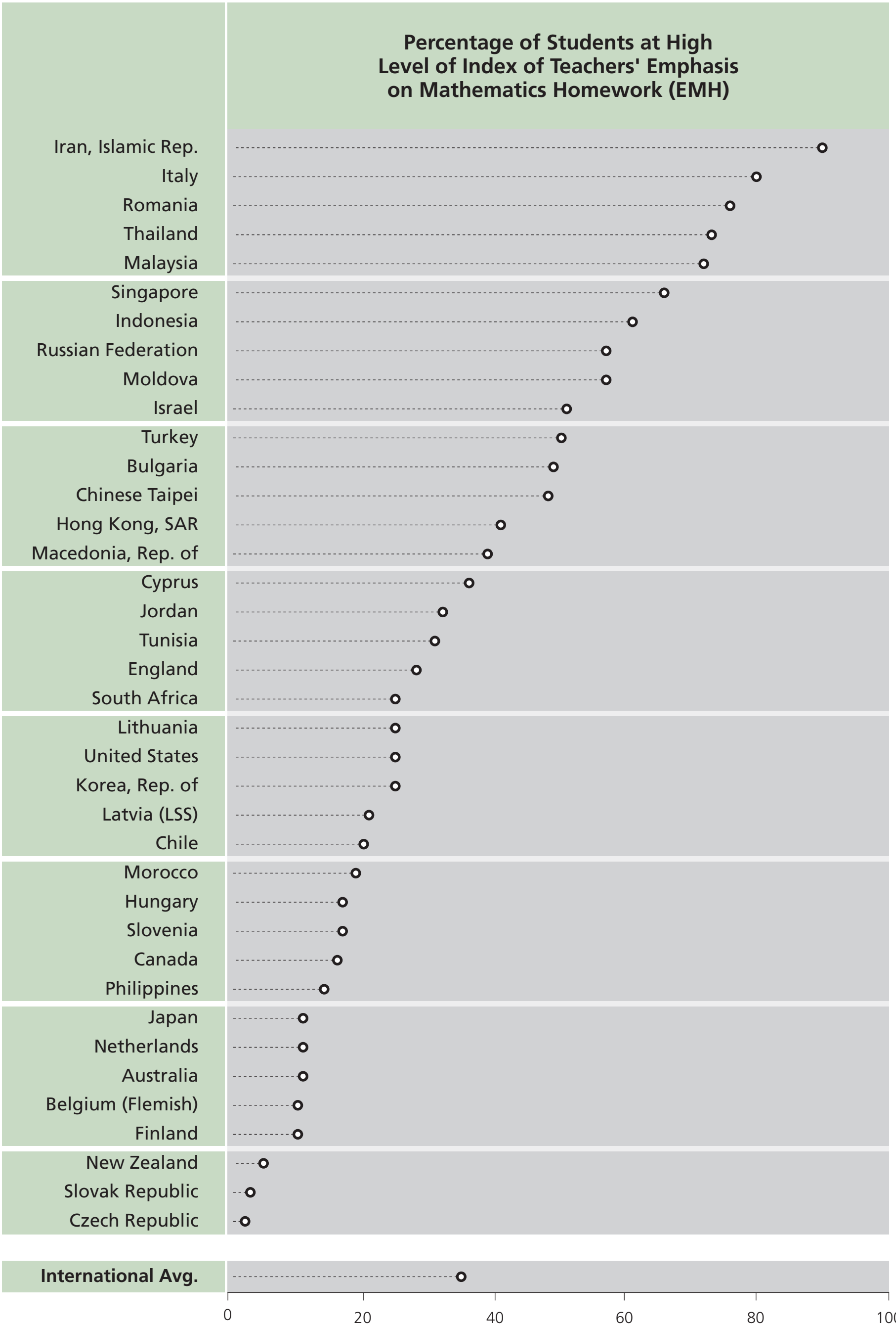
	High EMH		**Medium** EMH		**Low** EMH	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Iran, Islamic Rep.	90 (2.7)	421 (3.5)	10 (2.6)	435 (14.9)	1 (0.0)	~ ~
Italy	80 (3.0)	479 (4.9)	20 (2.9)	479 (7.9)	0 (0.0)	~ ~
Romania	76 (3.9)	471 (6.7)	24 (3.9)	477 (9.9)	0 (0.0)	~ ~
Thailand	73 (3.7)	473 (6.8)	27 (3.7)	451 (6.9)	0 (0.0)	~ ~
Malaysia	72 (3.8)	518 (6.0)	27 (3.8)	518 (9.6)	1 (0.0)	~ ~
Singapore	66 (4.6)	613 (6.9)	34 (4.6)	587 (10.6)	0 (0.0)	~ ~
Indonesia	61 (4.6)	413 (7.3)	39 (4.6)	394 (9.6)	0 (0.0)	~ ~
Russian Federation	57 (4.6)	527 (6.7)	43 (4.6)	525 (7.8)	0 (0.0)	~ ~
Moldova	57 (4.4)	469 (6.1)	43 (4.4)	469 (6.8)	0 (0.0)	~ ~
Israel	51 (3.4)	474 (5.4)	49 (3.3)	459 (5.7)	1 (0.4)	~ ~
Turkey	50 (4.0)	437 (5.5)	46 (3.8)	421 (5.4)	4 (1.4)	401 (10.2)
Bulgaria	49 (5.4)	524 (9.9)	51 (5.4)	496 (7.4)	1 (0.5)	~ ~
Chinese Taipei	48 (3.6)	593 (6.4)	50 (3.7)	580 (5.5)	2 (1.1)	~ ~
Hong Kong, SAR	41 (4.3)	580 (5.9)	57 (4.4)	585 (5.8)	2 (1.2)	~ ~
Macedonia, Rep. of	39 (4.3)	430 (6.8)	60 (4.3)	456 (5.9)	1 (0.6)	~ ~
Cyprus	36 (4.4)	477 (3.3)	64 (4.4)	476 (2.6)	0 (0.0)	~ ~
Jordan	32 (3.8)	423 (7.1)	68 (3.8)	428 (5.2)	0 (0.0)	~ ~
Tunisia	31 (3.9)	458 (4.6)	66 (4.0)	445 (2.9)	3 (1.5)	428 (14.5)
England	28 (2.9)	529 (8.2)	71 (3.0)	485 (4.7)	1 (0.5)	~ ~
South Africa	25 (3.1)	261 (9.9)	75 (3.1)	281 (7.8)	0 (0.0)	~ ~
Lithuania ‡	25 (3.7)	504 (9.4)	75 (3.7)	474 (4.9)	0 (0.0)	~ ~
United States	25 (2.1)	528 (9.6)	75 (2.0)	495 (3.8)	1 (0.6)	~ ~
Korea, Rep. of	25 (3.4)	587 (4.2)	62 (3.6)	586 (2.9)	14 (2.6)	593 (4.4)
Latvia (LSS)	21 (3.5)	514 (8.0)	78 (3.7)	504 (4.1)	2 (1.3)	~ ~
Chile	20 (3.4)	391 (9.4)	61 (3.8)	390 (5.1)	19 (2.9)	402 (10.8)
Morocco	19 (2.7)	339 (6.1)	72 (3.4)	337 (2.8)	10 (1.7)	335 (7.6)
Hungary	17 (3.1)	535 (9.5)	83 (3.1)	531 (4.1)	0 (0.0)	~ ~
Slovenia	17 (2.8)	529 (6.4)	83 (2.8)	530 (3.1)	0 (0.0)	~ ~
Canada	16 (2.3)	527 (6.2)	83 (2.4)	532 (2.8)	1 (0.6)	~ ~
Philippines	14 (3.0)	358 (15.6)	84 (3.0)	340 (6.8)	2 (1.1)	~ ~
Japan	11 (2.5)	578 (3.9)	55 (4.3)	580 (2.8)	34 (4.3)	574 (5.3)
Netherlands	11 (2.6)	555 (14.6)	88 (2.6)	538 (8.0)	1 (0.5)	~ ~
Australia	11 (2.7)	531 (13.5)	87 (2.8)	526 (5.4)	2 (1.0)	~ ~
Belgium (Flemish)	10 (2.0)	582 (8.6)	73 (3.6)	557 (5.5)	17 (3.2)	548 (15.0)
Finland	10 (2.3)	521 (10.8)	90 (2.3)	521 (2.8)	0 (0.0)	~ ~
New Zealand	5 (1.8)	475 (13.1)	92 (2.1)	495 (5.4)	2 (1.1)	~ ~
Slovak Republic	3 (1.7)	554 (28.7)	94 (2.5)	532 (3.9)	3 (1.8)	566 (14.6)
Czech Republic	2 (1.2)	~ ~	85 (3.8)	520 (4.8)	13 (3.6)	513 (9.9)
International Avg.	35 (0.6)	491 (1.8)	62 (0.6)	485 (1.0)	4 (0.2)	484 (4.0)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 tilde (~) indicates insufficient data to report achievement.



SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Exhibit 6.22 Trends in Index of Teachers' Emphasis on Mathematics Homework (EMH)

TIMSS 1999 8th grade Mathematics

	High EMH Percent of Students			Medium EMH Percent of Students			Low EMH Percent of Students		
	1995	1999	1995-1999 Difference	1995	1999	1995-1999 Difference	1995	1999	1995-1999 Difference
Australia	8 (1.9)	11 (2.7)	3 (3.3) ●	88 (2.5)	87 (2.8)	-1 (3.8) ●	5 (1.6)	2 (1.0)	-2 (1.9) ●
Belgium (Flemish)	14 (2.8)	10 (2.0)	-3 (3.4) ●	72 (4.1)	73 (3.6)	1 (5.4) ●	15 (3.4)	17 (3.2)	2 (4.6) ●
Canada	14 (3.2)	16 (2.3)	3 (4.0) ●	84 (3.3)	83 (2.4)	-1 (4.1) ●	3 (1.2)	1 (0.6)	-2 (1.4) ●
Cyprus	41 (5.8)	36 (4.4)	-5 (7.3) ●	59 (5.8)	64 (4.4)	5 (7.3) ●	0 (0.0)	0 (0.0)	– –
Czech Republic r	1 (0.6)	2 (1.2)	1 (1.4) ●	86 (4.1)	85 (3.8)	-1 (5.6) ●	13 (4.1)	13 (3.6)	0 (5.4) ●
England	47 (3.5)	28 (2.9)	-20 (4.5) ▼	50 (3.4)	71 (3.0)	21 (4.5) ▲	3 (1.0)	1 (0.5)	-2 (1.1) ●
Hong Kong, SAR	28 (4.8)	41 (4.3)	14 (6.5) ●	68 (5.3)	57 (4.4)	-10 (7.0) ●	5 (3.0)	2 (1.2)	-3 (3.2) ●
Hungary	13 (2.8)	17 (3.1)	4 (4.1) ●	86 (2.8)	83 (3.1)	-3 (4.2) ●	1 (0.1)	0 (0.0)	-1 (0.1) ▼
Iran, Islamic Rep.	81 (3.5)	90 (2.7)	8 (4.4) ●	18 (3.4)	10 (2.6)	-8 (4.3) ●	1 (0.6)	1 (0.0)	0 (0.6) ●
Israel †	45 (8.3)	52 (3.8)	6 (9.1) ●	53 (8.4)	47 (3.8)	-6 (9.2) ●	1 (0.3)	1 (0.5)	0 (0.6) ●
Italy	76 (3.6)	81 (3.5)	6 (5.0) ●	23 (3.6)	18 (3.4)	-5 (5.0) ●	1 (0.1)	0 (0.0)	0 (0.1) ▼
Japan	16 (3.4)	11 (2.5)	-5 (4.2) ●	57 (4.3)	55 (4.3)	-2 (6.1) ●	27 (3.7)	34 (4.3)	7 (5.7) ●
Korea, Rep. of	38 (4.7)	25 (3.4)	-14 (5.8) ●	57 (4.8)	62 (3.6)	5 (6.0) ●	5 (2.0)	14 (2.6)	9 (3.3) ●
Latvia (LSS)	8 (2.6)	21 (3.5)	12 (4.4) ●	92 (2.6)	78 (3.7)	-14 (4.5) ▼	0 (0.0)	2 (1.3)	2 (1.3) ●
Lithuania	19 (3.1)	25 (3.7)	6 (4.8) ●	81 (3.1)	75 (3.7)	-6 (4.8) ●	0 (0.0)	0 (0.0)	– –
Netherlands	5 (2.4)	11 (2.6)	6 (3.5) ●	93 (2.7)	88 (2.6)	-4 (3.8) ●	2 (1.4)	1 (0.5)	-1 (1.5) ●
New Zealand	6 (1.9)	5 (1.8)	0 (2.6) ●	89 (2.4)	92 (2.1)	3 (3.3) ●	5 (1.8)	2 (1.1)	-3 (2.1) ●
Romania	85 (2.9)	76 (3.9)	-9 (4.9) ●	15 (2.9)	24 (3.9)	9 (4.9) ●	0 (0.0)	0 (0.0)	– –
Russian Federation	54 (4.1)	57 (4.6)	3 (6.1) ●	46 (4.1)	43 (4.6)	-3 (6.1) ●	0 (0.0)	0 (0.0)	– –
Singapore	69 (4.6)	66 (4.6)	-3 (6.4) ●	30 (4.4)	34 (4.6)	4 (6.3) ●	1 (0.9)	0 (0.0)	-1 (0.9) ●
Slovak Republic	4 (1.7)	3 (1.7)	-1 (2.4) ●	95 (1.9)	94 (2.5)	-1 (3.1) ●	1 (0.0)	3 (1.8)	2 (1.8) ●
Slovenia	22 (3.9)	17 (2.8)	-5 (4.8) ●	78 (3.9)	83 (2.8)	5 (4.8) ●	0 (0.0)	0 (0.0)	– – ●
Thailand †	55 (4.9)	73 (3.7)	18 (6.1) ●	45 (4.9)	27 (3.7)	-18 (6.1) ●	0 (0.0)	0 (0.0)	– – ●
United States	18 (2.4)	25 (2.1)	6 (3.1) ●	79 (2.4)	75 (2.0)	-5 (3.2) ●	3 (0.9)	1 (0.6)	-2 (1.1) ●
International Avg. §	30 (0.7)	31 (0.7)	0 (1.0) ●	66 (0.8)	65 (0.7)	-1 (1.1) ●	4 (0.4)	4 (0.3)	0 (0.5) ●

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

Background data provided by teachers.

† Countries with unapproved sampling procedures at the classroom level in 1995.

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian-Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

Background data for Bulgaria and South Africa are unavailable for 1995.

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

A dash (–) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students, based on the lower response rate in either 1995 or 1999.

Exhibit 6.23 Types of Assessment Teachers Give Quite A Lot or A Great Deal of Weight

TIMSS 1999 8th grade Mathematics

	Percentage of Students by Type of Assessment						
	External Standardized Tests	Teacher-Made Tests Requiring Explanations	Teacher-Made Objective Tests	Homework Assignments	Projects or Practical Exercises	Observations of Students	Students' Responses in Class
Australia	14 (3.0)	37 (4.5)	32 (4.0)	38 (3.7)	32 (3.3)	38 (3.8)	40 (3.5)
Belgium (Flemish)	12 (3.0)	94 (1.4)	11 (2.4)	23 (3.0)	12 (2.1)	17 (3.4)	52 (4.4)
Bulgaria	34 (4.7)	83 (2.8)	31 (5.6)	81 (3.3)	30 (4.0)	71 (4.1)	99 (0.8)
Canada	21 (3.1)	61 (3.0)	r 26 (2.8)	r 51 (3.8)	r 38 (2.7)	r 34 (3.2)	42 (3.4)
Chile	29 (3.5)	79 (3.3)	62 (3.6)	55 (4.0)	45 (3.9)	71 (3.2)	87 (2.2)
Chinese Taipei	36 (4.0)	43 (4.0)	76 (3.4)	81 (3.2)	17 (3.4)	68 (3.1)	72 (3.6)
Cyprus	r 48 (4.7)	r 59 (4.8)	r 37 (4.7)	r 92 (2.0)	r 66 (4.0)	r 99 (0.9)	r 99 (1.0)
Czech Republic	53 (5.4)	97 (1.8)	9 (2.6)	26 (5.0)	23 (5.2)	80 (4.2)	98 (1.5)
England	s 51 (4.1)	s 35 (3.6)	s 7 (1.4)	s 81 (2.2)	s 41 (3.4)	s 78 (2.9)	s 78 (2.7)
Finland	21 (3.8)	18 (3.5)	20 (3.3)	85 (3.1)	52 (4.1)	83 (3.6)	90 (2.9)
Hong Kong, SAR	17 (3.2)	52 (4.2)	47 (3.6)	44 (4.0)	10 (2.6)	38 (4.3)	44 (4.3)
Hungary	44 (4.1)	66 (4.1)	17 (3.1)	36 (3.9)	62 (3.8)	71 (3.7)	88 (2.9)
Indonesia	50 (4.8)	81 (3.2)	44 (4.8)	65 (4.3)	72 (4.3)	76 (4.1)	81 (3.7)
Iran, Islamic Rep.	76 (3.8)	79 (3.4)	46 (4.3)	78 (3.2)	20 (2.8)	38 (4.0)	86 (3.1)
Israel	10 (2.0)	78 (3.3)	28 (3.5)	53 (3.5)	40 (3.9)	44 (3.2)	59 (3.3)
Italy	22 (3.2)	92 (2.2)	63 (3.8)	67 (3.6)	75 (3.1)	96 (1.4)	99 (0.6)
Japan	15 (2.9)	55 (4.4)	25 (3.9)	47 (4.0)	41 (4.0)	67 (4.1)	65 (4.3)
Jordan	30 (4.0)	78 (3.8)	32 (4.2)	70 (3.7)	41 (4.3)	82 (3.1)	88 (2.6)
Korea, Rep. of	37 (3.8)	48 (3.7)	45 (3.7)	32 (3.6)	43 (3.3)	50 (4.1)	61 (4.1)
Latvia (LSS)	80 (3.8)	81 (4.1)	50 (4.6)	63 (4.6)	69 (4.3)	79 (3.7)	98 (1.2)
Lithuania ‡	35 (3.9)	57 (4.3)	14 (2.7)	25 (3.4)	18 (3.5)	27 (3.7)	75 (3.7)
Macedonia, Rep. of	69 (4.3)	63 (4.1)	65 (4.2)	85 (3.1)	47 (4.2)	98 (1.5)	100 (0.0)
Malaysia	18 (3.2)	38 (4.1)	66 (4.2)	84 (3.2)	32 (4.2)	76 (3.7)	86 (2.8)
Moldova	60 (4.6)	95 (2.0)	55 (4.3)	84 (3.5)	48 (4.5)	85 (3.0)	88 (2.6)
Morocco	30 (2.9)	74 (3.1)	42 (3.0)	80 (2.7)	78 (2.2)	78 (2.5)	87 (1.8)
Netherlands	29 (5.5)	96 (1.8)	20 (5.8)	18 (4.7)	8 (2.6)	28 (4.7)	27 (5.4)
New Zealand	16 (3.0)	59 (4.2)	23 (3.5)	39 (4.0)	29 (3.6)	55 (4.5)	55 (4.6)
Philippines	38 (4.1)	74 (4.0)	73 (4.0)	79 (3.4)	72 (4.4)	77 (3.4)	95 (1.9)
Romania	66 (4.0)	80 (3.4)	55 (4.2)	79 (3.2)	35 (4.3)	86 (2.6)	98 (1.2)
Russian Federation	– –	98 (1.0)	54 (4.4)	68 (3.7)	59 (3.8)	91 (2.2)	86 (2.5)
Singapore	36 (4.2)	22 (3.9)	5 (2.0)	61 (4.5)	37 (4.2)	46 (4.6)	52 (4.2)
Slovak Republic	79 (4.2)	89 (3.1)	56 (5.5)	29 (4.3)	69 (4.9)	83 (3.1)	98 (1.1)
Slovenia	41 (4.8)	61 (3.9)	14 (2.7)	51 (4.3)	32 (3.8)	46 (4.2)	82 (3.4)
South Africa	39 (4.3)	55 (4.1)	49 (4.7)	74 (4.4)	35 (4.1)	58 (3.4)	76 (3.4)
Thailand	28 (4.0)	70 (3.6)	72 (3.7)	80 (3.5)	43 (4.0)	60 (3.9)	71 (3.7)
Tunisia	24 (3.7)	78 (3.6)	64 (4.1)	76 (3.8)	62 (4.1)	74 (4.0)	89 (2.8)
Turkey	24 (3.1)	50 (4.3)	35 (4.4)	58 (3.4)	31 (3.7)	51 (4.3)	96 (1.5)
United States	28 (3.0)	55 (3.3)	28 (3.5)	56 (4.3)	33 (3.5)	40 (3.2)	41 (3.6)
International Avg.	37 (0.6)	67 (0.6)	39 (0.6)	60 (0.6)	42 (0.6)	64 (0.6)	77 (0.5)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

CHAPTER 7

7

School Contexts for Learning and Instruction

Chapter 7 presents findings about the school contexts for learning and instruction in mathematics, including school characteristics, policies, and practices. Information is presented about the extent of school resources in each country, including computers and Internet access. Data also are provided about the role of the school principal and issues related to school climate and environment, including attendance problems and school safety.

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 (ASRMI). As described in Exhibit 7.1, 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. 7.1

Students in schools that reported being well resourced generally had higher average mathematics achievement than those in schools where across-the-board shortages affect instructional capacity some or a lot. For example, in Australia, 33 percent of the students were in the high category with average mathematics achievement of 538, compared with eight percent in the low category with an average of 509. In very few countries – Belgium (Flemish), Singapore, and the Czech Republic –were the majority of students in the high category. On average internationally, only 19 percent of the students were at the high level, and 63 percent at the medium level. It is interesting to note that in high-performing Hong Kong, Chinese Taipei, and Korea, fewer than one-fourth of the students were in schools with a high level of resources.

Exhibit R4.1 in the reference section shows the results for each of the types of facilities and materials summarized in the general capacity part of the index. There was substantial variation across countries, but internationally on average, nearly half the students were in schools where instruction was negatively affected by shortages or inadequacies in instructional materials, budget for supplies, school buildings, and instructional space. R4.1 R

Exhibit R4.2, also in the reference section, shows the results for each of the types of equipment and materials summarized in the mathematics instructional capacity part of the index. More than half of the students, on average internationally, were in schools where shortages or inadequa- R4.2 R cies in computers and computer software affected the capacity to provide mathematics instruction. Half the students were in schools where the lack of audio-visual resources affected instruction, and 46 percent were in schools needing more library materials relevant to mathematics instruction. Only about one-third of the students, however, were in schools needing more calculators.

R4.3–R4.4

Exhibits R4.3 and R4.4 in the reference section present more data on access to computers and the Internet for instructional purposes. Countries seem to have computers either in nearly all of their schools or in only a fraction of them. Internationally on average, 60 percent of the students were in schools with a student to computer ratio of less than 15 to one, and 25 percent were in schools having no computers. Forty-one percent of the students, on average across countries, attended schools with access to the World Wide Web, and another 29 percent were in schools planning to have access to the Internet by 2001.

7.2

Exhibit 7.2 presents trends in the index of availability of school resources for mathematics instruction. There was little or no change between 1995 and 1999 in the percentages of students in schools with low and medium levels of resources. There was a small but significant increase, internationally on average, in the percentage of students in the high category. The Czech Republic, Hungary, Italy, New Zealand, and the United States had increased percentages of students at the high level of the index.

Exhibits 7.1 and 7.2 Overleaf

Exhibit 7.1 Index of Availability of School Resources for Mathematics Instruction (ASRMI)

Index of Availability of School Resources for Mathematics Instruction

Index based on schools' average response to five questions about shortages that affect general capacity to provide instruction (instructional materials; budget for supplies; school buildings and grounds; heating/cooling and lighting systems; instructional space), and the average response to five questions about shortages that affect mathematics instruction (computers; computer software; calculators; library materials; audio-visual resources) (see reference exhibits R4.1–R4.2). High level indicates that both shortages, on average, affect instructional capacity none or a little. Medium level indicates that one shortage affects instructional capacity none or a little and the other shortage affects instructional capacity some or a lot. Low level indicates that both shortages affect instructional capacity some or a lot.

	High ASRMI		Medium ASRMI		Low ASRMI	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Belgium (Flemish)	54 (4.6)	556 (7.1)	46 (4.6)	558 (10.1)	0 (0.0)	~ ~
Singapore	50 (4.0)	603 (8.4)	46 (4.1)	608 (8.8)	4 (1.4)	589 (16.2)
Czech Republic	50 (3.6)	525 (6.7)	49 (3.9)	516 (5.8)	2 (1.5)	~ ~
Netherlands r	40 (6.2)	539 (10.5)	60 (6.2)	552 (10.5)	0 (0.0)	~ ~
United States r	37 (3.8)	516 (6.9)	59 (3.6)	493 (5.2)	4 (1.5)	480 (14.2)
Japan	36 (4.3)	582 (3.9)	61 (4.2)	578 (2.6)	3 (1.5)	562 (5.5)
Hungary	35 (4.0)	520 (6.6)	59 (4.1)	537 (5.5)	6 (2.2)	524 (19.2)
New Zealand	34 (4.3)	510 (8.5)	62 (4.3)	478 (6.7)	4 (1.7)	518 (24.9)
Australia	33 (4.1)	538 (8.0)	60 (4.1)	519 (7.5)	8 (1.9)	509 (20.3)
Israel	32 (4.1)	480 (5.6)	62 (4.3)	461 (6.6)	6 (2.0)	412 (17.7)
Canada	31 (2.5)	547 (4.9)	64 (2.7)	523 (3.1)	5 (1.1)	528 (12.8)
Finland	30 (4.2)	525 (5.0)	63 (4.1)	520 (3.3)	6 (2.5)	508 (5.2)
Italy	28 (3.4)	484 (8.4)	66 (4.0)	478 (4.6)	6 (2.0)	473 (8.6)
England r	26 (4.2)	535 (10.1)	72 (4.4)	486 (5.4)	2 (1.5)	~ ~
Indonesia	23 (3.9)	421 (12.8)	66 (4.8)	397 (6.2)	11 (3.0)	387 (18.3)
Chile	22 (3.1)	435 (11.2)	68 (3.3)	383 (4.4)	10 (2.2)	365 (8.2)
Hong Kong, SAR	22 (4.1)	585 (12.8)	67 (4.4)	586 (5.8)	10 (2.7)	567 (11.1)
Malaysia	20 (3.6)	541 (11.2)	73 (3.8)	511 (5.4)	7 (1.9)	538 (13.6)
Slovenia	15 (2.8)	519 (6.9)	72 (3.7)	533 (3.4)	13 (2.4)	525 (7.0)
Cyprus	15 (0.2)	465 (3.8)	85 (0.2)	481 (2.2)	0 (0.0)	~ ~
Philippines	12 (2.7)	389 (22.8)	59 (4.1)	342 (7.3)	29 (3.6)	331 (11.6)
Morocco	9 (2.2)	331 (8.7)	64 (4.2)	339 (2.9)	27 (4.1)	334 (5.0)
Lithuania ‡	8 (2.2)	459 (17.1)	67 (3.6)	488 (5.0)	25 (3.5)	469 (9.8)
Slovak Republic	8 (2.4)	566 (11.3)	85 (2.9)	529 (4.4)	7 (2.4)	540 (9.8)
South Africa	8 (2.0)	302 (31.0)	46 (4.2)	282 (8.6)	46 (4.4)	265 (10.4)
Romania	6 (2.4)	498 (27.0)	67 (3.7)	467 (7.4)	26 (3.5)	480 (10.4)
Iran, Islamic Rep.	6 (1.8)	430 (12.5)	71 (4.1)	427 (4.4)	23 (3.7)	405 (6.4)
Chinese Taipei	6 (1.9)	580 (14.2)	78 (3.2)	587 (4.8)	16 (2.7)	577 (10.7)
Jordan	5 (1.9)	394 (11.7)	64 (4.4)	426 (4.9)	31 (4.2)	435 (9.0)
Tunisia	4 (1.8)	469 (15.8)	78 (3.9)	450 (2.9)	17 (3.5)	437 (4.9)
Turkey	4 (1.9)	475 (21.4)	64 (4.0)	428 (6.3)	32 (4.0)	423 (5.7)
Korea, Rep. of	4 (1.6)	594 (12.1)	81 (3.5)	588 (2.1)	16 (3.1)	583 (4.1)
Latvia (LSS)	2 (1.4)	~ ~	58 (4.2)	503 (4.9)	40 (4.0)	507 (5.6)
Macedonia, Rep. of	2 (1.2)	~ ~	59 (3.7)	445 (5.7)	39 (3.8)	446 (8.0)
Russian Federation	1 (0.9)	~ ~	47 (4.0)	536 (8.4)	52 (3.9)	518 (6.6)
Bulgaria	1 (1.0)	~ ~	62 (4.7)	502 (6.2)	36 (4.6)	529 (11.4)
Thailand	1 (0.8)	~ ~	49 (4.0)	465 (5.7)	50 (4.0)	470 (8.0)
Moldova	0 (0.4)	~ ~	33 (4.3)	462 (8.1)	67 (4.4)	473 (5.0)
International Avg.	19 (0.5)	497 (2.5)	63 (0.7)	486 (1.0)	18 (0.5)	476 (2.0)

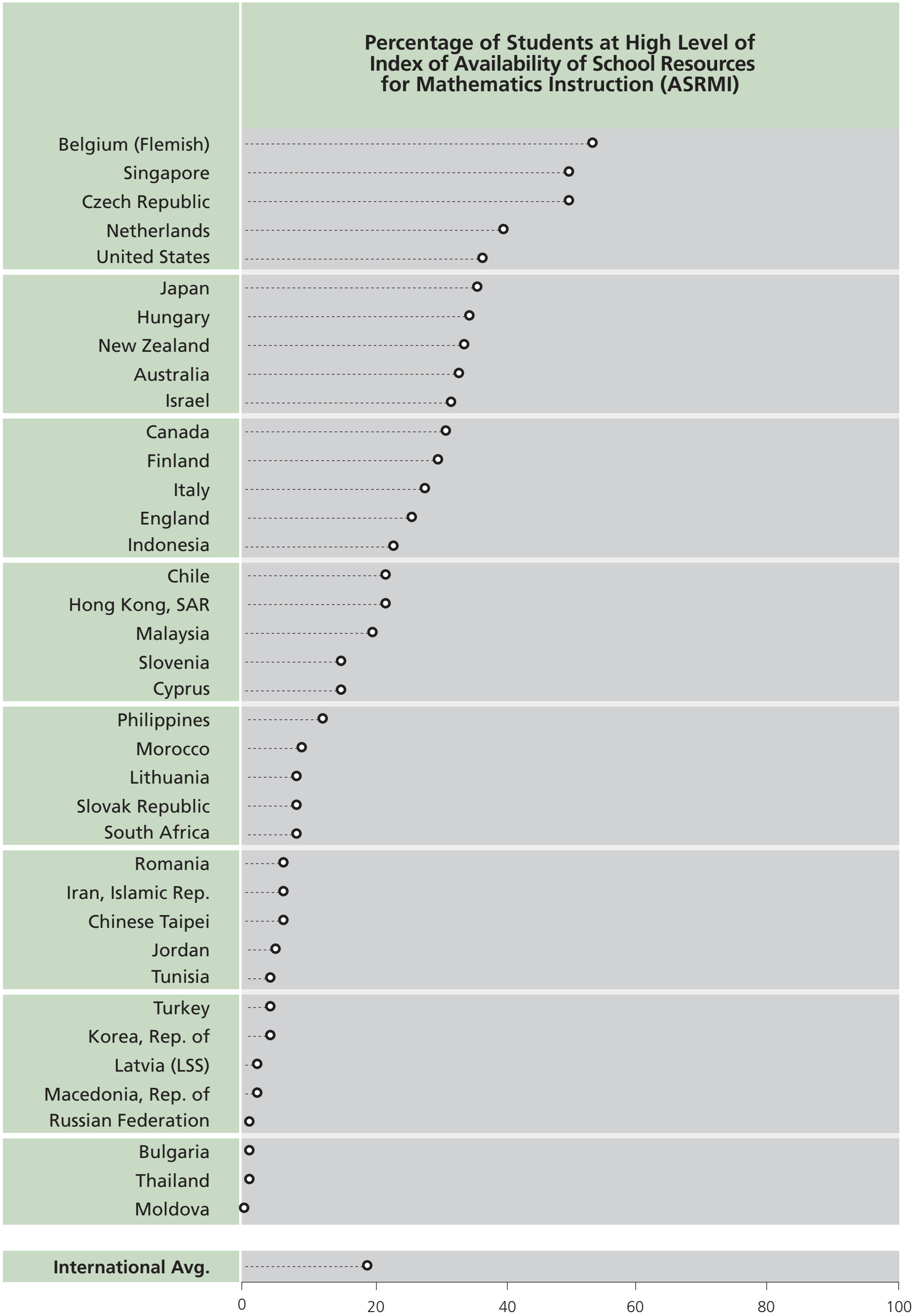
SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 tilde (~) indicates insufficient data to report achievement.

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



SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Exhibit 7.2 Trends in Index of Availability of School Resources for Mathematics Instruction (ASRMI)

TIMSS 1999 8th grade Mathematics

Country		High ASRMI Percent of Students			Medium ASRMI Percent of Students			Low ASRMI Percent of Students		
		1995	1999	1995-1999 Difference	1995	1999	1995-1999 Difference	1995	1999	1995-1999 Difference
Australia	r	42 (5.0)	33 (4.1)	-9 (6.5) ●	52 (5.2)	60 (4.1)	8 (6.6) ●	6 (2.4)	8 (1.9)	1 (3.1) ●
Belgium (Flemish)		48 (5.3)	54 (4.6)	6 (7.1) ●	52 (5.3)	46 (4.6)	-6 (7.1) ●	0 (0.0)	0 (0.0)	– –
Canada		25 (3.2)	31 (2.5)	6 (4.0) ●	73 (3.1)	64 (2.7)	-9 (4.1) ●	2 (0.8)	5 (1.1)	3 (1.4) ●
Cyprus	r	31 (0.5)	15 (0.2)	-16 (0.5) ▼	63 (0.5)	85 (0.2)	22 (0.6) ▲	6 (0.4)	0 (0.0)	-6 (0.4) ▼
Czech Republic		30 (5.0)	50 (3.6)	20 (6.2) ▲	70 (4.9)	49 (3.9)	-21 (6.2) ▼	0 (0.4)	2 (1.5)	1 (1.5) ●
England	r	25 (4.7)	26 (4.2)	1 (6.3) ●	73 (4.9)	72 (4.4)	-2 (6.6) ●	2 (1.5)	2 (1.5)	0 (2.1) ●
Hong Kong, SAR		23 (5.4)	22 (4.1)	0 (6.8) ●	72 (5.6)	67 (4.4)	-5 (7.1) ●	5 (2.6)	10 (2.7)	5 (3.7) ●
Hungary		19 (3.2)	35 (4.0)	16 (5.1) ▲	79 (3.3)	59 (4.1)	-20 (5.2) ▼	2 (1.2)	6 (2.2)	4 (2.5) ●
Iran, Islamic Rep.		1 (0.9)	6 (1.8)	5 (2.0) ●	67 (4.7)	71 (4.1)	4 (6.2) ●	32 (4.7)	23 (3.7)	-9 (5.9) ●
Israel †	s	17 (6.1)	38 (5.0)	21 (7.9) ●	76 (7.2)	60 (5.0)	-17 (8.8) ●	7 (4.4)	2 (1.6)	-4 (4.7) ●
Italy		9 (2.4)	27 (4.0)	18 (4.7) ▲	73 (4.0)	67 (4.6)	-6 (6.1) ●	18 (3.3)	6 (2.3)	-12 (4.0) ●
Japan		28 (3.5)	36 (4.3)	9 (5.6) ●	68 (3.9)	61 (4.2)	-7 (5.7) ●	4 (1.9)	3 (1.5)	-2 (2.4) ●
Korea, Rep. of		4 (1.6)	4 (1.6)	0 (2.3) ●	82 (3.2)	81 (3.5)	-2 (4.7) ●	14 (2.9)	16 (3.1)	2 (4.2) ●
Latvia (LSS)	r	2 (0.9)	2 (1.4)	1 (1.6) ●	51 (4.3)	58 (4.2)	7 (6.0) ●	47 (4.4)	40 (4.0)	-7 (5.9) ●
Lithuania		2 (1.1)	8 (2.2)	6 (2.5) ●	79 (3.5)	67 (3.6)	-12 (5.0) ●	19 (3.3)	25 (3.5)	6 (4.8) ●
Netherlands	r	46 (7.1)	40 (6.2)	-6 (9.4) ●	53 (7.0)	60 (6.2)	7 (9.3) ●	1 (0.1)	0 (0.0)	-1 (0.1) ▼
New Zealand		15 (2.9)	34 (4.3)	19 (5.2) ▲	79 (3.6)	62 (4.3)	-17 (5.6) ▼	6 (2.1)	4 (1.7)	-2 (2.7) ●
Romania		4 (1.4)	6 (2.4)	2 (2.8) ●	73 (3.8)	67 (3.7)	-5 (5.3) ●	23 (3.7)	26 (3.5)	3 (5.1) ●
Russian Federation		1 (0.0)	1 (0.9)	1 (0.9) ●	46 (4.5)	47 (4.0)	0 (6.1) ●	53 (4.6)	52 (3.9)	-1 (6.0) ●
Singapore		55 (4.6)	50 (4.0)	-5 (6.1) ●	43 (4.4)	46 (4.1)	4 (6.0) ●	2 (1.2)	4 (1.4)	2 (1.8) ●
Slovak Republic		13 (2.7)	8 (2.4)	-5 (3.7) ●	84 (2.7)	85 (2.9)	1 (4.0) ●	3 (1.4)	7 (2.4)	4 (2.8) ●
Slovenia	r	12 (3.3)	15 (2.8)	4 (4.3) ●	80 (4.1)	72 (3.7)	-9 (5.5) ●	8 (2.9)	13 (2.4)	5 (3.7) ●
Thailand †		0 (0.0)	1 (0.8)	1 (0.8) ●	58 (5.2)	49 (4.0)	-9 (6.6) ●	41 (5.2)	50 (4.0)	8 (6.6) ●
United States	r	18 (3.2)	37 (3.8)	19 (5.0) ▲	75 (3.6)	59 (3.6)	-16 (5.1) ▼	6 (1.4)	4 (1.5)	-3 (2.1) ●
International Avg. §		21 (0.8)	25 (0.7)	4 (1.1) ▲	68 (0.9)	64 (0.9)	-4 (1.2) ●	12 (0.5)	12 (0.5)	0 (0.7) ●

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

Background data provided by schools.

† Countries with unapproved sampling procedures at the classroom level in 1995.

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian-Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

Background data for Bulgaria and South Africa are unavailable for 1995.

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

A dash (–) indicates data are not available.

An "r" indicates school response data available for 70-84% of students, based on the lower response rate in either 1995 or 1999. An "s" indicates school response data available for 50-69% of students, based on the lower response rate in either 1995 or 1999.

What Is the Role of the School Principal?

To better understand the roles and responsibilities of schools across countries, TIMSS asked school principals how much time per month they spend on various school-related activities. More specifically, they were asked how much time they spend on instructional leadership activities, including discussing educational objectives with teachers, initiating curriculum revisions and planning, training teachers, and engaging in professional development activities. They were asked how much time they spend per month talking with parents, counseling and disciplining students, and responding to requests from local, regional, or national education officials. They also responded to questions about how much time they spend carrying out administrative duties, including hiring teachers, representing the school in the community and at official meetings, and doing internal tasks (e.g., regulations, school budget, and timetable). Finally, they were asked how much time they spend teaching. The results presented in Exhibit 7.3 show that principals reported spending, internationally on average, 51 hours per month on administrative duties, 35 hours per month communicating with various constituents, 33 hours per month on instructional leadership activities, and 16 hours per month teaching.[1] 7.3

Countries where principals reported spending an average of at least 75 hours per month on administrative duties included Australia, Chinese Taipei, Hong Kong, and New Zealand. Principals reported spending at least 50 hours per month communicating with various groups in Australia, Canada, and the United States. Principals in 10 countries reported spending at least 40 hours per month on instructional leadership activities, and in eight countries they reported that teaching duties (including preparation) occupied at least 30 hours per month.

It is noteworthy that a number of countries, such as Australia, Canada, Chinese Taipei, Hong Kong, New Zealand, Singapore, Thailand, and the United States, have similar patterns in principals' use of time. For example, unlike in most European countries, principals in these countries spend relatively little time teaching, and most of it on administrative duties, communicating with constituents, and engaging in instructional leadership activities.

1 Activities reported by principals are not necessarily exclusive; principals may have reported engaging in more than one activity at the same time.

Exhibit 7.3 Time Principal Spends on Various School-Related Activities

TIMSS 1999 8th grade Mathematics

	Average Total Hours Per Month Spent on Activities[1]			
	Instructional Leadership Activities[2]	Communicating with Students, Parents, and Education Officials[3]	Administrative Duties[4]	Teaching (including preparation)
Australia	r 33 (1.9)	r 50 (2.7)	r 75 (3.2)	r 3 (0.7)
Belgium (Flemish)	29 (2.3)	27 (2.1)	56 (2.5)	0 (0.1)
Bulgaria	38 (2.5)	39 (1.9)	47 (2.3)	21 (1.0)
Canada	25 (1.1)	54 (1.4)	54 (2.1)	5 (0.9)
Chile	31 (1.4)	36 (1.5)	53 (3.0)	5 (0.6)
Chinese Taipei	24 (1.4)	34 (1.7)	86 (4.1)	4 (0.6)
Cyprus	r 18 (0.1)	r 46 (0.1)	33 (0.1)	r 18 (0.0)
Czech Republic	32 (1.9)	33 (1.8)	44 (2.4)	36 (1.8)
England	– –	– –	– –	– –
Finland	27 (1.5)	29 (1.2)	66 (2.7)	24 (1.6)
Hong Kong, SAR	r 43 (3.2)	r 29 (1.8)	r 75 (4.2)	r 3 (0.6)
Hungary	47 (2.1)	28 (1.2)	46 (2.1)	35 (1.6)
Indonesia	15 (1.8)	20 (1.6)	40 (2.9)	16 (1.8)
Iran, Islamic Rep.	28 (1.6)	42 (2.4)	35 (3.0)	4 (0.6)
Israel	43 (2.4)	38 (2.1)	43 (2.5)	24 (1.8)
Italy	36 (1.4)	44 (2.1)	45 (1.7)	– –
Japan	33 (2.0)	19 (1.3)	69 (3.6)	1 (0.8)
Jordan	31 (1.8)	43 (2.1)	27 (1.8)	9 (0.9)
Korea, Rep. of	30 (2.1)	22 (1.6)	46 (3.6)	3 (0.5)
Latvia (LSS)	r 33 (1.9)	r 26 (1.9)	r 58 (3.8)	r 41 (2.7)
Lithuania ‡	40 (1.7)	34 (1.4)	50 (2.4)	33 (1.4)
Macedonia, Rep. of	40 (2.2)	34 (1.7)	32 (1.9)	16 (1.9)
Malaysia	24 (1.5)	31 (1.7)	61 (3.1)	22 (2.1)
Moldova	r 45 (1.9)	r 32 (1.5)	r 55 (2.7)	r 41 (1.7)
Morocco	9 (0.8)	24 (1.7)	29 (4.9)	0 (0.0)
Netherlands	r 42 (4.0)	r 20 (2.0)	r 49 (5.6)	r 7 (1.7)
New Zealand	r 39 (2.0)	r 45 (1.9)	r 83 (3.6)	r 5 (0.8)
Philippines	30 (2.0)	31 (1.8)	42 (3.4)	10 (1.8)
Romania	31 (1.6)	32 (1.5)	40 (2.3)	45 (2.3)
Russian Federation	r 44 (1.9)	r 33 (1.7)	r 65 (3.1)	r 46 (2.1)
Singapore	45 (2.2)	46 (1.9)	56 (3.1)	3 (0.6)
Slovak Republic	36 (1.8)	31 (1.5)	34 (2.0)	32 (1.2)
Slovenia	43 (2.2)	29 (1.2)	41 (2.2)	11 (1.0)
South Africa	19 (1.2)	34 (2.3)	43 (3.4)	r 22 (2.6)
Thailand	37 (2.2)	32 (1.7)	68 (3.8)	6 (1.0)
Tunisia	28 (2.0)	47 (2.6)	55 (2.6)	– –
Turkey	25 (1.7)	43 (2.0)	46 (2.9)	17 (1.9)
United States	r 34 (1.9)	r 52 (2.4)	r 56 (3.2)	r 3 (0.6)
International Avg.	33 (0.3)	35 (0.3)	51 (0.5)	16 (0.2)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by schools.

1 Total hours reported for activities in each category averaged across students. Activites are not necessarily exclusive; principals may have reported engaging in more than one activity at the same time.

2 Includes discussing educational objectives with teachers; initiating curriculum revision and/or planning; training teachers; and professional development activities.

3 Includes talking with parents, counseling and disciplining of students and responding to requests from local, regional, or national education officials.

4 Includes hiring teachers; representing the school in the community; representing the school at official meetings; internal administrative tasks (e.g., regulations, school budget, timetable).

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

What Are the Schools' Expectations of Parents?

The schools' expectations for parental involvement are shown in Exhibit 7.4. Clearly schools expect help from parents. On average across countries, 85 percent of the students attended schools expecting parents to ensure that their children complete their homework, and 79 percent attended schools expecting parents to volunteer for school projects or field trips. About half the students were in schools expecting parents to help raise funds and to serve on committees. Only 28 percent were in schools expecting parents to help as aides in the classroom. 7.4

At the country level, in all countries with the exception of Japan, at least 60 percent of students were in schools where parents were expected to ensure that their children complete their homework. Twenty countries had at least 90 percent of their students in such schools, and in Canada and the United States almost all students (99 percent) were in such schools. The expectation that parents would serve as classroom aides was especially high in Iran, and low in Finland, Indonesia, Japan, and New Zealand. All Malaysian and Lithuanian students were in schools where parents were expected to volunteer for school projects or field trips. Raising funds was an expectation of parents for at least 75 percent of the students in Cyprus, Morocco, the Slovak Republic, South Africa, and Turkey. At least three-quarters of students were in schools where parents were expected to serve on committees in Australia, Iran, Latvia (LSS), Macedonia, Romania, South Africa, and Turkey.

Exhibit 7.4 Schools' Expectations for Parental Involvement

TIMSS 1999 8th grade Mathematics

	Percentage of Students Whose Schools Reported That They Expect Parents to Be Involved in the School-Related Activity				
	Be Sure Child Completes Homework	Serve as Teacher Aides in Classroom	Volunteer for School Projects, Programs, or Field Trips	Raise Funds for the School	Serve on Committees[1]
Australia	96 (1.7)	6 (1.9)	66 (4.5)	61 (5.4)	78 (3.9)
Belgium (Flemish)	94 (2.1)	19 (3.7)	39 (4.3)	9 (2.7)	10 (2.7)
Bulgaria	73 (5.6)	64 (5.1)	63 (5.5)	55 (5.2)	22 (3.5)
Canada	99 (0.6)	15 (1.7)	82 (2.2)	52 (3.4)	55 (2.7)
Chile	92 (2.1)	73 (3.3)	94 (1.9)	57 (3.6)	33 (3.1)
Chinese Taipei	97 (1.3)	58 (4.2)	90 (2.5)	41 (4.2)	56 (4.4)
Cyprus	78 (0.2)	15 (0.1)	44 (0.2)	87 (0.1)	18 (0.2)
Czech Republic	91 (3.1)	7 (2.7)	80 (3.8)	32 (4.7)	35 (4.9)
England	– –	– –	– –	– –	– –
Finland	94 (2.0)	4 (1.5)	72 (4.3)	23 (4.2)	57 (4.8)
Hong Kong, SAR	96 (1.8)	30 (4.2)	77 (3.8)	60 (4.6)	21 (3.7)
Hungary	96 (1.6)	35 (3.8)	95 (1.9)	12 (2.5)	35 (3.9)
Indonesia	97 (1.5)	4 (1.8)	70 (4.5)	59 (4.2)	28 (4.4)
Iran, Islamic Rep.	95 (2.1)	82 (3.7)	96 (2.0)	74 (3.7)	85 (2.7)
Israel	77 (4.0)	16 (3.0)	90 (2.4)	42 (4.6)	48 (4.8)
Italy	91 (2.3)	9 (2.2)	70 (3.4)	25 (3.1)	42 (3.7)
Japan	43 (4.4)	5 (2.0)	81 (2.8)	6 (2.0)	8 (2.2)
Jordan	78 (3.7)	23 (3.5)	77 (3.9)	29 (4.1)	17 (3.3)
Korea, Rep. of	64 (3.9)	33 (4.1)	71 (3.8)	31 (3.8)	44 (4.2)
Latvia (LSS)	69 (4.1)	65 (4.4)	95 (2.1)	45 (4.7)	75 (4.0)
Lithuania ‡	88 (2.6)	11 (2.6)	100 (0.0)	62 (3.9)	73 (3.8)
Macedonia, Rep. of	72 (3.6)	27 (4.1)	48 (4.1)	53 (3.9)	95 (2.0)
Malaysia	97 (1.4)	29 (4.0)	100 (0.0)	64 (4.3)	21 (3.2)
Moldova	66 (4.5)	46 (4.4)	66 (3.4)	55 (4.5)	62 (4.3)
Morocco	62 (3.2)	37 (3.9)	90 (2.2)	80 (2.9)	14 (2.6)
Netherlands	r 81 (5.6)	r 46 (6.2)	r 61 (6.2)	r 16 (5.2)	r 46 (6.5)
New Zealand	97 (1.6)	4 (1.6)	74 (3.7)	62 (4.2)	21 (3.5)
Philippines	86 (2.9)	30 (4.1)	89 (2.8)	65 (4.1)	37 (4.0)
Romania	90 (2.6)	8 (2.4)	86 (3.2)	73 (4.1)	79 (4.3)
Russian Federation	78 (3.1)	36 (3.3)	91 (1.7)	59 (2.8)	59 (4.1)
Singapore	95 (1.8)	6 (2.2)	44 (4.5)	51 (4.3)	41 (4.3)
Slovak Republic	84 (2.8)	42 (5.0)	90 (2.9)	81 (3.3)	65 (4.1)
Slovenia	98 (1.3)	16 (2.8)	94 (2.1)	35 (3.8)	42 (4.0)
South Africa	93 (1.8)	39 (4.4)	97 (1.2)	87 (2.4)	99 (0.8)
Thailand	92 (2.2)	40 (3.6)	76 (3.5)	69 (3.6)	48 (3.8)
Tunisia	73 (4.0)	15 (3.2)	71 (3.6)	55 (3.7)	21 (3.3)
Turkey	85 (2.8)	33 (3.9)	94 (2.3)	78 (3.2)	89 (2.4)
United States	r 99 (0.7)	r 15 (3.0)	r 94 (1.7)	r 55 (4.7)	r 68 (4.1)
International Avg.	85 (0.5)	28 (0.6)	79 (0.5)	51 (0.6)	47 (0.6)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by schools.

1 Serve on committees which select school personnel or review school finances.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

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 (SCA) 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 are presented in Exhibit 7.5. Sixty percent of students on average internationally were in the medium category, where principals had judged their schools to have a moderate attendance problem. Exactly one-fifth of the students were in schools at the high level of the index, and another 19 percent were in schools at the low index level. 7.5

The information used to compute this index appears in Exhibit 7.6, together with data showing the percentages of students in schools where the behaviors occur at least weekly. Student attendance problems were common and considered to be a serious problem in many countries, and were most acute in South Africa. For most countries, however, schools reported the frequency of the attendance problems to be greater than their seriousness. 7.6

Exhibit 7.5 Index of Good School and Class Attendance (SCA)

Index of Good School and Class Attendance

Index based on schools' responses to three questions about the seriousness of attendance problems in school: arriving late at school; absenteeism; skipping class (see exhibit 7.6). High level indicates that all three behaviors are reported to be not 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.

	High SCA		Medium SCA		Low SCA	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Belgium (Flemish)	52 (4.4)	579 (7.1)	45 (4.5)	536 (7.4)	3 (1.0)	535 (9.3)
Slovenia	39 (4.0)	531 (4.3)	58 (4.0)	533 (3.2)	4 (1.7)	474 (15.5)
Jordan	39 (4.2)	430 (6.2)	56 (4.5)	426 (5.9)	5 (1.9)	404 (8.0)
Iran, Islamic Rep.	37 (4.9)	422 (5.8)	61 (4.9)	423 (4.4)	2 (1.3)	~ ~
Czech Republic	36 (5.8)	526 (9.9)	56 (6.0)	516 (4.4)	8 (2.3)	539 (20.2)
Italy	33 (3.3)	497 (5.8)	58 (3.6)	481 (5.1)	9 (2.4)	424 (12.4)
Singapore	32 (4.1)	630 (11.9)	64 (4.0)	592 (7.0)	3 (1.6)	597 (19.3)
Korea, Rep. of	31 (3.7)	585 (3.7)	61 (4.0)	588 (2.4)	9 (2.4)	595 (5.4)
Macedonia, Rep. of	31 (4.2)	448 (9.3)	51 (4.5)	448 (7.7)	19 (3.2)	433 (14.2)
Slovak Republic	31 (4.3)	534 (6.8)	57 (4.5)	535 (4.7)	12 (3.3)	513 (11.4)
Netherlands r	30 (7.3)	524 (14.5)	46 (7.3)	555 (6.6)	24 (7.5)	519 (27.9)
Chinese Taipei	28 (3.7)	616 (7.6)	61 (3.6)	570 (4.0)	11 (2.7)	591 (10.1)
Turkey	26 (3.1)	450 (9.5)	62 (3.9)	422 (4.6)	12 (2.8)	418 (11.6)
Hong Kong, SAR	25 (3.9)	603 (7.4)	68 (4.3)	582 (6.8)	7 (2.5)	540 (13.3)
Bulgaria	23 (5.7)	510 (9.3)	61 (5.4)	516 (9.0)	17 (3.1)	495 (12.8)
Hungary	23 (3.6)	546 (9.7)	60 (4.2)	529 (5.0)	17 (3.1)	521 (10.8)
United States r	19 (3.0)	534 (11.5)	68 (3.4)	498 (5.2)	13 (2.5)	470 (9.3)
Cyprus r	19 (0.1)	482 (3.8)	54 (0.2)	476 (2.2)	27 (0.2)	476 (5.2)
Canada	18 (2.2)	530 (7.1)	73 (3.0)	530 (3.0)	9 (2.0)	535 (7.9)
Thailand	17 (3.3)	461 (10.9)	68 (4.3)	472 (6.6)	14 (3.3)	473 (19.9)
Australia	17 (3.5)	543 (8.2)	70 (4.0)	528 (6.0)	13 (3.3)	489 (14.8)
Chile	16 (3.1)	414 (11.9)	70 (3.8)	391 (5.4)	13 (2.7)	380 (6.9)
Finland	15 (2.9)	520 (7.8)	67 (4.4)	520 (3.6)	18 (3.8)	522 (5.0)
Tunisia	15 (3.1)	461 (5.7)	60 (3.8)	448 (3.4)	26 (3.6)	440 (3.5)
New Zealand	15 (2.9)	511 (14.9)	69 (3.7)	495 (6.0)	16 (2.5)	443 (10.8)
Romania	15 (3.2)	476 (13.2)	55 (4.2)	466 (7.7)	31 (4.1)	478 (10.5)
Lithuania ‡	12 (2.6)	481 (13.4)	56 (4.2)	491 (5.8)	32 (3.7)	468 (6.9)
Latvia (LSS) r	11 (2.6)	503 (11.6)	63 (4.6)	506 (5.1)	26 (4.3)	497 (6.5)
Russian Federation	10 (1.7)	535 (12.0)	70 (3.8)	532 (6.4)	20 (3.4)	500 (8.2)
Indonesia	10 (2.6)	396 (17.0)	57 (4.5)	408 (7.9)	33 (4.1)	389 (8.6)
Philippines	8 (2.4)	345 (16.6)	72 (3.9)	351 (8.2)	20 (3.4)	323 (9.6)
Japan	7 (2.4)	590 (12.2)	47 (4.1)	579 (2.6)	46 (3.9)	576 (2.4)
Israel r	7 (2.3)	458 (17.7)	57 (4.8)	478 (5.6)	36 (4.6)	449 (10.4)
Malaysia	6 (2.4)	503 (21.2)	69 (4.1)	527 (5.4)	25 (3.8)	500 (9.2)
Morocco	4 (1.4)	337 (11.4)	56 (4.3)	336 (3.7)	40 (4.4)	339 (4.0)
South Africa	3 (1.2)	386 (34.0)	44 (3.9)	295 (12.4)	53 (4.0)	251 (8.0)
Moldova	1 (1.0)	~ ~	63 (3.8)	469 (4.8)	35 (3.8)	463 (7.7)
England	– –	– –	– –	– –	– –	– –
International Avg.	20 (0.6)	497 (2.8)	60 (0.7)	488 (1.0)	19 (0.5)	474 (2.0)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

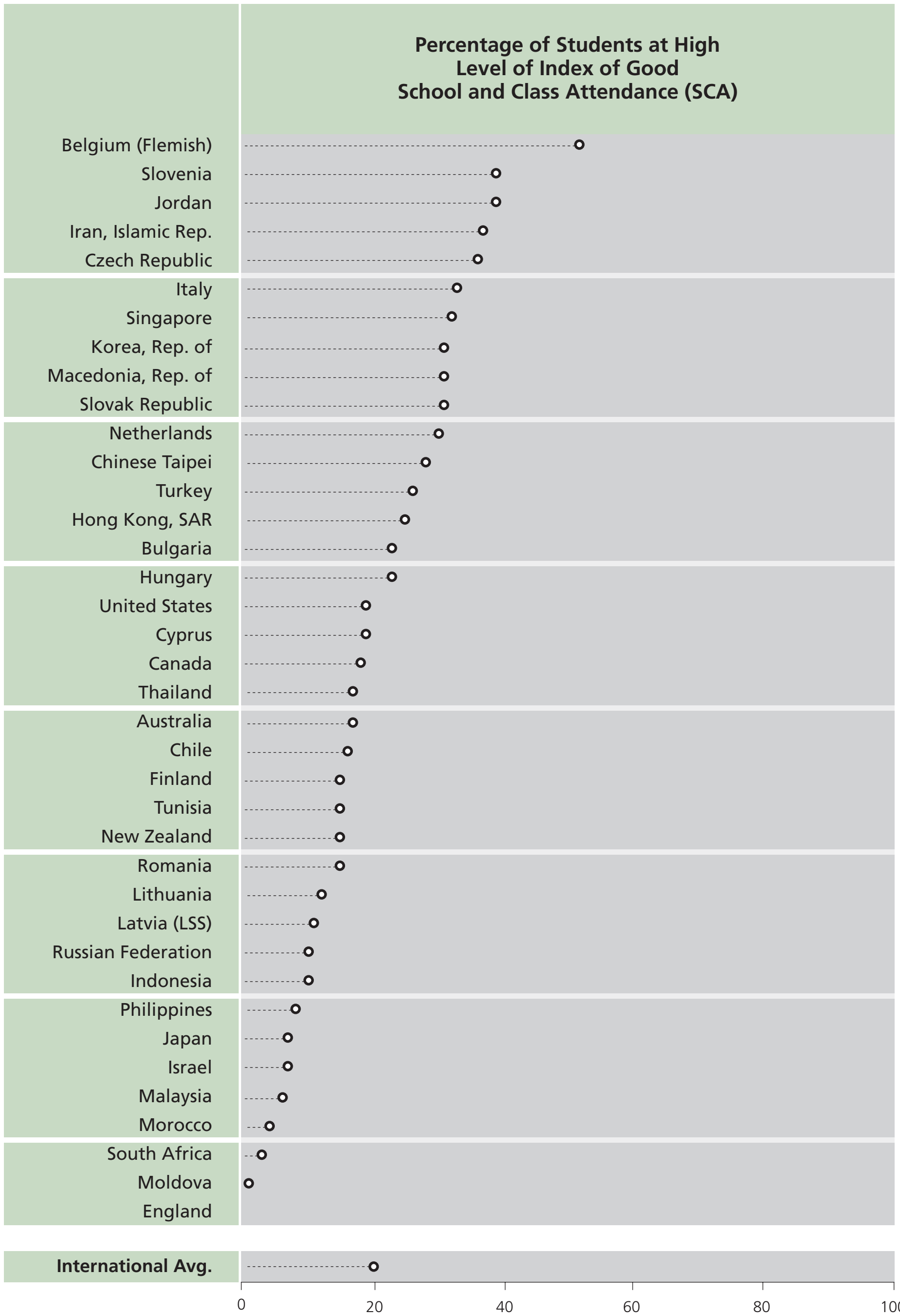
‡ Lithuania tested the same cohort of students as other countries, but later in 1999, at the beginning of the next school year.

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

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

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

Exhibit 7. 5: Index of Good School and Class Attendance (SCA) (Continued)



SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Exhibit 7.6 Frequency and Seriousness of Student Attendance Problems

TIMSS 1999 8th grade Mathematics

	Percentage of Students Whose Schools Reported the Behavior					
	Arriving Late		Absenteeism		Skipping Class	
	Occurs at Least Weekly	Is a Serious Problem	Occurs at Least Weekly	Is a Serious Problem	Occurs at Least Weekly	Is a Serious Problem
Australia	77 (3.5)	6 (2.5)	63 (4.1)	11 (2.7)	50 (4.0)	4 (2.0)
Belgium (Flemish)	44 (4.7)	3 (1.4)	11 (2.4)	4 (1.8)	4 (1.3)	2 (1.0)
Bulgaria	34 (4.6)	11 (2.8)	26 (3.8)	18 (3.4)	16 (3.3)	8 (2.4)
Canada	58 (2.7)	7 (1.7)	45 (3.1)	7 (1.6)	22 (2.3)	3 (1.0)
Chile	62 (3.6)	17 (2.8)	40 (3.5)	8 (2.1)	11 (2.7)	5 (1.6)
Chinese Taipei	43 (4.1)	2 (1.1)	32 (4.0)	10 (2.7)	30 (3.8)	11 (2.8)
Cyprus	52 (0.2)	r 15 (0.2)	52 (0.2)	r 25 (0.2)	26 (0.2)	r 28 (0.2)
Czech Republic	21 (3.8)	0 (0.3)	9 (2.8)	8 (2.5)	5 (2.2)	8 (2.4)
England	– –	– –	– –	– –	– –	– –
Finland	62 (3.8)	13 (3.4)	46 (4.0)	12 (3.0)	34 (4.3)	11 (3.1)
Hong Kong, SAR	r 61 (4.8)	9 (2.8)	r 34 (4.5)	3 (1.6)	r 10 (2.8)	r 1 (0.9)
Hungary	20 (3.4)	7 (2.2)	10 (2.5)	17 (3.0)	4 (1.7)	10 (2.3)
Indonesia	55 (4.6)	16 (3.0)	44 (4.8)	24 (3.4)	29 (4.2)	32 (4.2)
Iran, Islamic Rep.	29 (3.3)	4 (1.8)	11 (2.6)	5 (2.1)	3 (1.7)	r 3 (1.4)
Israel	74 (4.0)	r 30 (4.2)	53 (4.4)	r 24 (4.1)	48 (4.7)	r 24 (4.3)
Italy	32 (3.6)	4 (1.6)	11 (2.2)	9 (2.3)	8 (2.2)	7 (2.0)
Japan	55 (4.1)	20 (3.4)	63 (4.1)	76 (3.9)	14 (3.2)	27 (3.8)
Jordan	34 (4.0)	3 (1.6)	26 (4.1)	1 (1.0)	17 (3.3)	r 6 (2.2)
Korea, Rep. of	32 (4.0)	1 (1.0)	31 (4.1)	12 (2.9)	21 (3.6)	5 (1.8)
Latvia (LSS)	46 (4.4)	r 12 (3.2)	19 (3.3)	r 16 (3.4)	31 (3.7)	r 21 (3.7)
Lithuania ‡	45 (3.8)	19 (2.7)	37 (3.8)	27 (3.6)	42 (3.5)	25 (3.2)
Macedonia, Rep. of	34 (4.0)	14 (2.9)	34 (4.0)	13 (2.5)	20 (3.3)	14 (3.2)
Malaysia	41 (4.1)	7 (2.4)	44 (4.2)	23 (3.7)	31 (3.6)	12 (2.5)
Moldova	52 (4.3)	24 (3.6)	44 (3.7)	32 (3.9)	39 (4.1)	14 (2.8)
Morocco	81 (3.4)	16 (2.7)	73 (3.4)	40 (4.4)	42 (3.9)	34 (4.3)
Netherlands	r 76 (4.9)	r 18 (6.8)	r 35 (5.9)	r 12 (6.4)	r 44 (6.5)	r 15 (7.1)
New Zealand	73 (3.8)	7 (1.7)	66 (3.9)	15 (2.5)	60 (4.1)	8 (2.2)
Philippines	57 (4.5)	9 (2.6)	55 (4.5)	17 (3.2)	41 (4.3)	8 (2.2)
Romania	30 (4.0)	11 (2.8)	27 (3.8)	27 (4.0)	20 (3.8)	29 (4.2)
Russian Federation	41 (3.8)	14 (3.5)	22 (2.9)	12 (2.2)	32 (4.2)	10 (2.2)
Singapore	51 (4.8)	3 (1.6)	40 (4.4)	3 (1.5)	23 (4.0)	0 (0.0)
Slovak Republic	20 (3.5)	1 (0.8)	10 (3.0)	11 (3.1)	8 (2.4)	4 (1.9)
Slovenia	52 (4.2)	2 (1.1)	51 (4.0)	3 (1.3)	32 (4.0)	2 (1.2)
South Africa	75 (3.6)	48 (4.5)	69 (3.6)	r 46 (3.9)	57 (4.4)	36 (3.5)
Thailand	45 (4.3)	5 (1.9)	37 (4.3)	11 (3.0)	32 (3.9)	8 (2.3)
Tunisia	49 (3.9)	6 (2.1)	33 (3.9)	20 (3.2)	32 (3.6)	21 (3.5)
Turkey	32 (3.5)	6 (1.5)	33 (3.3)	15 (3.4)	15 (2.4)	5 (2.1)
United States	r 71 (3.7)	r 12 (2.3)	r 60 (4.2)	r 12 (2.7)	r 29 (3.6)	r 4 (1.8)
International Avg.	49 (0.6)	11 (0.4)	38 (0.6)	17 (0.5)	27 (0.6)	13 (0.5)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by schools.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

How Safe and Orderly Are Schools?

The frequency and seriousness of student behavior threatening an orderly school environment are presented in Exhibit 7.7. The three behaviors are violating the dress code, creating a classroom disturbance, and cheating. Violation of dress code is likely to reflect, at least partially, whether there is a uniform requirement. For many countries, violating the dress code was not reported to be a serious problem, and on average internationally only six percent of the students were in schools where it was a serious problem. 7.7

In contrast, 13 percent of the students, on average internationally, were in schools that reported classroom disturbances to be a serious problem. Most countries showed a pattern in which a larger percentage of students were in schools where classroom disturbances occurred at least weekly compared with the percentage of students in schools where it was considered a serious problem. The single exception was Japan, where just five percent of the students were in schools in which classroom disturbances occurred weekly, and yet 23 percent were in schools that considered classroom disturbances to be a serious problem.

The frequency and seriousness of student behavior threatening a safe school environment are shown in Exhibit 7.8. The five behaviors are vandalism, theft, physical injury to other students, intimidation or verbal abuse of other students, and intimidation or verbal abuse of teachers or staff. As in other reports of student behavior, cross-national comparisons are difficult because of differing perceptions of what constitutes a serious problem. However, with only a few exceptions, the overwhelming majority of students attend schools judged to have few serious problems. The incidence of these student behaviors was generally low in most countries. The exception was intimidation or verbal abuse of other students, for which several countries had relatively high percentages of students in schools where the behavior occurs at least weekly; in Australia, Israel, the Netherlands, and the United States, close to half of the students were in such schools. 7.8

Exhibit 7.7 Frequency and Seriousness of Student Behavior Threatening an Orderly School Environment

	Percentage of Students Whose Schools Reported the Behavior					
	Violating Dress Code		Classroom Disturbance		Cheating	
	Occurs at Least Weekly	Is a Serious Problem	Occurs at Least Weekly	Is a Serious Problem	Occurs at Least Weekly	Is a Serious Problem
Australia	75 (4.1)	r 9 (3.0)	73 (4.2)	11 (2.8)	7 (2.6)	0 (0.0)
Belgium (Flemish)	6 (2.1)	0 (0.0)	40 (5.4)	7 (2.5)	14 (2.7)	1 (0.0)
Bulgaria	2 (1.1)	0 (0.0)	22 (3.8)	6 (1.9)	3 (1.5)	0 (0.4)
Canada	22 (1.8)	2 (0.8)	60 (2.6)	21 (2.3)	4 (1.4)	2 (0.9)
Chile	31 (3.8)	4 (1.5)	46 (3.6)	15 (2.7)	13 (2.8)	2 (1.0)
Chinese Taipei	41 (4.1)	3 (1.5)	30 (3.8)	4 (1.6)	9 (2.1)	8 (2.3)
Cyprus	26 (0.2)	r 12 (0.1)	r 55 (0.2)	r 25 (0.2)	4 (0.1)	r 15 (0.2)
Czech Republic	3 (1.7)	0 (0.0)	63 (4.7)	21 (4.4)	9 (4.3)	11 (3.5)
England	– –	– –	– –	– –	– –	– –
Finland	2 (1.1)	1 (0.0)	50 (3.9)	6 (2.1)	0 (0.4)	0 (0.4)
Hong Kong, SAR	r 42 (4.6)	r 7 (2.5)	36 (4.7)	r 9 (2.9)	4 (1.7)	r 4 (1.9)
Hungary	2 (1.1)	1 (0.8)	41 (4.2)	15 (2.4)	2 (1.1)	16 (2.9)
Indonesia	31 (4.6)	19 (3.5)	21 (3.4)	12 (3.0)	12 (2.7)	15 (2.9)
Iran, Islamic Rep.	3 (1.1)	2 (1.0)	21 (3.4)	5 (1.9)	0 (0.0)	4 (1.3)
Israel	46 (4.9)	r 12 (3.8)	61 (4.5)	r 35 (4.9)	6 (2.1)	r 5 (2.2)
Italy	– –	– –	47 (4.0)	32 (3.6)	13 (2.7)	5 (1.4)
Japan	30 (4.0)	18 (3.5)	5 (1.5)	23 (3.7)	2 (1.1)	13 (2.8)
Jordan	23 (3.9)	r 15 (3.4)	28 (3.7)	r 5 (2.2)	5 (2.0)	r 6 (2.1)
Korea, Rep. of	37 (4.3)	3 (1.4)	43 (4.2)	7 (1.8)	3 (1.3)	8 (2.5)
Latvia (LSS)	s 5 (2.4)	r 2 (1.3)	37 (4.5)	17 (3.8)	53 (5.0)	r 18 (3.9)
Lithuania ‡	4 (1.7)	1 (1.0)	18 (2.8)	12 (2.4)	7 (2.1)	6 (2.0)
Macedonia, Rep. of	1 (1.0)	0 (0.0)	13 (2.3)	5 (2.0)	8 (1.9)	2 (0.7)
Malaysia	30 (3.7)	6 (1.8)	26 (3.7)	8 (2.3)	10 (2.4)	7 (1.8)
Moldova	6 (1.9)	3 (1.4)	29 (3.7)	13 (2.7)	19 (3.2)	14 (3.3)
Morocco	38 (4.9)	13 (2.8)	32 (3.8)	28 (3.2)	9 (2.0)	28 (3.1)
Netherlands	r 10 (4.2)	r 0 (0.0)	r 76 (5.5)	r 14 (5.4)	r 60 (6.5)	r 1 (0.8)
New Zealand	75 (3.9)	7 (2.0)	68 (3.8)	9 (2.5)	6 (2.0)	0 (0.0)
Philippines	33 (4.2)	3 (1.5)	27 (3.7)	4 (1.7)	13 (3.1)	2 (1.3)
Romania	16 (3.2)	7 (2.4)	17 (3.3)	14 (3.0)	0 (0.0)	10 (2.6)
Russian Federation	7 (2.2)	0 (0.0)	13 (2.8)	4 (1.6)	1 (0.5)	2 (1.2)
Singapore	36 (4.8)	2 (1.3)	32 (3.9)	3 (1.7)	3 (1.4)	0 (0.0)
Slovak Republic	3 (1.6)	2 (1.3)	60 (4.4)	21 (4.1)	51 (4.1)	4 (1.8)
Slovenia	4 (1.8)	1 (0.0)	61 (4.3)	9 (2.5)	4 (1.7)	0 (0.4)
South Africa	60 (4.2)	r 33 (3.3)	39 (4.1)	15 (3.3)	21 (3.6)	13 (2.3)
Thailand	40 (4.5)	4 (1.8)	13 (2.6)	3 (1.4)	3 (1.5)	r 2 (1.2)
Tunisia	18 (3.1)	4 (1.7)	54 (4.0)	20 (3.2)	2 (1.4)	38 (4.2)
Turkey	10 (2.2)	6 (2.2)	15 (2.5)	10 (2.8)	5 (1.6)	4 (1.8)
United States	r 42 (4.0)	r 3 (1.2)	r 69 (4.3)	r 11 (2.6)	r 12 (2.8)	r 1 (0.0)
International Avg.	24 (0.6)	6 (0.3)	39 (0.6)	13 (0.5)	11 (0.4)	7 (0.3)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by schools.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

Exhibit 7.8 Overleaf

Exhibit 7.8 Frequency and Seriousness of Student Behavior Threatening a Safe School Environment

	Percentage of Students Whose Schools Reported the Behavior					
	Vandalism		Theft		Physical Injury to Other Students	
	Occurs at Least Weekly	Is a Serious Problem	Occurs at Least Weekly	Is a Serious Problem	Occurs at Least Weekly	Is a Serious Problem
Australia	27 (4.2)	2 (1.2)	23 (3.7)	1 (0.7)	14 (3.1)	3 (1.4)
Belgium (Flemish)	8 (2.4)	9 (2.6)	7 (2.2)	9 (2.5)	8 (1.9)	6 (2.1)
Bulgaria	5 (1.8)	4 (1.6)	1 (0.6)	1 (1.0)	4 (1.4)	1 (0.0)
Canada	15 (1.5)	6 (2.0)	7 (1.4)	6 (1.9)	6 (1.8)	4 (1.5)
Chile	9 (2.3)	7 (2.0)	10 (2.3)	7 (1.9)	12 (2.5)	9 (1.8)
Chinese Taipei	14 (3.1)	11 (2.5)	7 (2.2)	16 (2.9)	8 (2.3)	21 (3.2)
Cyprus	r 18 (0.1)	r 22 (0.2)	r 8 (0.1)	r 23 (0.2)	2 (0.0)	r 20 (0.2)
Czech Republic	13 (2.7)	21 (3.6)	3 (1.9)	17 (3.8)	2 (1.7)	17 (3.7)
England	– –	– –	– –	– –	– –	– –
Finland	6 (2.2)	3 (1.6)	3 (1.8)	1 (0.8)	7 (2.5)	2 (1.4)
Hong Kong, SAR	18 (3.7)	r 6 (2.3)	8 (2.6)	r 5 (2.2)	5 (2.1)	r 3 (1.6)
Hungary	10 (2.6)	30 (3.5)	2 (1.1)	25 (3.4)	8 (2.0)	23 (3.1)
Indonesia	4 (1.8)	29 (4.0)	1 (0.9)	30 (4.1)	0 (0.0)	26 (3.9)
Iran, Islamic Rep.	3 (1.4)	r 4 (1.6)	1 (0.6)	4 (1.6)	3 (1.4)	r 2 (1.4)
Israel	30 (4.2)	r 28 (4.1)	10 (2.9)	r 15 (3.5)	24 (4.3)	r 18 (3.7)
Italy	7 (1.9)	18 (2.8)	4 (1.4)	16 (2.8)	9 (2.1)	19 (3.0)
Japan	3 (1.3)	23 (3.5)	1 (0.9)	25 (3.7)	1 (0.9)	22 (3.6)
Jordan	5 (1.8)	r 16 (3.6)	2 (1.1)	r 12 (3.1)	9 (2.5)	r 10 (2.7)
Korea, Rep. of	12 (2.8)	10 (2.5)	9 (2.5)	13 (3.0)	10 (2.6)	9 (2.6)
Latvia (LSS)	2 (1.3)	r 4 (2.0)	0 (0.0)	10 (3.0)	5 (2.3)	r 8 (2.6)
Lithuania ‡	0 (0.0)	6 (1.7)	0 (0.0)	9 (2.0)	1 (0.0)	7 (1.3)
Macedonia, Rep. of	3 (1.4)	8 (2.6)	1 (0.9)	6 (2.2)	3 (1.6)	9 (2.4)
Malaysia	12 (3.0)	17 (3.4)	7 (2.0)	12 (2.8)	2 (1.1)	11 (2.2)
Moldova	1 (1.0)	3 (1.3)	0 (0.0)	8 (2.3)	0 (0.0)	2 (1.2)
Morocco	17 (2.8)	34 (4.0)	8 (1.8)	26 (3.3)	9 (2.3)	25 (3.6)
Netherlands	r 45 (7.6)	r 28 (7.4)	r 22 (5.9)	r 19 (6.4)	r 2 (1.3)	r 4 (2.0)
New Zealand	21 (3.5)	4 (1.8)	15 (3.0)	4 (1.5)	8 (2.0)	1 (0.9)
Philippines	16 (3.2)	11 (2.4)	6 (2.2)	2 (1.1)	6 (2.0)	1 (0.7)
Romania	0 (0.0)	11 (2.9)	2 (1.3)	19 (3.5)	9 (2.6)	22 (3.5)
Russian Federation	0 (0.4)	3 (1.5)	1 (0.5)	6 (2.0)	2 (1.1)	4 (1.3)
Singapore	5 (1.8)	2 (1.3)	5 (2.0)	2 (1.4)	1 (0.7)	0 (0.0)
Slovak Republic	15 (3.4)	24 (4.1)	2 (1.4)	17 (3.4)	3 (1.7)	15 (3.8)
Slovenia	8 (2.0)	2 (1.5)	3 (1.3)	1 (0.8)	4 (1.9)	1 (0.8)
South Africa	18 (3.3)	32 (4.2)	16 (2.7)	29 (4.2)	7 (2.0)	14 (3.3)
Thailand	9 (2.3)	3 (1.6)	4 (1.6)	4 (1.7)	3 (1.5)	3 (1.5)
Tunisia	9 (2.5)	35 (4.4)	2 (1.2)	29 (4.0)	5 (1.9)	28 (3.8)
Turkey	10 (2.0)	11 (2.9)	6 (1.9)	10 (3.1)	7 (1.4)	10 (2.8)
United States	r 11 (2.3)	r 1 (0.8)	r 10 (2.5)	r 2 (1.1)	r 10 (2.4)	r 3 (1.8)
International Avg.	11 (0.4)	13 (0.5)	6 (0.3)	12 (0.5)	6 (0.3)	10 (0.4)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by schools.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

	Percentage of Students Whose Schools Reported the Behavior			
	Intimidation or Verbal Abuse of Other Students		Intimidation or Verbal Abuse of Teachers or Staff	
	Occurs at Least Weekly	Is a Serious Problem	Occurs at Least Weekly	Is a Serious Problem
Australia	51 (4.0)	11 (3.1)	16 (3.2)	5 (1.8)
Belgium (Flemish)	23 (3.4)	15 (3.7)	5 (1.5)	3 (1.2)
Bulgaria	9 (2.3)	2 (0.9)	1 (0.6)	0 (0.4)
Canada	42 (3.0)	22 (2.5)	4 (1.2)	3 (1.1)
Chile	23 (3.3)	14 (2.4)	4 (1.5)	7 (2.0)
Chinese Taipei	11 (2.7)	18 (3.1)	1 (1.0)	17 (3.0)
Cyprus	r 23 (0.2)	r 20 (0.2)	3 (0.1)	r 25 (0.2)
Czech Republic	5 (1.5)	17 (3.6)	0 (0.0)	9 (2.6)
England	– –	– –	– –	– –
Finland	14 (3.2)	7 (2.2)	4 (1.4)	2 (1.1)
Hong Kong, SAR	r 8 (2.7)	r 4 (1.8)	r 3 (1.5)	r 2 (1.3)
Hungary	9 (2.5)	25 (3.6)	1 (0.6)	8 (1.9)
Indonesia	2 (1.3)	25 (3.9)	0 (0.0)	28 (3.8)
Iran, Islamic Rep.	11 (2.9)	2 (1.5)	2 (1.2)	r 4 (1.8)
Israel	51 (4.6)	r 32 (5.1)	8 (2.6)	r 14 (3.6)
Italy	14 (2.3)	23 (3.0)	4 (1.7)	13 (2.7)
Japan	3 (1.5)	25 (3.8)	2 (1.2)	23 (3.7)
Jordan	18 (3.0)	r 8 (2.4)	1 (0.8)	r 11 (2.9)
Korea, Rep. of	12 (2.9)	12 (2.8)	8 (2.3)	9 (2.5)
Latvia (LSS)	1 (1.1)	r 5 (2.1)	0 (0.0)	r 1 (0.6)
Lithuania ‡	3 (1.4)	14 (2.2)	0 (0.0)	6 (1.4)
Macedonia, Rep. of	6 (1.8)	7 (2.0)	1 (0.0)	5 (2.0)
Malaysia	4 (1.7)	11 (2.3)	1 (0.9)	8 (2.1)
Moldova	3 (1.4)	5 (1.9)	1 (0.0)	4 (1.7)
Morocco	18 (3.0)	22 (3.1)	10 (2.4)	32 (3.7)
Netherlands	r 49 (7.3)	r 23 (6.9)	r 17 (6.6)	r 16 (6.4)
New Zealand	39 (3.9)	12 (2.7)	13 (2.8)	3 (1.5)
Philippines	10 (2.7)	0 (0.0)	3 (1.6)	1 (0.0)
Romania	10 (2.5)	21 (3.5)	2 (1.1)	14 (3.3)
Russian Federation	3 (1.3)	7 (2.1)	1 (0.5)	1 (0.6)
Singapore	7 (2.3)	2 (1.2)	1 (0.7)	1 (0.9)
Slovak Republic	10 (3.0)	17 (4.0)	0 (0.0)	8 (2.7)
Slovenia	17 (3.0)	3 (1.4)	1 (0.8)	0 (0.4)
South Africa	22 (3.0)	17 (2.8)	4 (1.5)	12 (3.5)
Thailand	7 (2.1)	4 (1.7)	2 (1.2)	3 (1.3)
Tunisia	5 (1.9)	25 (3.6)	2 (1.3)	38 (4.1)
Turkey	9 (1.8)	12 (2.8)	3 (1.4)	6 (2.5)
United States	r 46 (4.3)	r 16 (3.6)	r 7 (2.0)	r 3 (1.5)
International Avg.	16 (0.5)	14 (0.5)	4 (0.3)	9 (0.4)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

REFERENCE 1

Students’ Backgrounds and Attitudes Towards Mathematics

Exhibit R1.1 Educational Aids in the Home: Dictionary, Study Desk/Table, and Computer

	Have All Three Educational Aids		Do Not Have All Three Educational Aids		Percentage of Students		
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Have Dictionary	Have Study Desk/Table for Own Use	Have Computer
Australia	82 (1.1)	533 (4.8)	18 (1.1)	492 (6.3)	99 (0.2)	95 (0.4)	86 (1.0)
Belgium (Flemish)	82 (1.2)	567 (3.3)	18 (1.2)	520 (8.6)	98 (0.7)	96 (0.6)	86 (1.0)
Bulgaria	21 (2.4)	546 (13.1)	79 (2.4)	502 (4.8)	89 (0.9)	87 (1.2)	23 (2.3)
Canada	78 (0.8)	537 (2.6)	22 (0.8)	510 (3.1)	98 (0.2)	91 (0.6)	85 (0.8)
Chile	21 (1.7)	442 (9.8)	79 (1.7)	381 (3.2)	97 (0.4)	78 (0.9)	23 (1.7)
Chinese Taipei	61 (1.1)	608 (3.8)	39 (1.1)	551 (4.4)	98 (0.2)	94 (0.4)	63 (1.0)
Cyprus	56 (0.8)	493 (2.6)	44 (0.8)	459 (2.6)	97 (0.3)	97 (0.3)	58 (0.9)
Czech Republic	43 (1.2)	541 (4.5)	57 (1.2)	504 (4.6)	94 (0.8)	91 (0.7)	47 (1.2)
England	79 (0.9)	507 (4.0)	21 (0.9)	461 (6.0)	98 (0.3)	92 (0.6)	85 (0.8)
Finland	71 (1.2)	528 (3.0)	29 (1.2)	501 (3.5)	89 (0.7)	97 (0.4)	79 (0.9)
Hong Kong, SAR	57 (1.3)	592 (4.1)	43 (1.3)	571 (4.9)	99 (0.1)	75 (0.9)	72 (1.3)
Hungary	48 (1.4)	562 (4.0)	52 (1.4)	504 (3.9)	95 (0.8)	95 (0.5)	50 (1.4)
Indonesia	6 (0.8)	468 (15.0)	94 (0.8)	400 (4.8)	86 (0.9)	84 (1.1)	7 (0.8)
Iran, Islamic Rep.	5 (0.7)	457 (9.5)	95 (0.7)	422 (3.1)	51 (1.5)	47 (2.2)	7 (0.8)
Israel	78 (1.5)	486 (3.2)	22 (1.5)	409 (6.2)	98 (0.3)	97 (0.3)	80 (1.5)
Italy	59 (1.1)	492 (4.0)	41 (1.1)	461 (4.2)	98 (0.3)	93 (0.6)	63 (1.0)
Japan	52 (1.0)	592 (2.3)	48 (1.0)	566 (2.3)	99 (0.1)	97 (0.2)	52 (0.9)
Jordan	16 (0.9)	469 (6.9)	84 (0.9)	425 (3.7)	80 (0.9)	73 (1.1)	23 (1.1)
Korea, Rep. of	65 (0.9)	602 (1.7)	35 (0.9)	561 (3.0)	99 (0.2)	96 (0.2)	67 (0.9)
Latvia (LSS)	14 (1.0)	537 (6.0)	86 (1.0)	500 (3.5)	94 (0.7)	98 (0.3)	15 (1.0)
Lithuania ‡	15 (1.1)	529 (8.1)	85 (1.1)	474 (4.1)	86 (0.9)	95 (0.5)	16 (1.1)
Macedonia, Rep. of	18 (1.2)	484 (5.6)	82 (1.2)	442 (4.3)	83 (1.2)	87 (0.8)	21 (1.3)
Malaysia	28 (1.2)	563 (5.5)	72 (1.2)	503 (4.1)	99 (0.2)	87 (0.6)	31 (1.3)
Moldova	5 (0.6)	489 (11.8)	95 (0.6)	469 (3.8)	72 (1.3)	79 (0.9)	7 (0.7)
Morocco	6 (0.7)	357 (11.5)	94 (0.7)	339 (2.3)	71 (1.2)	52 (1.1)	9 (0.9)
Netherlands	94 (1.0)	543 (7.2)	6 (1.0)	509 (8.7)	100 (0.2)	99 (0.2)	96 (1.0)
New Zealand	67 (1.3)	512 (5.6)	33 (1.3)	453 (4.5)	97 (0.4)	90 (0.6)	72 (1.2)
Philippines	11 (0.9)	392 (14.9)	89 (0.9)	342 (5.9)	89 (0.7)	74 (1.0)	15 (0.9)
Romania	11 (0.8)	509 (10.2)	89 (0.8)	471 (5.1)	69 (1.6)	76 (1.4)	14 (1.0)
Russian Federation	19 (1.2)	537 (6.6)	81 (1.2)	524 (6.3)	88 (1.3)	92 (0.8)	22 (1.2)
Singapore	75 (1.4)	615 (6.1)	25 (1.4)	573 (7.1)	99 (0.2)	92 (0.5)	80 (1.3)
Slovak Republic	36 (1.3)	556 (5.2)	64 (1.3)	522 (3.7)	96 (0.5)	88 (0.8)	41 (1.3)
Slovenia	61 (1.2)	547 (2.8)	39 (1.2)	506 (3.6)	92 (0.6)	96 (0.3)	66 (1.2)
South Africa	8 (1.0)	415 (15.1)	92 (1.0)	265 (6.6)	75 (1.1)	56 (1.1)	11 (1.1)
Thailand	8 (0.6)	538 (9.2)	92 (0.6)	462 (5.1)	75 (1.2)	63 (1.5)	8 (0.7)
Tunisia	23 (1.3)	462 (3.5)	77 (1.3)	444 (2.6)	87 (1.0)	92 (0.6)	24 (1.3)
Turkey	8 (0.6)	471 (7.1)	92 (0.6)	426 (4.4)	89 (0.7)	69 (1.3)	10 (0.7)
United States	74 (1.3)	518 (3.7)	26 (1.3)	463 (4.3)	97 (0.3)	90 (0.5)	80 (1.2)
International Avg.	41 (0.2)	516 (1.2)	59 (0.2)	471 (0.8)	90 (0.1)	86 (0.1)	45 (0.2)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 R1.2 Trends in Educational Aids in the Home

TIMSS 1999
8th grade
Mathematics

	Have All Three Educational Aids		Have Dictionary		Have Study Desk/ Table for Own Use		Have Computer	
	Percent of Students	1995 - 1999 Difference	Percent of Students	1995 - 1999 Difference	Percent of Students	1995 - 1999 Difference	Percent of Students	1995 - 1999 Difference
Australia	82 (1.1)	16 (1.6) ▲	99 (0.2)	11 (0.8) ▲	95 (0.4)	-2 (0.5) ▼	86 (1.0)	13 (1.5) ▲
Belgium (Flemish)	82 (1.2)	19 (1.8) ▲	98 (0.7)	0 (0.8) ●	96 (0.6)	-1 (0.8) ●	86 (1.0)	19 (1.6) ▲
Canada	78 (0.8)	21 (1.6) ▲	98 (0.2)	2 (0.4) ▲	91 (0.6)	2 (0.8) ●	85 (0.8)	24 (1.6) ▲
Cyprus	56 (0.8)	18 (1.2) ▲	97 (0.3)	0 (0.5) ●	97 (0.3)	1 (0.6) ●	58 (0.9)	19 (1.3) ▲
Czech Republic	43 (1.2)	11 (1.8) ▲	94 (0.8)	-1 (0.9) ●	91 (0.7)	2 (0.9) ●	47 (1.2)	11 (1.7) ▲
England	79 (0.9)	-1 (1.4) ●	98 (0.3)	0 (0.5) ●	92 (0.6)	2 (1.0) ●	85 (0.8)	-4 (1.2) ▼
Hong Kong, SAR	57 (1.3)	24 (2.2) ▲	99 (0.1)	0 (0.2) ●	75 (0.9)	-5 (1.4) ▼	72 (1.3)	33 (2.3) ▲
Hungary	– –	– –	– –	– –	95 (0.5)	3 (0.9) ▲	50 (1.4)	13 (1.8) ▲
Iran, Islamic Rep.	5 (0.7)	4 (0.8) ▲	51 (1.5)	-2 (2.1) ●	47 (2.2)	8 (3.0) ●	7 (0.8)	3 (1.0) ▲
Israel †	83 (1.7)	9 (2.7) ▲	99 (0.2)	-1 (0.3) ●	98 (0.2)	0 (0.5) ●	85 (1.8)	9 (2.7) ▲
Italy	58 (1.4)	-1 (2.1) ●	98 (0.4)	-1 (0.4) ●	93 (0.6)	-1 (1.0) ●	62 (1.3)	0 (2.0) ●
Japan	– –	– –	– –	– –	– –	– –	– –	– –
Korea, Rep. of	65 (0.9)	27 (1.5) ▲	99 (0.2)	0 (0.3) ●	96 (0.2)	1 (0.5) ●	67 (0.9)	27 (1.5) ▲
Latvia (LSS)	14 (1.0)	2 (1.3) ●	94 (0.7)	1 (0.9) ●	98 (0.3)	0 (0.5) ●	15 (1.0)	2 (1.3) ●
Lithuania	– –	– –	86 (0.9)	-2 (1.4) ●	95 (0.5)	1 (0.8) ●	– –	– –
Netherlands	94 (1.0)	11 (1.6) ▲	100 (0.2)	0 (0.2) ●	99 (0.2)	0 (0.3) ●	96 (1.0)	11 (1.6) ▲
New Zealand	67 (1.3)	11 (1.9) ▲	97 (0.4)	-2 (0.4) ▼	90 (0.6)	0 (0.8) ●	72 (1.2)	12 (1.8) ▲
Romania	11 (0.8)	3 (1.3) ●	69 (1.6)	9 (2.2) ▲	76 (1.4)	7 (1.9) ▲	14 (1.0)	-5 (1.5) ▼
Russian Federation	19 (1.2)	-11 (1.9) ▼	88 (1.3)	-1 (1.7) ●	92 (0.8)	-3 (1.1) ●	22 (1.2)	-13 (2.0) ▼
Singapore	75 (1.4)	28 (2.0) ▲	99 (0.2)	0 (0.2) ●	92 (0.5)	0 (0.7) ●	80 (1.3)	31 (2.0) ▲
Slovak Republic	36 (1.3)	9 (1.8) ▲	96 (0.5)	0 (0.7) ●	88 (0.8)	1 (1.1) ●	41 (1.3)	10 (1.8) ▲
Slovenia	61 (1.2)	18 (1.8) ▲	92 (0.6)	-2 (0.8) ●	96 (0.3)	3 (0.7) ▲	66 (1.2)	19 (1.8) ▲
Thailand †	8 (0.6)	4 (1.0) ▲	75 (1.2)	8 (2.4) ▲	63 (1.5)	-2 (2.6) ●	8 (0.7)	4 (1.1) ▲
United States	74 (1.3)	18 (2.1) ▲	97 (0.3)	0 (0.5) ●	90 (0.5)	0 (0.9) ●	80 (1.2)	21 (2.1) ▲
International Avg. §	53 (0.2)	10 (0.4) ▲	93 (0.1)	1 (0.2) ▲	90 (0.2)	1 (0.2) ▲	57 (0.2)	10 (0.4) ▲

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

Background data provided by students.

† Countries with unapproved sampling procedures at the classroom level in 1995.

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian-Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

Background data for Bulgaria and South Africa are unavailable for 1995.

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

A dash (–) indicates data are not available.

Exhibit R1.3 Number of Books in the Home

TIMSS 1999 8th grade Mathematics

	Three or More Bookcases (More Than 200 Books)		About Two Bookcases (101-200 Books)		About One Bookcase (26-100 Books)		About One Shelf (11-25 Books)		None or Very Few (0-10 Books)	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Australia	38 (1.2)	544 (5.0)	27 (0.9)	526 (5.9)	24 (0.9)	511 (5.0)	7 (0.6)	498 (8.6)	3 (0.4)	479 (13.3)
Belgium (Flemish)	14 (0.8)	580 (5.1)	14 (0.6)	578 (7.3)	31 (1.3)	569 (6.1)	21 (0.7)	549 (5.1)	19 (1.3)	523 (4.9)
Bulgaria	37 (2.2)	544 (8.2)	19 (0.9)	513 (6.3)	24 (1.1)	499 (5.6)	12 (1.0)	466 (6.7)	9 (1.3)	457 (9.6)
Canada	31 (0.9)	543 (3.5)	24 (0.8)	536 (3.5)	28 (0.7)	527 (3.3)	11 (0.5)	507 (5.1)	5 (0.3)	510 (5.9)
Chile	9 (0.6)	442 (13.1)	11 (0.6)	424 (8.3)	28 (0.9)	414 (4.9)	32 (0.9)	374 (4.0)	20 (1.1)	355 (3.0)
Chinese Taipei	16 (0.8)	637 (5.8)	12 (0.5)	629 (5.7)	31 (0.7)	599 (4.4)	23 (0.7)	563 (4.0)	17 (0.9)	513 (4.4)
Cyprus	17 (0.8)	497 (4.3)	23 (0.9)	494 (3.9)	36 (1.0)	479 (2.6)	19 (0.9)	450 (4.0)	5 (0.5)	428 (9.2)
Czech Republic	28 (1.4)	539 (5.0)	30 (1.4)	532 (5.6)	34 (1.1)	506 (5.1)	7 (0.8)	472 (7.2)	1 (0.2)	~ ~
England	26 (1.2)	537 (6.1)	23 (0.8)	505 (4.9)	32 (1.1)	488 (3.8)	13 (0.8)	456 (5.8)	7 (0.7)	438 (9.7)
Finland	22 (1.1)	538 (5.0)	22 (0.9)	527 (4.3)	39 (1.1)	521 (3.3)	14 (0.8)	492 (3.7)	4 (0.4)	483 (8.3)
Hong Kong, SAR	8 (0.5)	588 (8.8)	10 (0.5)	590 (7.4)	27 (0.7)	592 (4.3)	27 (0.7)	584 (5.0)	28 (0.9)	568 (4.3)
Hungary	38 (1.4)	564 (4.0)	21 (0.8)	548 (4.3)	25 (1.0)	513 (3.5)	12 (0.8)	467 (6.6)	3 (0.5)	429 (10.2)
Indonesia	5 (0.5)	406 (12.1)	5 (0.4)	430 (11.8)	26 (0.9)	421 (5.1)	39 (1.0)	395 (5.1)	26 (1.3)	399 (7.0)
Iran, Islamic Rep.	9 (0.7)	461 (7.2)	8 (0.7)	452 (6.8)	22 (0.6)	441 (4.5)	32 (0.8)	417 (3.1)	29 (1.4)	397 (3.2)
Israel	22 (1.3)	495 (4.9)	21 (0.8)	497 (5.2)	33 (1.0)	469 (4.7)	18 (0.9)	431 (5.2)	6 (0.5)	412 (9.8)
Italy	20 (0.9)	505 (5.6)	15 (0.7)	495 (4.9)	28 (0.9)	487 (4.5)	25 (0.9)	460 (5.4)	12 (0.8)	444 (7.0)
Japan	18 (0.7)	605 (4.6)	18 (0.6)	598 (4.0)	31 (0.7)	577 (2.7)	19 (0.6)	565 (4.3)	14 (0.6)	549 (4.8)
Jordan	10 (0.6)	462 (6.1)	10 (0.6)	467 (8.8)	28 (0.8)	448 (4.4)	31 (1.1)	423 (3.9)	21 (1.2)	395 (4.7)
Korea, Rep. of	20 (0.8)	625 (2.9)	23 (0.6)	605 (3.1)	36 (0.7)	581 (2.2)	10 (0.5)	550 (3.8)	10 (0.4)	527 (5.1)
Latvia (LSS)	47 (1.4)	525 (4.2)	25 (0.9)	501 (4.5)	21 (0.9)	483 (4.4)	6 (0.7)	455 (9.4)	1 (0.2)	~ ~
Lithuania ‡	17 (1.0)	524 (5.8)	21 (1.0)	513 (4.8)	36 (1.2)	478 (4.3)	20 (1.1)	440 (5.9)	7 (0.8)	417 (7.4)
Macedonia, Rep. of	7 (0.7)	475 (8.7)	9 (0.6)	483 (7.2)	30 (1.2)	475 (5.0)	38 (1.3)	438 (4.5)	15 (1.3)	401 (8.4)
Malaysia	9 (0.7)	566 (6.8)	12 (0.6)	546 (5.8)	32 (0.9)	536 (5.0)	34 (0.9)	499 (3.9)	13 (0.8)	477 (4.8)
Moldova	9 (0.7)	497 (7.0)	11 (0.8)	498 (6.4)	28 (1.0)	482 (4.6)	33 (1.2)	462 (5.3)	20 (1.1)	445 (6.0)
Morocco	3 (0.3)	352 (18.8)	5 (0.4)	352 (8.6)	20 (1.0)	347 (6.3)	35 (0.9)	344 (6.1)	37 (1.7)	330 (6.9)
Netherlands	24 (1.8)	564 (8.5)	23 (1.2)	551 (8.1)	31 (1.1)	540 (8.2)	15 (1.4)	512 (9.6)	8 (1.4)	499 (11.1)
New Zealand	33 (1.1)	518 (6.3)	24 (0.8)	507 (5.7)	27 (0.8)	480 (5.6)	10 (0.7)	450 (6.6)	6 (0.5)	408 (9.1)
Philippines	5 (0.4)	358 (16.9)	5 (0.4)	376 (15.9)	15 (0.8)	378 (10.4)	33 (0.9)	353 (7.2)	41 (1.4)	325 (4.8)
Romania	15 (1.3)	517 (8.5)	15 (0.9)	509 (8.3)	32 (1.1)	476 (5.1)	24 (1.6)	450 (8.4)	14 (1.1)	431 (7.6)
Russian Federation	23 (1.5)	556 (6.3)	29 (1.1)	539 (5.5)	31 (1.3)	517 (5.3)	13 (1.0)	485 (9.0)	4 (0.5)	460 (16.2)
Singapore	12 (0.6)	618 (8.3)	14 (0.7)	627 (9.0)	40 (1.1)	613 (6.1)	22 (1.0)	586 (6.8)	12 (0.8)	572 (7.2)
Slovak Republic	17 (0.9)	565 (5.3)	24 (1.0)	554 (4.4)	43 (1.1)	528 (3.8)	14 (1.0)	490 (4.9)	2 (0.4)	~ ~
Slovenia	14 (0.9)	561 (5.4)	20 (0.8)	555 (4.2)	46 (1.0)	530 (2.8)	16 (0.8)	488 (6.2)	4 (0.4)	479 (11.4)
South Africa	7 (0.5)	320 (16.8)	6 (0.5)	343 (17.8)	14 (0.8)	317 (10.4)	31 (0.8)	281 (6.6)	43 (1.6)	248 (9.6)
Thailand	6 (0.5)	504 (9.1)	8 (0.5)	488 (7.9)	27 (0.9)	486 (5.9)	37 (1.1)	459 (4.8)	22 (1.0)	443 (6.5)
Tunisia	9 (0.6)	462 (5.8)	9 (0.6)	468 (5.5)	25 (0.7)	459 (3.3)	36 (0.9)	438 (2.7)	21 (1.1)	438 (3.3)
Turkey	6 (0.4)	444 (8.6)	8 (0.5)	457 (6.5)	28 (0.8)	448 (6.0)	37 (0.8)	421 (4.7)	22 (1.1)	405 (5.2)
United States	28 (1.2)	537 (5.5)	22 (0.6)	523 (3.5)	29 (0.8)	495 (3.1)	14 (0.7)	461 (5.0)	8 (0.6)	439 (5.2)
International Avg.	18 (0.2)	515 (1.3)	16 (0.1)	509 (1.1)	29 (0.2)	492 (0.8)	22 (0.1)	464 (0.9)	14 (0.2)	443 (1.6)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 tilde (~) indicates insufficient data to report achievement.

Exhibit R1.4 Trends in Number of Books in the Home

TIMSS1999 8th grade Mathematics

	Two or More Bookcases (More Than 100 Books)		About One Bookcase (26-100 Books)		About One Shelf or Fewer (0-25 Books)	
	Percent of Students 1999	1995 - 1999 Difference	Percent of Students 1999	1995 - 1999 Difference	Percent of Students 1999	1995 - 1999 Difference
Australia	65 (1.3)	-2 (1.9) ●	24 (0.9)	1 (1.3) ●	11 (0.8)	1 (1.1) ●
Belgium (Flemish)	28 (1.0)	-11 (1.7) ▼	31 (1.3)	-2 (1.7) ●	41 (1.6)	13 (2.3) ▲
Canada	56 (1.1)	-2 (1.7) ●	28 (0.7)	0 (1.3) ●	16 (0.6)	2 (1.0) ●
Cyprus	40 (1.0)	-2 (1.5) ●	36 (1.0)	2 (1.3) ●	24 (1.0)	0 (1.5) ●
Czech Republic	58 (1.5)	-8 (2.4) ▼	34 (1.1)	4 (1.9) ●	8 (0.8)	4 (1.0) ▲
England	49 (1.6)	-5 (2.3) ●	32 (1.1)	5 (1.7) ●	19 (1.1)	0 (1.5) ●
Hong Kong, SAR	17 (0.8)	-3 (1.6) ●	27 (0.7)	-2 (1.2) ●	55 (1.2)	4 (1.9) ●
Hungary	60 (1.5)	-4 (2.1) ●	25 (1.0)	1 (1.4) ●	15 (1.1)	3 (1.4) ●
Iran, Islamic Rep.	16 (1.3)	3 (1.6) ●	22 (0.6)	5 (1.1) ▲	62 (1.6)	-8 (2.2) ▼
Israel †	44 (1.9)	-7 (3.3) ●	34 (1.1)	2 (2.3) ●	23 (1.3)	5 (1.9) ●
Italy	34 (1.5)	-8 (2.2) ▼	28 (1.2)	-4 (1.8) ●	38 (1.5)	12 (1.9) ▲
Japan	– –	– –	– –	– –	– –	– –
Korea, Rep. of	44 (1.0)	-1 (1.6) ●	36 (0.7)	3 (1.2) ●	20 (0.7)	-2 (1.2) ●
Latvia (LSS)	72 (1.3)	-6 (1.8) ▼	21 (0.9)	4 (1.3) ▲	8 (0.8)	2 (1.0) ●
Lithuania	38 (1.6)	-6 (2.1) ▼	36 (1.2)	0 (1.7) ●	26 (1.6)	6 (1.9) ▲
Netherlands	47 (2.6)	5 (3.3) ●	31 (1.1)	-3 (1.7) ●	23 (2.3)	-2 (2.8) ●
New Zealand	56 (1.3)	-9 (1.8) ▼	27 (0.8)	3 (1.2) ●	16 (1.0)	6 (1.3) ▲
Romania	30 (1.8)	-5 (2.7) ●	32 (1.1)	12 (1.4) ▲	38 (2.0)	-8 (2.8) ●
Russian Federation	53 (2.0)	2 (2.7) ●	31 (1.3)	-5 (1.8) ●	17 (1.3)	3 (1.6) ●
Singapore	26 (1.2)	0 (1.8) ●	40 (1.1)	-1 (1.4) ●	34 (1.5)	1 (2.0) ●
Slovak Republic	41 (1.5)	-1 (2.1) ●	43 (1.1)	-2 (1.5) ●	16 (1.2)	3 (1.4) ●
Slovenia	34 (1.3)	-10 (1.9) ▼	46 (1.0)	7 (1.6) ▲	20 (1.1)	2 (1.4) ●
Thailand †	15 (0.7)	-3 (1.6) ●	27 (0.9)	-7 (1.5) ▼	59 (1.3)	10 (2.4) ▲
United States	50 (1.4)	-2 (2.2) ●	29 (0.8)	0 (1.2) ●	22 (1.1)	1 (1.8) ●
International Avg. §	43 (0.3)	-4 (0.4) ▼	31 (0.2)	1 (0.3) ▲	26 (0.3)	2 (0.4) ▲

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

Background data provided by students.

† Countries with unapproved sampling procedures at the classroom level in 1995.

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian-Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

Background data for Bulgaria and South Africa are unavailable for 1995.

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

A dash (–) indicates data are not available.

Exhibit R1.5 Highest Level of Education of Either Parent*

TIMSS 1999 8th grade Mathematics

	Finished University¹		Finished Upper Secondary School But Not University²		Finished Primary School But Not Upper Secondary School³		Did Not Finish Primary School⁴		Do Not Know	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Australia	28 (1.8)	563 (5.0)	30 (1.1)	528 (5.7)	21 (1.1)	512 (5.5)	0 (0.1)	~ ~	21 (1.0)	499 (6.5)
Belgium (Flemish)	16 (1.0)	595 (6.9)	45 (0.9)	568 (3.8)	10 (0.7)	540 (6.3)	0 (0.1)	~ ~	29 (1.0)	534 (4.2)
Bulgaria	34 (2.9)	541 (10.3)	51 (2.4)	502 (4.4)	7 (0.8)	460 (7.4)	1 (0.2)	~ ~	7 (0.7)	490 (11.7)
Canada	45 (1.3)	543 (3.5)	34 (1.0)	530 (2.8)	6 (0.5)	509 (8.1)	0 (0.1)	~ ~	15 (0.7)	506 (4.0)
Chile r	14 (1.4)	470 (11.5)	30 (1.2)	415 (5.4)	34 (1.4)	366 (3.1)	13 (0.8)	351 (6.2)	10 (0.6)	376 (6.5)
Chinese Taipei	15 (1.0)	635 (6.5)	64 (0.8)	590 (3.8)	14 (0.7)	550 (4.8)	1 (0.1)	~ ~	7 (0.4)	527 (7.5)
Cyprus	22 (0.7)	513 (4.3)	48 (0.9)	484 (2.3)	26 (0.9)	444 (3.2)	1 (0.2)	~ ~	3 (0.3)	448 (8.7)
Czech Republic	22 (1.2)	555 (6.2)	46 (1.3)	527 (4.5)	21 (1.2)	503 (5.5)	0 (0.0)	~ ~	11 (0.9)	480 (7.1)
England	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –
Finland	7 (0.8)	559 (5.8)	28 (1.1)	538 (3.9)	11 (0.7)	503 (5.4)	3 (0.4)	508 (8.9)	51 (1.5)	515 (3.4)
Hong Kong, SAR	7 (0.7)	607 (8.5)	38 (1.0)	591 (4.3)	32 (0.9)	583 (4.2)	9 (0.7)	558 (7.6)	13 (0.6)	568 (5.7)
Hungary	27 (1.4)	583 (4.9)	59 (1.3)	525 (3.2)	7 (0.7)	462 (7.0)	0 (0.0)	~ ~	7 (0.7)	491 (9.4)
Indonesia	9 (0.9)	450 (12.8)	30 (1.2)	431 (5.5)	44 (1.4)	385 (5.0)	10 (0.6)	385 (8.3)	7 (0.6)	391 (9.3)
Iran, Islamic Rep.	8 (1.1)	469 (7.7)	17 (1.4)	455 (6.0)	48 (1.5)	421 (3.0)	25 (1.5)	402 (3.8)	2 (0.2)	~ ~
Israel	34 (1.6)	507 (4.9)	42 (1.3)	469 (3.4)	10 (0.6)	428 (7.3)	3 (0.7)	356 (23.6)	11 (1.0)	442 (9.6)
Italy	10 (0.8)	513 (6.4)	45 (1.3)	499 (3.6)	40 (1.5)	455 (4.5)	2 (0.3)	~ ~	3 (0.4)	453 (12.0)
Japan	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –
Jordan	29 (1.1)	467 (6.3)	34 (1.0)	435 (4.3)	23 (0.9)	401 (5.8)	5 (0.5)	383 (10.1)	8 (0.7)	405 (7.7)
Korea, Rep. of	25 (1.0)	620 (2.5)	48 (0.8)	587 (2.7)	14 (0.5)	566 (3.2)	5 (0.4)	559 (6.1)	8 (0.4)	545 (4.3)
Latvia (LSS)	29 (1.5)	538 (5.1)	42 (1.3)	509 (3.9)	7 (0.7)	456 (9.7)	0 (0.1)	~ ~	21 (1.3)	481 (5.0)
Lithuania ‡	29 (1.6)	523 (5.8)	54 (1.5)	476 (3.9)	4 (0.6)	436 (11.9)	0 (0.1)	~ ~	13 (0.9)	449 (7.5)
Macedonia, Rep. of	18 (1.2)	507 (6.8)	51 (1.2)	465 (4.1)	24 (1.5)	395 (7.5)	3 (0.6)	383 (18.8)	3 (0.4)	411 (9.8)
Malaysia	12 (0.9)	569 (6.6)	44 (0.9)	525 (4.8)	29 (1.0)	506 (5.1)	3 (0.3)	496 (8.4)	12 (0.9)	489 (6.4)
Moldova	28 (1.5)	493 (5.8)	49 (1.6)	471 (4.9)	8 (0.8)	460 (9.5)	1 (0.1)	~ ~	14 (1.2)	445 (6.4)
Morocco r	7 (0.7)	366 (11.6)	14 (0.8)	356 (6.2)	27 (0.9)	341 (7.7)	42 (1.9)	330 (4.3)	9 (0.7)	337 (8.6)
Netherlands	12 (1.1)	572 (9.8)	53 (2.4)	553 (6.8)	7 (1.0)	518 (12.6)	1 (0.5)	~ ~	27 (2.1)	516 (9.1)
New Zealand	28 (1.4)	531 (6.2)	34 (0.7)	486 (5.3)	12 (0.7)	475 (5.9)	0 (0.1)	~ ~	25 (1.1)	467 (6.1)
Philippines	30 (1.5)	385 (9.8)	37 (0.9)	341 (6.8)	25 (1.1)	327 (7.4)	5 (0.4)	304 (11.1)	4 (0.4)	331 (12.8)
Romania	20 (1.7)	516 (9.1)	49 (1.6)	484 (5.1)	17 (1.6)	459 (7.7)	3 (0.5)	419 (17.8)	11 (0.9)	432 (9.5)
Russian Federation	33 (1.4)	551 (6.4)	47 (1.2)	522 (6.4)	5 (0.5)	488 (10.2)	1 (0.2)	~ ~	14 (0.9)	504 (6.1)
Singapore	11 (1.0)	652 (8.4)	51 (1.0)	608 (5.8)	23 (1.0)	589 (6.9)	4 (0.3)	579 (9.2)	12 (0.6)	588 (7.0)
Slovak Republic	22 (1.5)	578 (4.7)	64 (1.3)	529 (3.8)	6 (0.7)	488 (8.9)	0 (0.1)	~ ~	8 (0.7)	492 (5.7)
Slovenia	19 (0.9)	573 (5.1)	65 (1.0)	528 (2.8)	10 (0.7)	495 (6.1)	1 (0.2)	~ ~	5 (0.5)	492 (9.9)
South Africa	15 (1.1)	323 (12.9)	30 (1.3)	293 (9.4)	32 (1.1)	256 (6.2)	11 (1.2)	225 (9.1)	12 (0.9)	266 (9.7)
Thailand	9 (0.9)	539 (10.2)	13 (0.8)	495 (6.5)	40 (1.3)	466 (5.4)	30 (1.5)	448 (6.2)	9 (0.7)	447 (6.9)
Tunisia	10 (0.8)	477 (4.6)	28 (1.1)	455 (3.1)	41 (1.3)	443 (2.8)	14 (0.9)	431 (3.7)	6 (0.9)	439 (6.3)
Turkey	9 (0.8)	486 (7.6)	20 (1.0)	447 (5.8)	60 (1.3)	419 (3.5)	10 (0.7)	416 (8.4)	2 (0.2)	~ ~
United States	35 (1.7)	535 (4.9)	46 (1.3)	496 (3.2)	5 (0.4)	456 (5.4)	1 (0.2)	~ ~	13 (0.7)	468 (5.6)
International Avg.	20 (0.2)	525 (1.4)	41 (0.2)	492 (0.8)	21 (0.2)	460 (1.1)	6 (0.1)	418 (3.0)	12 (0.1)	463 (1.3)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students

* Response categories were defined by each country to conform to their own educational system and may not be strictly comparable across countries. See reference exhibit R1.6 for country modifications to the definitions of educational levels.

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

2 Finished upper secondary school with or without some tertiary education not equivalent to a university degree. In most countries, finished secondary corresponds to completion of an upper-secondary track terminating after 11 to 13 years of schooling (ISCED level 3 vocational, apprenticeship or academic tracks).

3 Finished primary school or attended some secondary school not equivalent to completion of upper secondary.

4 Some primary school or did not go to school.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available. A tilde (~) indicates insufficient data to report achievement.

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

Exhibit R1.6 Overleaf

Exhibit R1.6 Country Modifications to the Definitions of Educational Levels for Parents' Education or Students' Expectations for Finishing School*

	Finished University	Finished Upper Secondary School But Not University	
		Post-Secondary Level	Upper-Secondary Level [1]
Internationally Defined Level	Finished University	Some Vocational-Technical Education After Secondary School or Some University	Finished Secondary School
Australia §			
Belgium (Flemish) §		Post-Secondary Tertiary Higher Education Outside University or Some Years of University	Finish Higher Secondary School
Canada	Finish University or College	Some Vocational-Technical Education After Secondary School or Some University or College	
Chile			
Cyprus §	University Degree		Finish Upper Secondary
Czech Republic (P) §‡	Finish University (4-5 years university study)	Some Vocational-Technical Education After Secondary School or Some University	Vocational Training or Secondary With Maturita
Czech Republic (S)	Finish University (4-5 years university study)	Medium-cycle higher education or bachelor studies (3 years university study or special higher education)	Vocational Training or Secondary With Maturita
Finland			Finish secondary school (about 12 years)
Hungary §	University or College Degree	Not Included	Apprenticeship (3-year trade school) or Final Exam in Secondary School (4-year academic/vocational)
Indonesia	Completed University Degree (Sarjana 1/2/3)	Academy (3 years or less of higher education outside university - Diploma D1/D2/D3) or Some University (Did Not Complete Degree)	Finish Secondary (SMP, SMA, SMEA, STM, etc.)
Italy §	Finish University (Laurea or Dottorato di Ricerca; 4-6 Year Diploma)	Vocational/Professional Course After Secondary Diploma or Some University (2-3 Year Short-Course Diploma)	Finish Secondary School With Maturita (Classical/Technical) or Vocational Training Diploma
Japan (S) [3]	University or Graduate School	Vocational/Technical Education After Secondary or 2-year college	Upper secondary
Korea, Rep. of §			
Latvia (LSS) §	Higher Education (5 years)	Vocational School (Post-Secondary) or Technikum (3 years) or Some Higher Education	Finish Secondary or Vocational School (11 years)
Lithuania §	University or Other Higher Education	Vocational or Agricultural School or College (Technical, Art, Music)	
Netherlands	University With Diploma	Vocational/Technical Education After Secondary (bv.heao, hts, pedagogical academy) or Some Years At University (Without Diploma)	Finish Secondary School With Diploma
New Zealand (P) ‡	University or Teachers' College (College of Education)	Vocational/Polytechnic Education After Secondary School or Some University	Complete Form 6 or Form 7
New Zealand (S) §	University, College of Education (teacher training) or degree or national diploma course at polytech	Certificate course at polytech (e.g, trade certificate) or some university	Finish secondary school (complete Form 6 or Form 7)
Philippines §	Finish College/University	Some Vocational/Technical Education After High School or Some College/University	Finish High School
Romania §	Finish University (facultate)	Post-Secondary Technical School or Did Not Complete University	Finish Senior Secondary (liceu)
Singapore §		Finish JC/Pre-U or Polytechnic or Some Other Vocational/Technical Education After Secondary (e.g., ITE, VITB)' [includes GCE 'A' level, which is 2 years additional schooling beyond completion of secondary.]	Finish Secondary School
Slovenia (S) §‡			Finish gymnasium or secondary school
South Africa §		Finish Technikon or Some University	Finish Secondary
Thailand §	Graduate level (Finish Tertiary Education, 4 years)	Diploma/Undergraduate Level (higher certificate, 2 years)	Finish Academic or Vocational/Technical Upper-Secondary Track
Tunisia	Bachelor's Degree (BA)		
United States (P) ‡	Completed Bachelor's Degree at College or University	Some Vocational-Technical Education After Secondary School or Some Community College, College or University Courses	Finish High School
United States (S) §	Finish community college, college or university	Some Vocational-Technical Education After Secondary School or Some Community College, College or University Courses	Finish High School

National educational level is the same as the internationally-defined level

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

* Educational levels were translated and defined in most countries to be comparable to the internationally-defined levels. Countries that used modified response options to conform to their national education systems are indicated to aid in the interpretation of the reporting categories in exhibits 4.4 and R1.5. National modifications pertain to both the parents' education and students' expectations questions unless otherwise indicated.

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

2 Primary school or lower educational levels were included only in the parents' education question.

3 Japan administered the question pertaining to students' expectations but not the question pertaining to parents' education.

§ Some educational levels modified from 1995.

‡ Educational levels differ for the parents' education (P) question and the students' expectations (S) question.

Finished Primary School But Not Upper Secondary School: Lower-Secondary Level	Finished Primary School But Not Upper Secondary School: Primary Level[2]	Did Not Finish Primary School[2]	
Finished Some Secondary School	Finished Primary School	Some Primary School or Did Not Go to School	**Internationally Defined Level**
		Less Than Year 6 in Primary School	Australia
Finish Lower Secondary School	Finish Basic School	Some Years of Basic School or Did Not Go to School	Belgium (Flemish)
			Canada
	Finish Primary School (grade 8)		Chile
Finish Lower Secondary (Gymnasium - grade 9)			Cyprus
Vocational Training or Secondary School Without Maturita		Not Included	Czech Republic (P)
Vocational Training or Secondary School Without Maturita			Czech Republic (S)
Some Secondary School (10 - 11 years)	Finish Primary School (about 9 years)	Did Not Go to School, Primary School or Part of Lower Secondary (< 9 years)	Finland
Finish General School (grade 8)	Some General School	Not Included	Hungary
	Finish Primary School (SD)		Indonesia
Finish Middle School			Italy
Lower Secondary			Japan (S)
Some High School	Finish Middle School	Some middle school or did not go to school	Korea, Rep. of
			Latvia (LSS)
	Finish Basic School (grade 10)	Some Basic School or Did Not Go to School	Lithuania
Some Years of Secondary School (mavo, havo, vwo) without Diploma	Finish Primary School (grade 8)		Netherlands
			New Zealand (P)
			New Zealand (S)
Some High School	Finish Elementary School	Some Elementary School or Did Not Go to School	Philippines
Did Not Complete Senior Secondary	Finish Junior Secondary (Gymnasium - grade 8)	Did Not Finish Grade 8 or Did Not Go to School	Romania
			Singapore
			Slovenia (S)
			South Africa
Finish Lower Secondary School	Finish Upper Primary School	Finish Lower Primary School or Did Not Go to School	Thailand
			Tunisia
Some High School	Finish Elementary School	Finish elementary school or did not go to school	United States (P)
Some High School			United States (S)

National educational level is the same as the internationally-defined level

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Exhibit R1.7 Students' Perception of the Importance of Various Activities

TIMSS 1999 8th grade Mathematics

	Percentage of Students Agreeing That It Is Important to Do Each Activity				
	Do Well in Mathematics	Do Well in Science	Do Well in Language	Have Time to Have Fun	Be Good at Sports
Australia	97 (0.3)	92 (0.6)	97 (0.4)	99 (0.2)	83 (0.8)
Belgium (Flemish)	98 (0.3)	91 (0.8)	96 (0.4)	98 (0.4)	77 (0.9)
Bulgaria	96 (0.6)	91 (0.8)	96 (0.5)	96 (0.5)	83 (1.0)
Canada	98 (0.2)	95 (0.4)	97 (0.5)	99 (0.2)	82 (0.6)
Chile	99 (0.2)	98 (0.2)	98 (0.2)	98 (0.3)	95 (0.4)
Chinese Taipei	89 (0.5)	89 (0.5)	89 (0.5)	99 (0.1)	94 (0.3)
Cyprus	96 (0.3)	91 (0.5)	96 (0.3)	97 (0.3)	90 (0.5)
Czech Republic	98 (0.3)	93 (0.6)	97 (0.4)	97 (0.4)	82 (1.0)
England	99 (0.2)	97 (0.3)	99 (0.2)	98 (0.3)	79 (0.9)
Finland	93 (0.6)	84 (0.9)	91 (0.6)	96 (0.4)	82 (1.0)
Hong Kong, SAR	95 (0.4)	86 (0.7)	96 (0.4)	97 (0.3)	84 (0.6)
Hungary	97 (0.3)	87 (0.6)	97 (0.4)	96 (0.4)	68 (0.9)
Indonesia	97 (0.3)	98 (0.2)	98 (0.2)	71 (1.0)	96 (0.3)
Iran, Islamic Rep.	96 (0.4)	96 (0.3)	94 (0.5)	89 (0.6)	93 (0.5)
Israel	98 (0.3)	90 (0.7)	92 (0.6)	96 (0.4)	86 (0.7)
Italy	97 (0.4)	94 (0.5)	97 (0.3)	98 (0.3)	89 (0.6)
Japan	88 (0.5)	83 (0.7)	89 (0.6)	99 (0.2)	82 (0.6)
Jordan	96 (0.4)	97 (0.3)	95 (0.4)	87 (0.7)	89 (0.5)
Korea, Rep. of	90 (0.4)	87 (0.5)	89 (0.4)	92 (0.3)	88 (0.5)
Latvia (LSS)	98 (0.3)	86 (0.9)	98 (0.3)	97 (0.3)	88 (0.7)
Lithuania ‡	97 (0.4)	84 (1.0)	98 (0.3)	96 (0.4)	92 (0.6)
Macedonia, Rep. of	95 (0.4)	96 (0.4)	97 (0.3)	94 (0.5)	95 (0.4)
Malaysia	99 (0.1)	99 (0.1)	99 (0.2)	78 (1.0)	93 (0.5)
Moldova	93 (0.7)	95 (0.6)	95 (0.4)	92 (0.7)	91 (0.5)
Morocco	r 91 (0.5)	r 92 (0.6)	r 90 (0.5)	r 65 (1.1)	r 91 (0.5)
Netherlands	98 (0.3)	94 (0.9)	99 (0.3)	98 (0.3)	76 (1.5)
New Zealand	97 (0.3)	93 (0.5)	97 (0.3)	98 (0.2)	86 (0.8)
Philippines	91 (0.6)	93 (0.5)	90 (0.8)	78 (1.0)	87 (0.7)
Romania	97 (0.4)	94 (0.6)	98 (0.3)	91 (0.8)	83 (1.0)
Russian Federation	97 (0.4)	96 (0.3)	97 (0.4)	98 (0.3)	90 (0.6)
Singapore	99 (0.2)	98 (0.2)	100 (0.1)	93 (0.6)	90 (0.5)
Slovak Republic	99 (0.2)	96 (0.5)	99 (0.2)	99 (0.2)	91 (0.7)
Slovenia	91 (0.6)	80 (0.9)	92 (0.5)	97 (0.3)	87 (0.7)
South Africa	90 (0.5)	89 (1.3)	91 (0.6)	72 (1.1)	83 (0.7)
Thailand	95 (0.3)	96 (0.3)	97 (0.3)	92 (0.5)	95 (0.3)
Tunisia	96 (0.5)	97 (0.3)	96 (0.3)	83 (0.7)	91 (0.5)
Turkey	96 (0.3)	97 (0.3)	97 (0.2)	75 (1.0)	86 (0.6)
United States	97 (0.3)	96 (0.3)	96 (0.3)	99 (0.2)	84 (0.6)
International Avg.	96 (0.1)	92 (0.1)	96 (0.1)	92 (0.1)	87 (0.1)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

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

Exhibit R1.8 Students' Perception of Their Mothers' View of the Importance of Various Activities

TIMSS 1999 8th grade Mathematics

	Percentage of Students Agreeing That Their Mothers Think It Is Important to Do Each Activity				
	Do Well in Mathematics	Do Well in Science	Do Well in Language	Have Time to Have Fun	Be Good at Sports
Australia	98 (0.2)	96 (0.4)	98 (0.3)	95 (0.5)	78 (0.7)
Belgium (Flemish)	97 (0.4)	92 (0.6)	97 (0.5)	96 (0.5)	66 (1.6)
Bulgaria	97 (0.3)	92 (0.6)	96 (0.6)	90 (0.7)	79 (1.3)
Canada	99 (0.1)	98 (0.3)	99 (0.2)	96 (0.4)	76 (0.8)
Chile	99 (0.2)	98 (0.2)	99 (0.2)	93 (0.5)	95 (0.4)
Chinese Taipei	95 (0.5)	95 (0.4)	93 (0.4)	95 (0.3)	91 (0.4)
Cyprus	96 (0.4)	92 (0.5)	97 (0.3)	95 (0.4)	85 (0.8)
Czech Republic	99 (0.2)	96 (0.5)	99 (0.3)	90 (0.7)	72 (1.1)
England	99 (0.2)	98 (0.3)	99 (0.2)	94 (0.5)	74 (1.0)
Finland	96 (0.4)	90 (0.7)	95 (0.4)	88 (0.7)	74 (1.1)
Hong Kong, SAR	96 (0.3)	87 (0.7)	97 (0.3)	82 (0.7)	73 (0.9)
Hungary	97 (0.4)	86 (0.7)	97 (0.3)	83 (0.8)	46 (1.1)
Indonesia	97 (0.3)	98 (0.3)	98 (0.2)	65 (1.0)	95 (0.4)
Iran, Islamic Rep.	94 (0.4)	94 (0.5)	93 (0.5)	82 (0.8)	89 (0.6)
Israel	98 (0.2)	94 (0.5)	96 (0.3)	94 (0.4)	83 (0.8)
Italy	99 (0.3)	97 (0.3)	99 (0.2)	95 (0.4)	84 (0.8)
Japan	92 (0.5)	87 (0.6)	92 (0.5)	94 (0.4)	82 (0.6)
Jordan	95 (0.4)	96 (0.3)	95 (0.5)	82 (0.8)	86 (0.7)
Korea, Rep. of	95 (0.3)	90 (0.4)	92 (0.4)	66 (0.7)	78 (0.6)
Latvia (LSS)	98 (0.4)	90 (0.7)	98 (0.3)	90 (0.7)	82 (0.7)
Lithuania ‡	95 (0.5)	80 (1.0)	97 (0.4)	85 (0.8)	86 (0.8)
Macedonia, Rep. of	96 (0.3)	97 (0.3)	97 (0.3)	91 (0.7)	91 (0.6)
Malaysia	99 (0.1)	98 (0.2)	98 (0.2)	66 (1.2)	90 (0.5)
Moldova	91 (0.6)	91 (0.6)	93 (0.6)	85 (0.9)	86 (0.7)
Morocco	r 88 (0.7)	r 86 (0.7)	r 88 (0.6)	r 53 (1.2)	r 86 (0.7)
Netherlands	98 (0.3)	94 (0.8)	98 (0.3)	97 (0.5)	59 (1.9)
New Zealand	98 (0.2)	96 (0.3)	98 (0.2)	95 (0.4)	84 (0.9)
Philippines	90 (0.7)	93 (0.5)	89 (0.8)	75 (0.8)	85 (0.6)
Romania	97 (0.5)	96 (0.7)	98 (0.4)	79 (1.0)	75 (1.5)
Russian Federation	96 (0.4)	96 (0.4)	97 (0.4)	92 (0.4)	86 (0.7)
Singapore	99 (0.2)	98 (0.2)	98 (0.2)	76 (0.9)	80 (0.7)
Slovak Republic	99 (0.2)	98 (0.3)	99 (0.2)	96 (0.4)	89 (0.8)
Slovenia	91 (0.5)	83 (0.8)	94 (0.5)	89 (0.6)	82 (0.9)
South Africa	89 (0.6)	89 (1.2)	91 (0.6)	70 (1.0)	81 (0.8)
Thailand	94 (0.4)	96 (0.3)	97 (0.3)	80 (0.7)	93 (0.4)
Tunisia	92 (0.7)	96 (0.3)	94 (0.4)	72 (0.7)	87 (0.5)
Turkey	94 (0.5)	95 (0.4)	95 (0.4)	67 (1.0)	79 (0.9)
United States	98 (0.2)	98 (0.2)	98 (0.2)	93 (0.4)	76 (0.6)
International Avg.	96 (0.1)	93 (0.1)	96 (0.1)	85 (0.1)	81 (0.1)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

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

Exhibit R1.9 Students' Perception of Their Friends' View of the Importance of Various Activities

TIMSS 1999 8th grade Mathematics

	Percentage of Students Agreeing That Their Friends Think It Is Important To Do Each Activity				
	Do Well in Mathematics	Do Well in Science	Do Well in Language	Have Time to Have Fun	Be Good at Sports
Australia	79 (1.0)	65 (1.4)	78 (1.0)	98 (0.2)	81 (0.8)
Belgium (Flemish)	81 (1.1)	66 (1.2)	77 (1.4)	98 (0.5)	76 (1.1)
Bulgaria	84 (0.8)	70 (1.7)	85 (0.9)	96 (0.4)	82 (1.2)
Canada	84 (0.6)	72 (0.9)	82 (0.7)	99 (0.1)	84 (0.9)
Chile	94 (0.3)	89 (0.6)	94 (0.4)	98 (0.3)	95 (0.4)
Chinese Taipei	84 (0.7)	82 (0.7)	84 (0.6)	98 (0.2)	94 (0.4)
Cyprus	87 (0.6)	75 (0.9)	88 (0.6)	94 (0.4)	89 (0.5)
Czech Republic	84 (0.9)	68 (1.0)	83 (0.8)	97 (0.4)	83 (0.9)
England	90 (0.8)	84 (1.0)	90 (0.7)	99 (0.2)	80 (1.0)
Finland	70 (1.2)	53 (1.2)	65 (1.2)	97 (0.4)	74 (1.2)
Hong Kong, SAR	84 (0.7)	66 (1.0)	87 (0.8)	96 (0.3)	83 (0.8)
Hungary	80 (0.9)	62 (0.9)	79 (1.0)	94 (0.5)	62 (1.0)
Indonesia	96 (0.2)	96 (0.3)	97 (0.3)	69 (1.0)	95 (0.4)
Iran, Islamic Rep.	92 (0.5)	90 (0.5)	89 (0.8)	87 (0.6)	92 (0.5)
Israel	92 (0.5)	68 (1.2)	79 (0.9)	96 (0.4)	81 (0.9)
Italy	80 (0.9)	66 (1.3)	84 (0.7)	98 (0.3)	94 (0.5)
Japan	85 (0.6)	78 (0.8)	85 (0.8)	99 (0.2)	80 (0.7)
Jordan	93 (0.5)	95 (0.4)	93 (0.4)	85 (0.7)	88 (0.6)
Korea, Rep. of	77 (0.7)	72 (0.8)	73 (0.8)	93 (0.3)	80 (0.8)
Latvia (LSS)	87 (0.9)	53 (1.6)	87 (0.8)	96 (0.4)	85 (0.7)
Lithuania ‡	87 (1.0)	54 (1.4)	88 (0.8)	96 (0.4)	90 (0.7)
Macedonia, Rep. of	89 (0.6)	86 (0.7)	92 (0.5)	93 (0.6)	93 (0.5)
Malaysia	99 (0.2)	98 (0.2)	97 (0.3)	77 (1.0)	91 (0.5)
Moldova	91 (0.7)	90 (0.7)	93 (0.6)	93 (0.5)	90 (0.6)
Morocco	r 88 (0.7)	r 86 (0.6)	r 86 (0.6)	r 63 (1.0)	r 89 (0.5)
Netherlands	88 (1.0)	79 (1.2)	90 (0.9)	98 (0.4)	70 (1.9)
New Zealand	76 (0.9)	67 (1.1)	75 (0.8)	97 (0.4)	86 (0.7)
Philippines	88 (0.7)	91 (0.6)	87 (0.7)	79 (0.9)	86 (0.7)
Romania	90 (0.9)	84 (1.2)	92 (0.6)	92 (0.9)	83 (1.0)
Russian Federation	89 (0.6)	83 (0.7)	89 (0.6)	97 (0.4)	87 (0.8)
Singapore	96 (0.3)	94 (0.6)	97 (0.3)	93 (0.6)	88 (0.6)
Slovak Republic	88 (0.9)	78 (1.2)	89 (0.7)	99 (0.2)	93 (0.6)
Slovenia	69 (1.2)	44 (1.4)	70 (1.1)	96 (0.3)	85 (0.9)
South Africa	88 (0.6)	85 (1.1)	90 (0.6)	72 (1.1)	81 (0.7)
Thailand	94 (0.4)	95 (0.4)	96 (0.3)	93 (0.4)	95 (0.4)
Tunisia	91 (0.7)	88 (0.6)	91 (0.6)	81 (0.7)	88 (0.5)
Turkey	93 (0.3)	93 (0.4)	94 (0.3)	77 (0.8)	85 (0.7)
United States	79 (0.8)	72 (0.8)	76 (1.0)	98 (0.2)	86 (0.5)
International Avg.	86 (0.1)	77 (0.2)	86 (0.1)	92 (0.1)	85 (0.1)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

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

Exhibit R1.10 Why Students Need to Do Well in Mathematics

TIMSS1999 8th grade Mathematics

	Percentage of Students Reporting								
	To Get Desired Job			To Please Parents			To Get Into Desired Secondary School or University		
	Strongly Agree	Agree	Disagree/ Strongly Disagree	Strongly Agree	Agree	Disagree/ Strongly Disagree	Strongly Agree	Agree	Disagree/ Strongly Disagree
Australia	37 (1.2)	42 (1.0)	21 (1.0)	24 (1.0)	48 (1.0)	29 (1.0)	36 (1.2)	44 (1.0)	20 (1.0)
Belgium (Flemish)	18 (1.2)	40 (1.4)	42 (1.1)	15 (0.6)	52 (1.2)	33 (1.1)	24 (0.8)	46 (1.3)	30 (1.2)
Bulgaria	45 (1.2)	39 (1.1)	16 (1.0)	25 (1.1)	36 (1.3)	40 (1.3)	50 (1.4)	36 (1.3)	14 (0.9)
Canada	43 (1.1)	40 (0.9)	17 (0.6)	25 (0.5)	46 (0.6)	30 (0.6)	57 (0.8)	36 (0.6)	7 (0.5)
Chile	52 (1.0)	33 (0.8)	15 (0.6)	38 (0.9)	35 (0.7)	27 (1.0)	66 (0.9)	26 (0.8)	7 (0.5)
Chinese Taipei	27 (0.7)	50 (0.8)	23 (0.9)	29 (0.8)	50 (0.6)	20 (0.7)	42 (0.9)	46 (0.7)	11 (0.5)
Cyprus	55 (1.2)	33 (1.1)	12 (0.6)	29 (0.9)	37 (0.8)	35 (0.9)	53 (1.1)	32 (1.0)	16 (0.7)
Czech Republic	32 (1.2)	48 (1.2)	20 (1.0)	22 (1.1)	56 (1.0)	22 (1.0)	46 (1.3)	39 (1.0)	15 (0.9)
England	36 (1.2)	41 (1.0)	23 (1.0)	21 (1.0)	41 (0.9)	38 (1.0)	43 (1.3)	42 (1.1)	15 (0.9)
Finland	22 (1.1)	46 (1.0)	32 (1.3)	8 (0.6)	35 (1.1)	57 (1.1)	25 (1.0)	56 (1.0)	19 (0.9)
Hong Kong, SAR	28 (0.8)	53 (0.8)	19 (0.6)	26 (0.7)	55 (0.7)	19 (0.7)	29 (0.8)	49 (0.8)	22 (0.8)
Hungary	25 (0.9)	58 (1.0)	16 (0.8)	8 (0.5)	45 (1.0)	47 (1.1)	33 (1.0)	49 (1.0)	18 (1.0)
Indonesia	46 (0.9)	50 (0.8)	4 (0.3)	45 (0.9)	50 (0.8)	5 (0.4)	46 (0.9)	49 (0.7)	5 (0.3)
Iran, Islamic Rep.	50 (1.3)	35 (0.8)	15 (0.8)	60 (1.1)	34 (1.0)	6 (0.4)	59 (1.3)	32 (1.1)	9 (0.7)
Israel	51 (1.3)	31 (0.9)	18 (0.8)	37 (1.0)	35 (1.0)	29 (0.8)	66 (1.2)	27 (1.0)	7 (0.5)
Italy	30 (0.7)	45 (1.0)	24 (0.8)	27 (1.0)	51 (1.0)	22 (0.9)	33 (0.7)	46 (1.0)	20 (0.9)
Japan	12 (0.5)	39 (0.7)	49 (1.0)	6 (0.4)	25 (0.7)	69 (0.8)	34 (0.8)	54 (0.7)	11 (0.7)
Jordan	60 (0.8)	30 (0.8)	10 (0.5)	59 (1.0)	30 (0.9)	11 (0.7)	69 (0.9)	23 (0.7)	7 (0.6)
Korea, Rep. of	10 (0.5)	34 (0.6)	56 (0.7)	12 (0.5)	50 (0.7)	38 (0.7)	31 (0.7)	54 (0.7)	15 (0.5)
Latvia (LSS)	36 (1.2)	50 (1.3)	14 (0.8)	21 (0.9)	52 (1.1)	27 (1.2)	47 (1.2)	46 (1.1)	7 (0.5)
Lithuania ‡	43 (1.3)	46 (1.3)	11 (0.9)	10 (0.7)	28 (1.2)	62 (1.2)	44 (1.3)	44 (1.3)	12 (0.9)
Macedonia, Rep. of	41 (1.1)	40 (1.0)	19 (0.8)	35 (1.1)	34 (0.9)	31 (1.2)	53 (1.0)	37 (0.9)	9 (0.5)
Malaysia	61 (1.0)	34 (0.9)	5 (0.3)	59 (1.2)	35 (0.9)	7 (0.6)	64 (1.1)	32 (1.0)	4 (0.4)
Moldova	40 (1.1)	46 (1.1)	14 (0.8)	31 (1.2)	47 (1.0)	23 (1.2)	39 (1.1)	47 (0.9)	15 (0.8)
Morocco	r 59 (0.9)	32 (0.9)	10 (0.6)	r 61 (0.8)	31 (0.7)	8 (0.6)	r 58 (0.9)	33 (0.8)	9 (0.7)
Netherlands	18 (1.2)	37 (0.9)	45 (1.3)	7 (0.8)	36 (1.2)	57 (1.3)	20 (1.2)	45 (1.1)	35 (1.6)
New Zealand	41 (1.1)	43 (0.9)	17 (0.8)	24 (1.0)	46 (0.9)	31 (0.9)	39 (1.0)	45 (1.0)	16 (0.9)
Philippines	44 (1.1)	44 (0.8)	11 (0.7)	34 (0.8)	48 (0.7)	19 (0.7)	47 (1.0)	41 (0.8)	12 (0.7)
Romania	40 (1.3)	48 (1.2)	12 (0.8)	34 (1.3)	49 (1.1)	17 (1.4)	45 (1.3)	43 (1.1)	12 (0.8)
Russian Federation	42 (1.1)	42 (1.0)	16 (0.8)	20 (0.7)	40 (1.0)	39 (1.3)	40 (1.0)	48 (1.0)	12 (0.6)
Singapore	40 (1.0)	46 (0.8)	13 (0.6)	26 (0.8)	46 (0.6)	28 (0.8)	54 (1.1)	41 (1.0)	5 (0.4)
Slovak Republic	31 (1.1)	53 (1.1)	17 (1.0)	13 (0.8)	47 (1.3)	40 (1.6)	49 (1.1)	45 (0.9)	6 (0.5)
Slovenia	25 (1.0)	52 (1.0)	24 (1.0)	6 (0.6)	26 (0.9)	67 (1.1)	35 (1.0)	54 (1.0)	11 (0.6)
South Africa	58 (0.9)	29 (0.6)	13 (0.7)	43 (1.0)	35 (1.0)	22 (0.8)	57 (1.0)	28 (0.7)	15 (0.6)
Thailand	43 (0.9)	52 (0.9)	5 (0.4)	50 (0.9)	47 (0.9)	3 (0.3)	54 (1.0)	42 (0.9)	4 (0.3)
Tunisia	51 (1.0)	33 (0.9)	16 (0.6)	36 (0.9)	42 (0.7)	22 (0.8)	51 (0.9)	34 (0.7)	15 (0.6)
Turkey	43 (0.8)	44 (0.7)	13 (0.6)	36 (0.9)	42 (0.8)	22 (0.8)	55 (0.8)	38 (0.7)	8 (0.3)
United States	41 (0.8)	40 (0.7)	18 (0.6)	34 (0.8)	47 (0.7)	19 (0.6)	58 (1.2)	36 (1.0)	6 (0.3)
International Avg.	39 (0.2)	42 (0.2)	19 (0.1)	29 (0.1)	42 (0.1)	30 (0.2)	46 (0.2)	41 (0.2)	13 (0.1)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

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

Exhibit R1.11 Students' Daily Out-of-School Study Time

	Average Hours Spent Each Day Studying or Doing Homework[1]				Percentage of Students Reporting Spending Some Time Studying All Three Subjects: Mathematics, Science, and Other
	Mathematics	Science	Other School Subjects	Total	
Australia	0.7 (0.02)	0.6 (0.02)	0.8 (0.02)	2.0 (0.04)	74 (1.6)
Belgium (Flemish)	1.1 (0.03)	0.8 (0.03)	1.4 (0.04)	2.9 (0.05)	86 (1.2)
Bulgaria	1.1 (0.04)	1.1 (0.03)	1.3 (0.04)	3.0 (0.06)	74 (1.9)
Canada	0.8 (0.02)	0.6 (0.01)	1.0 (0.02)	2.2 (0.04)	78 (1.0)
Chile	0.9 (0.02)	0.9 (0.02)	1.2 (0.03)	2.4 (0.04)	75 (1.0)
Chinese Taipei	0.7 (0.02)	0.6 (0.02)	1.0 (0.02)	2.0 (0.05)	55 (1.3)
Cyprus	1.1 (0.03)	0.7 (0.02)	1.5 (0.03)	2.8 (0.04)	79 (0.8)
Czech Republic	0.7 (0.02)	0.6 (0.02)	0.7 (0.02)	1.9 (0.04)	74 (1.4)
England	– –	– –	– –	– –	– –
Finland	0.6 (0.01)	0.5 (0.01)	0.7 (0.01)	1.8 (0.02)	90 (0.8)
Hong Kong, SAR	0.7 (0.02)	0.5 (0.01)	0.7 (0.02)	1.6 (0.04)	53 (1.3)
Hungary	0.8 (0.02)	1.1 (0.02)	1.2 (0.03)	2.8 (0.04)	90 (0.8)
Indonesia	1.2 (0.03)	1.1 (0.02)	1.3 (0.02)	3.0 (0.05)	83 (1.0)
Iran, Islamic Rep.	1.9 (0.03)	1.6 (0.03)	2.0 (0.04)	r 4.0 (0.05)	92 (0.5)
Israel	1.1 (0.03)	0.8 (0.02)	1.4 (0.04)	2.7 (0.05)	79 (0.9)
Italy	1.3 (0.03)	1.0 (0.02)	1.9 (0.03)	3.6 (0.04)	91 (0.8)
Japan	0.6 (0.01)	0.4 (0.01)	0.8 (0.02)	1.7 (0.04)	59 (1.4)
Jordan	1.7 (0.03)	1.5 (0.03)	2.4 (0.05)	r 3.7 (0.06)	r 87 (0.9)
Korea, Rep. of	0.6 (0.02)	0.4 (0.01)	0.7 (0.02)	1.6 (0.03)	50 (0.9)
Latvia (LSS)	1.0 (0.02)	0.8 (0.02)	1.5 (0.03)	3.0 (0.04)	89 (0.7)
Lithuania ‡	0.9 (0.03)	0.8 (0.02)	1.5 (0.04)	2.8 (0.04)	89 (1.0)
Macedonia, Rep. of	1.2 (0.03)	2.0 (0.05)	1.5 (0.04)	r 3.4 (0.05)	90 (0.5)
Malaysia	1.6 (0.02)	1.3 (0.02)	1.8 (0.03)	3.8 (0.04)	94 (0.4)
Moldova	1.1 (0.03)	1.7 (0.04)	1.4 (0.04)	r 3.3 (0.05)	83 (0.8)
Morocco	r 1.7 (0.07)	r 1.5 (0.06)	r 1.8 (0.06)	s 3.1 (0.05)	s 77 (1.3)
Netherlands	0.6 (0.02)	0.6 (0.02)	1.0 (0.02)	2.2 (0.04)	89 (1.1)
New Zealand	0.7 (0.02)	0.6 (0.02)	0.9 (0.02)	2.0 (0.04)	76 (1.3)
Philippines	1.7 (0.04)	1.7 (0.04)	2.1 (0.04)	r 3.3 (0.04)	88 (0.7)
Romania	1.6 (0.05)	1.2 (0.03)	1.4 (0.04)	3.4 (0.06)	77 (1.2)
Russian Federation	1.1 (0.03)	1.5 (0.03)	1.2 (0.04)	3.1 (0.05)	89 (0.7)
Singapore	1.3 (0.02)	1.2 (0.02)	1.7 (0.03)	3.5 (0.04)	90 (0.8)
Slovak Republic	0.8 (0.02)	0.8 (0.02)	0.9 (0.02)	2.3 (0.03)	88 (0.8)
Slovenia	0.8 (0.02)	0.9 (0.02)	0.9 (0.02)	2.5 (0.03)	85 (1.0)
South Africa	1.8 (0.04)	1.5 (0.05)	2.0 (0.06)	r 3.1 (0.06)	71 (1.9)
Thailand	1.1 (0.02)	1.0 (0.02)	1.2 (0.02)	2.9 (0.04)	88 (0.6)
Tunisia	1.8 (0.03)	1.2 (0.03)	2.1 (0.03)	r 3.6 (0.04)	82 (0.8)
Turkey	1.2 (0.02)	1.2 (0.02)	1.9 (0.03)	3.5 (0.05)	90 (0.7)
United States	0.8 (0.02)	0.6 (0.01)	0.9 (0.02)	2.1 (0.04)	72 (1.6)
International Avg.	1.1 (0.00)	1.0 (0.00)	1.3 (0.01)	2.8 (0.01)	80 (0.2)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

1 Average hours based on: No time=0; less than 1 hour=.5; 1-2 hours=1.5; 3-5 hours=4; more than 5 hours=7.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

Exhibit R1.12 Trends in Students' Daily Out-of-School Study Time

TIMSS 1999
8th grade
Mathematics

	Spend Any Time Studying All Three Mathematics, Science, and Other Subjects			Spend At Least 3 Hours Studying Across Subjects			Spend 1 Hour or More Studying Mathematics		
	Percent of Students 1999	1995 - 1999 Difference		Percent of Students 1999	1995 - 1999 Difference		Percent of Students 1999	1995 - 1999 Difference	
Australia	74 (1.6)	4 (2.1)	●	17 (0.9)	1 (1.1)	●	22 (1.0)	1 (1.4)	●
Belgium (Flemish)	85 (1.2)	-3 (1.5)	●	41 (1.3)	-1 (2.0)	●	47 (1.2)	1 (2.0)	●
Canada	78 (1.0)	7 (2.0)	▲	24 (0.8)	4 (1.3)	▲	28 (1.0)	4 (1.5)	●
Cyprus	79 (0.8)	4 (1.2)	●	35 (1.1)	-5 (1.4)	▼	40 (1.1)	-7 (1.4)	▼
Czech Republic	74 (1.4)	5 (2.2)	●	16 (1.1)	3 (1.3)	●	20 (1.1)	4 (1.5)	●
England	– –	– –		– –	– –		– –	– –	
Hong Kong, SAR	53 (1.3)	-17 (2.1)	▼	16 (0.8)	-12 (1.4)	▼	24 (1.1)	-10 (1.6)	▼
Hungary	90 (0.8)	2 (1.1)	●	40 (1.3)	2 (1.9)	●	25 (1.1)	-3 (1.6)	●
Iran, Islamic Rep.	92 (0.5)	r -3 (0.7)	▼	69 (1.1)	s -4 (1.9)	●	75 (1.0)	-3 (1.5)	●
Israel †	80 (0.9)	4 (1.7)	●	33 (1.7)	2 (2.5)	●	44 (1.5)	3 (2.9)	●
Italy	92 (0.8)	0 (1.2)	●	60 (1.6)	0 (2.2)	●	57 (1.6)	-1 (2.4)	●
Japan	59 (1.4)	-13 (1.9)	▼	17 (0.9)	-10 (1.3)	▼	20 (0.9)	-10 (1.3)	▼
Korea, Rep. of	50 (0.9)	-15 (1.6)	▼	16 (0.7)	-11 (1.4)	▼	21 (0.9)	-12 (1.5)	▼
Latvia (LSS)	89 (0.7)	9 (1.6)	▲	40 (1.2)	13 (1.6)	▲	40 (1.3)	8 (1.8)	▲
Lithuania	89 (1.0)	7 (1.5)	▲	35 (1.2)	10 (1.8)	▲	29 (1.3)	5 (1.7)	●
Netherlands	89 (1.1)	-1 (1.6)	●	19 (1.4)	3 (1.6)	●	14 (1.5)	3 (1.8)	●
New Zealand	76 (1.3)	0 (1.8)	●	17 (1.0)	1 (1.3)	●	20 (1.2)	2 (1.5)	●
Romania	76 (1.2)	1 (1.8)	●	55 (1.6)	r 4 (2.2)	●	66 (1.8)	3 (2.6)	●
Russian Federation	89 (0.7)	4 (1.1)	▲	48 (1.3)	13 (1.9)	▲	45 (1.5)	10 (1.9)	▲
Singapore	90 (0.8)	-2 (1.0)	●	59 (1.2)	-18 (1.5)	▼	61 (1.1)	-16 (1.5)	▼
Slovak Republic	88 (0.8)	4 (1.3)	▲	24 (0.9)	2 (1.3)	●	23 (0.9)	4 (1.4)	●
Slovenia	85 (1.0)	-1 (1.3)	●	32 (1.0)	-3 (1.4)	●	29 (1.0)	-6 (1.5)	▼
Thailand †	88 (0.6)	-3 (1.0)	●	45 (1.2)	-6 (2.0)	▼	49 (1.2)	-6 (2.2)	●
United States	72 (1.6)	1 (2.1)	●	22 (0.8)	0 (1.1)	●	27 (1.1)	0 (1.5)	●
International Avg. §	79 (0.2)	0 (0.4)	●	33 (0.2)	0 (0.4)	●	35 (0.3)	-1 (0.4)	●

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

Background data provided by students.

† Countries with unapproved sampling procedures at the classroom level in 1995.

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

Background data for Bulgaria and South Africa are unavailable for 1995.

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

A dash (–) indicates data are not available.

An "r" indicates a 70-84% student response rate, based on the lower response rate in either 1995 or 1999. An "s" indicates a 50-69% student response rate, based on the lower response rate in either 1995 or 1999.

Exhibit R1.13 Students' Daily Leisure Time*

TIMSS1999 8th grade Mathematics

	Average Hours Spent Each Day[1]					
	Watching Television or Videos	Playing Computer Games	Playing or Talking With Friends	Doing Jobs at Home	Playing Sports	Reading a Book for Enjoyment
Australia	2.3 (0.05)	0.8 (0.03)	1.5 (0.03)	0.9 (0.03)	1.6 (0.03)	0.6 (0.02)
Belgium (Flemish)	2.1 (0.04)	0.9 (0.04)	1.8 (0.05)	1.0 (0.04)	1.8 (0.07)	0.6 (0.02)
Bulgaria	2.8 (0.05)	0.8 (0.04)	2.6 (0.06)	1.9 (0.04)	1.5 (0.05)	1.0 (0.03)
Canada	2.2 (0.03)	0.8 (0.02)	2.1 (0.04)	1.1 (0.03)	1.9 (0.03)	0.7 (0.04)
Chile	2.7 (0.05)	0.6 (0.02)	1.9 (0.04)	1.5 (0.03)	2.0 (0.03)	0.7 (0.02)
Chinese Taipei	2.0 (0.04)	0.9 (0.03)	1.3 (0.03)	1.0 (0.02)	1.2 (0.02)	0.9 (0.02)
Cyprus	2.2 (0.04)	1.0 (0.03)	1.8 (0.04)	0.9 (0.03)	1.4 (0.04)	0.7 (0.02)
Czech Republic	2.3 (0.05)	0.9 (0.06)	3.0 (0.07)	1.2 (0.03)	2.0 (0.05)	1.0 (0.04)
England	2.6 (0.05)	1.2 (0.04)	2.5 (0.08)	0.8 (0.02)	1.6 (0.04)	0.6 (0.02)
Finland	2.5 (0.04)	1.1 (0.03)	3.2 (0.07)	0.9 (0.02)	1.6 (0.04)	0.8 (0.02)
Hong Kong, SAR	2.4 (0.04)	1.0 (0.03)	1.3 (0.04)	0.6 (0.01)	1.0 (0.03)	0.8 (0.02)
Hungary	2.7 (0.05)	1.0 (0.03)	2.0 (0.05)	1.6 (0.04)	1.5 (0.04)	0.8 (0.02)
Indonesia	1.7 (0.05)	0.2 (0.02)	1.1 (0.02)	1.9 (0.03)	1.0 (0.02)	0.9 (0.02)
Iran, Islamic Rep.	1.8 (0.04)	0.3 (0.03)	1.3 (0.04)	1.7 (0.04)	1.3 (0.06)	0.9 (0.02)
Israel	3.1 (0.05)	1.5 (0.04)	2.4 (0.04)	1.3 (0.05)	1.8 (0.05)	1.0 (0.03)
Italy	1.8 (0.03)	1.0 (0.03)	2.7 (0.05)	1.1 (0.03)	1.7 (0.03)	0.7 (0.02)
Japan	3.1 (0.05)	0.9 (0.03)	1.8 (0.04)	0.5 (0.02)	1.1 (0.03)	0.8 (0.02)
Jordan	1.7 (0.04)	0.8 (0.04)	1.1 (0.04)	1.3 (0.05)	1.4 (0.05)	r 1.4 (0.04)
Korea, Rep. of	2.9 (0.04)	0.8 (0.03)	1.3 (0.03)	0.6 (0.01)	0.6 (0.02)	0.6 (0.01)
Latvia (LSS)	2.8 (0.05)	0.7 (0.03)	2.6 (0.06)	1.7 (0.03)	1.3 (0.03)	0.9 (0.03)
Lithuania ‡	2.4 (0.05)	0.6 (0.03)	2.4 (0.06)	1.6 (0.05)	1.0 (0.03)	0.7 (0.02)
Macedonia, Rep. of	2.2 (0.05)	0.7 (0.04)	1.8 (0.05)	1.9 (0.04)	1.8 (0.05)	1.2 (0.04)
Malaysia	1.9 (0.05)	0.5 (0.02)	1.2 (0.03)	1.8 (0.03)	1.1 (0.02)	1.1 (0.02)
Moldova	2.6 (0.07)	1.0 (0.05)	1.9 (0.06)	3.2 (0.09)	1.4 (0.04)	1.5 (0.04)
Morocco	r 1.1 (0.03)	r 0.7 (0.02)	r 0.9 (0.03)	r 1.5 (0.03)	r 1.5 (0.04)	r 1.4 (0.05)
Netherlands	2.4 (0.10)	0.9 (0.04)	2.6 (0.09)	0.8 (0.04)	1.8 (0.06)	0.7 (0.04)
New Zealand	2.5 (0.05)	0.9 (0.04)	1.6 (0.04)	1.0 (0.03)	1.5 (0.04)	0.7 (0.02)
Philippines	1.7 (0.04)	0.7 (0.03)	1.2 (0.03)	2.4 (0.05)	1.6 (0.04)	1.6 (0.04)
Romania	2.2 (0.06)	0.6 (0.04)	1.6 (0.05)	2.0 (0.06)	1.2 (0.04)	1.0 (0.03)
Russian Federation	2.6 (0.05)	0.7 (0.03)	3.0 (0.05)	1.5 (0.03)	1.3 (0.03)	1.2 (0.03)
Singapore	2.4 (0.04)	1.1 (0.03)	1.5 (0.04)	0.9 (0.02)	1.5 (0.04)	1.0 (0.02)
Slovak Republic	2.5 (0.06)	0.6 (0.03)	2.7 (0.06)	1.6 (0.05)	1.9 (0.04)	0.7 (0.02)
Slovenia	2.3 (0.05)	0.9 (0.03)	1.8 (0.04)	1.2 (0.03)	1.6 (0.04)	0.7 (0.02)
South Africa	2.0 (0.07)	0.8 (0.04)	1.5 (0.04)	2.0 (0.04)	2.0 (0.05)	1.8 (0.05)
Thailand	2.1 (0.05)	0.4 (0.02)	1.6 (0.04)	1.6 (0.02)	1.5 (0.03)	1.0 (0.02)
Tunisia	2.0 (0.04)	0.9 (0.03)	1.3 (0.03)	1.7 (0.04)	1.9 (0.04)	1.4 (0.03)
Turkey	1.6 (0.04)	r 0.4 (0.02)	1.5 (0.03)	1.1 (0.04)	1.4 (0.03)	1.2 (0.03)
United States	2.5 (0.06)	0.9 (0.02)	2.4 (0.05)	1.1 (0.03)	1.9 (0.03)	0.6 (0.02)
International Avg.	2.3 (0.01)	0.8 (0.01)	1.9 (0.01)	1.4 (0.01)	1.5 (0.01)	1.0 (0.00)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

* Activities are not necessarily exclusive; students may have reported engaging in more than one activity at the same time.

1 Average hours based on: No time=0; less than 1 hour=.5; 1-2 hours=1.5; 3-5 hours=4; more than 5 hours=7.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

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

Exhibit R1.14 Students' Reports That Mathematics Is Not One of Their Strengths

TIMSS 1999 8th grade Mathematics

Country	Strongly Disagree		Disagree		Agree		Strongly Agree		Average [1]
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Australia	18 (1.1)	573 (5.8)	36 (1.0)	546 (5.3)	28 (0.9)	499 (5.2)	17 (0.8)	478 (5.4)	2.4 (0.03)
Belgium (Flemish)	17 (0.8)	598 (5.4)	30 (0.9)	580 (4.8)	31 (1.0)	540 (4.5)	21 (0.9)	526 (3.8)	2.6 (0.02)
Bulgaria	18 (1.9)	560 (10.6)	26 (1.2)	541 (6.3)	30 (1.4)	494 (4.9)	25 (1.5)	476 (5.1)	2.6 (0.05)
Canada	26 (1.2)	577 (3.2)	31 (0.7)	542 (3.0)	26 (1.0)	502 (4.7)	17 (0.8)	485 (3.4)	2.3 (0.03)
Chile	15 (0.6)	444 (8.7)	27 (0.7)	408 (4.7)	35 (0.7)	382 (4.7)	23 (0.7)	367 (5.5)	2.7 (0.02)
Chinese Taipei	16 (0.6)	646 (6.1)	28 (0.7)	623 (4.3)	34 (0.7)	564 (4.5)	23 (0.7)	533 (3.9)	2.6 (0.02)
Cyprus	23 (1.0)	525 (4.3)	34 (0.8)	492 (2.8)	27 (0.9)	445 (2.9)	16 (0.6)	438 (4.3)	2.4 (0.02)
Czech Republic	12 (0.9)	567 (6.9)	35 (1.2)	541 (5.0)	36 (1.1)	500 (4.7)	16 (0.9)	486 (5.8)	2.6 (0.03)
England	19 (0.9)	539 (6.9)	40 (1.2)	512 (4.5)	28 (1.2)	471 (4.8)	13 (0.8)	458 (6.3)	2.4 (0.02)
Finland	17 (0.8)	570 (4.4)	34 (1.0)	543 (3.8)	31 (1.1)	498 (2.6)	18 (1.0)	474 (3.7)	2.5 (0.03)
Hong Kong, SAR	11 (0.5)	619 (5.5)	31 (0.8)	606 (3.9)	39 (0.7)	573 (4.4)	20 (0.8)	549 (5.0)	2.7 (0.02)
Hungary	15 (0.7)	598 (5.7)	34 (1.1)	552 (4.7)	40 (1.1)	503 (3.7)	11 (0.7)	493 (5.9)	2.5 (0.02)
Indonesia	6 (0.4)	411 (10.6)	31 (0.8)	418 (5.2)	53 (1.0)	404 (4.6)	10 (0.5)	359 (10.7)	2.7 (0.01)
Iran, Islamic Rep.	26 (1.0)	459 (4.6)	35 (0.7)	426 (3.3)	25 (0.9)	404 (4.5)	14 (0.6)	397 (5.2)	2.3 (0.02)
Israel	29 (1.0)	508 (4.2)	32 (0.8)	483 (4.5)	25 (0.8)	438 (4.0)	14 (0.7)	418 (6.3)	2.2 (0.02)
Italy	22 (0.9)	529 (5.6)	32 (0.9)	495 (3.6)	27 (0.8)	456 (4.9)	18 (0.9)	435 (5.0)	2.4 (0.02)
Japan	12 (0.5)	602 (4.9)	29 (0.7)	598 (2.7)	38 (0.6)	576 (2.7)	21 (0.7)	545 (3.3)	2.7 (0.02)
Jordan	27 (1.1)	491 (5.4)	29 (0.9)	446 (4.3)	26 (0.9)	401 (4.3)	17 (0.8)	386 (4.8)	2.3 (0.03)
Korea, Rep. of	10 (0.5)	648 (3.9)	33 (0.7)	621 (3.0)	41 (0.8)	564 (2.7)	15 (0.5)	536 (3.6)	2.6 (0.02)
Latvia (LSS)	10 (0.7)	572 (6.2)	28 (1.1)	534 (4.9)	41 (1.0)	487 (3.8)	20 (0.9)	470 (4.3)	2.7 (0.02)
Lithuania ‡	11 (0.8)	536 (7.0)	35 (1.4)	508 (5.1)	42 (1.4)	461 (3.9)	12 (0.9)	436 (6.6)	2.6 (0.03)
Macedonia, Rep. of	13 (0.6)	501 (7.2)	27 (0.9)	474 (5.3)	37 (1.0)	441 (5.4)	24 (1.1)	423 (4.9)	2.7 (0.02)
Malaysia	23 (0.9)	544 (5.4)	45 (0.9)	525 (4.6)	27 (1.0)	497 (5.1)	5 (0.3)	481 (6.6)	2.1 (0.02)
Moldova	17 (1.0)	506 (6.0)	44 (1.2)	477 (4.6)	29 (1.0)	455 (5.5)	10 (0.7)	440 (6.9)	2.3 (0.02)
Morocco r	18 (0.7)	378 (6.1)	32 (1.2)	350 (5.9)	28 (0.9)	324 (4.2)	22 (0.7)	320 (6.0)	2.5 (0.02)
Netherlands	16 (0.8)	570 (7.4)	28 (1.4)	557 (7.9)	36 (1.5)	529 (8.2)	20 (1.0)	515 (9.2)	2.6 (0.03)
New Zealand	16 (0.8)	548 (6.7)	36 (1.1)	518 (5.4)	32 (0.9)	466 (4.7)	15 (0.8)	436 (5.1)	2.5 (0.03)
Philippines	14 (0.5)	374 (9.6)	37 (1.1)	368 (6.9)	31 (0.8)	337 (5.7)	17 (0.8)	309 (6.1)	2.5 (0.02)
Romania	11 (0.7)	517 (6.2)	26 (1.1)	498 (6.5)	44 (1.3)	466 (6.3)	19 (1.0)	450 (7.1)	2.7 (0.02)
Russian Federation	21 (0.9)	580 (5.8)	40 (0.9)	538 (5.6)	30 (1.2)	501 (7.3)	9 (0.6)	471 (10.0)	2.3 (0.03)
Singapore	16 (0.7)	631 (7.3)	37 (0.7)	614 (6.1)	33 (0.8)	593 (6.4)	13 (0.6)	575 (6.9)	2.4 (0.02)
Slovak Republic	12 (0.7)	586 (7.8)	34 (1.1)	554 (4.4)	40 (1.2)	516 (3.9)	14 (0.8)	498 (5.6)	2.6 (0.02)
Slovenia	24 (0.8)	583 (4.4)	40 (1.2)	542 (3.4)	24 (0.9)	490 (3.8)	12 (0.8)	471 (5.7)	2.2 (0.02)
South Africa	18 (0.6)	313 (8.5)	26 (1.0)	295 (12.4)	31 (0.8)	264 (6.8)	26 (0.9)	247 (5.2)	2.6 (0.02)
Thailand	7 (0.4)	515 (8.5)	34 (0.9)	490 (5.2)	46 (0.9)	454 (5.3)	13 (0.5)	435 (7.5)	2.6 (0.02)
Tunisia	25 (0.8)	476 (3.7)	31 (0.8)	452 (3.7)	25 (0.7)	432 (5.0)	19 (0.6)	428 (3.5)	2.4 (0.02)
Turkey	13 (0.5)	468 (5.9)	36 (0.8)	446 (4.8)	36 (0.8)	425 (3.8)	15 (0.6)	397 (6.4)	2.5 (0.02)
United States	26 (0.8)	547 (4.6)	33 (0.6)	517 (4.5)	24 (0.6)	478 (4.4)	18 (0.7)	455 (4.3)	2.3 (0.02)
International Avg.	17 (0.1)	532 (1.0)	33 (0.2)	506 (0.8)	33 (0.2)	469 (0.8)	17 (0.1)	450 (0.9)	2.5 (0.00)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

1 Average scale value based on: Strongly disagree=4; disagree=3; agree=2; strongly agree=1.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

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

Exhibit R1.15 Students' Liking Mathematics

	Like a Lot		Like		Dislike		Dislike a Lot		Average[1]
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	
Australia	17 (0.9)	552 (6.6)	51 (1.0)	528 (5.4)	23 (1.0)	512 (6.7)	10 (0.7)	496 (6.5)	2.7 (0.03)
Belgium (Flemish)	20 (0.9)	598 (5.1)	46 (1.3)	562 (4.2)	24 (1.3)	537 (6.8)	10 (0.7)	518 (5.1)	2.8 (0.02)
Bulgaria	22 (1.9)	540 (12.0)	46 (1.3)	520 (5.3)	23 (1.3)	491 (5.3)	9 (1.1)	475 (7.7)	2.8 (0.04)
Canada	24 (1.0)	561 (3.8)	49 (1.6)	531 (2.6)	18 (0.8)	513 (4.8)	9 (0.5)	486 (4.6)	2.9 (0.02)
Chile	26 (1.0)	416 (6.6)	47 (0.7)	392 (4.5)	20 (0.8)	378 (4.5)	6 (0.4)	364 (9.2)	2.9 (0.02)
Chinese Taipei	15 (0.7)	654 (5.3)	41 (0.8)	617 (3.5)	33 (0.8)	546 (5.2)	12 (0.6)	502 (5.3)	2.6 (0.02)
Cyprus	30 (1.0)	513 (3.3)	47 (1.1)	472 (2.8)	15 (0.8)	452 (4.9)	8 (0.6)	426 (5.4)	3.0 (0.02)
Czech Republic	11 (0.9)	580 (7.9)	44 (1.5)	530 (4.5)	34 (1.7)	498 (5.6)	11 (0.8)	489 (7.6)	2.5 (0.03)
England	23 (1.1)	514 (6.8)	54 (1.1)	497 (4.3)	16 (0.9)	487 (5.5)	6 (0.5)	470 (8.7)	3.0 (0.02)
Finland	17 (1.1)	558 (4.1)	47 (1.4)	522 (3.6)	27 (1.2)	508 (3.5)	9 (1.0)	480 (6.8)	2.7 (0.03)
Hong Kong, SAR	22 (0.7)	610 (4.7)	53 (0.7)	587 (4.0)	20 (0.8)	558 (4.7)	5 (0.4)	521 (7.3)	2.9 (0.02)
Hungary	14 (0.7)	592 (7.6)	48 (1.3)	537 (4.1)	30 (1.2)	506 (4.1)	8 (0.7)	501 (7.2)	2.7 (0.02)
Indonesia	22 (1.2)	418 (6.9)	70 (1.0)	403 (4.9)	8 (0.7)	377 (8.0)	1 (0.1)	~ ~	3.1 (0.02)
Iran, Islamic Rep.	35 (1.1)	447 (5.4)	49 (0.9)	416 (3.1)	10 (0.5)	394 (7.5)	6 (0.5)	389 (7.1)	3.1 (0.02)
Israel	29 (1.2)	469 (7.7)	45 (0.9)	476 (4.3)	17 (0.9)	472 (5.7)	8 (0.5)	429 (6.3)	3.0 (0.03)
Italy	30 (1.0)	517 (4.6)	38 (1.1)	482 (4.3)	22 (0.8)	446 (5.1)	10 (0.7)	433 (5.8)	2.9 (0.02)
Japan	9 (0.5)	631 (5.7)	39 (0.9)	600 (2.2)	38 (1.0)	563 (2.5)	14 (0.6)	530 (4.1)	2.4 (0.02)
Jordan	41 (1.4)	451 (5.8)	41 (0.9)	425 (3.4)	11 (0.7)	403 (5.6)	7 (0.6)	411 (6.7)	3.2 (0.03)
Korea, Rep. of	12 (0.5)	647 (4.2)	42 (0.8)	608 (2.4)	38 (0.7)	557 (2.7)	8 (0.4)	536 (3.8)	2.6 (0.02)
Latvia (LSS)	11 (0.7)	549 (6.7)	50 (1.3)	513 (4.1)	32 (1.3)	486 (4.5)	7 (0.6)	472 (7.5)	2.6 (0.02)
Lithuania ‡	16 (1.1)	527 (7.6)	55 (1.3)	483 (4.5)	24 (1.2)	458 (5.2)	4 (0.5)	446 (12.1)	2.8 (0.02)
Macedonia, Rep. of	30 (1.0)	460 (6.3)	51 (1.0)	451 (4.2)	14 (0.8)	440 (6.2)	5 (0.4)	446 (10.8)	3.1 (0.02)
Malaysia	42 (1.0)	540 (4.7)	53 (1.0)	505 (4.5)	4 (0.2)	486 (6.1)	1 (0.1)	~ ~	3.4 (0.01)
Moldova	26 (1.0)	455 (5.1)	17 (0.8)	453 (5.7)	53 (1.4)	486 (4.4)	4 (0.6)	485 (13.1)	2.6 (0.02)
Morocco r	54 (0.9)	352 (3.9)	33 (0.7)	335 (6.6)	9 (0.6)	307 (8.2)	3 (0.3)	308 (17.7)	3.4 (0.01)
Netherlands	– –	– –	– –	– –	– –	– –	– –	– –	– –
New Zealand	20 (1.0)	516 (7.5)	53 (0.9)	496 (5.0)	20 (0.8)	478 (6.6)	8 (0.6)	441 (7.8)	2.8 (0.02)
Philippines	32 (1.0)	358 (8.0)	59 (1.0)	348 (5.9)	7 (0.5)	313 (10.7)	2 (0.2)	~ ~	3.2 (0.01)
Romania	19 (0.8)	513 (7.4)	50 (0.9)	483 (6.1)	25 (1.0)	445 (6.7)	6 (0.7)	435 (10.9)	2.8 (0.02)
Russian Federation	22 (1.0)	562 (5.5)	56 (0.8)	529 (5.8)	19 (0.9)	498 (8.1)	3 (0.3)	460 (13.3)	3.0 (0.02)
Singapore	30 (1.0)	626 (6.6)	49 (0.8)	602 (6.4)	14 (0.6)	583 (7.3)	6 (0.4)	564 (7.5)	3.0 (0.02)
Slovak Republic	16 (1.0)	584 (5.7)	54 (1.2)	536 (4.0)	24 (1.2)	507 (5.2)	6 (0.6)	492 (8.3)	2.8 (0.03)
Slovenia	12 (0.7)	585 (6.4)	48 (1.6)	536 (3.2)	29 (1.1)	513 (3.7)	11 (0.8)	496 (6.7)	2.6 (0.02)
South Africa	53 (1.0)	275 (6.5)	35 (0.9)	276 (9.2)	8 (0.4)	288 (11.3)	5 (0.3)	268 (16.6)	3.4 (0.02)
Thailand	13 (0.7)	518 (6.2)	66 (0.8)	467 (5.1)	18 (0.9)	441 (6.0)	2 (0.2)	~ ~	2.9 (0.02)
Tunisia	31 (0.9)	472 (3.5)	46 (0.8)	448 (3.1)	15 (0.6)	423 (4.0)	9 (0.5)	412 (3.1)	3.0 (0.02)
Turkey	27 (1.0)	460 (6.1)	50 (0.8)	428 (4.1)	17 (0.8)	409 (5.4)	7 (0.4)	393 (8.0)	3.0 (0.02)
United States	23 (0.9)	527 (4.5)	46 (0.6)	505 (4.0)	19 (0.7)	496 (4.5)	12 (0.7)	465 (5.6)	2.8 (0.02)
International Avg.	24 (0.2)	518 (0.9)	48 (0.2)	489 (0.8)	21 (0.2)	466 (1.0)	7 (0.1)	456 (1.4)	2.9 (0.00)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background date provided by students.

1 Average scale value based on: Like a lot=4; like=3; dislike=2; dislike a lot=1.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available. A tilde (~) indicates insufficient data to report achievement.

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

REFERENCE 2

The Mathematics Curriculum

Exhibit R2.1 Achievement Standards in Mathematics

	Achievement Standards
Australia	Achievement standards are stated as learning outcomes.
Belgium (Flemish)	Achievement standards are stated in terms of final learning objectives for A Stream and developmental objectives for B Stream. Students not meeting the standards may need to repeat the grade, receive reduced hours of instruction, or be moved to an easier class.
Bulgaria	Achievement standards are stated as broad descriptions of what students should know. Students not meeting the standards take an extra exam to be promoted; some students may need to repeat the grade.
Canada	Achievement standards are stated as specific learning outcomes. Students are expected to learn each concept, topic, or application.
Chile	There are no performance standards but there are objectives describing what students should learn. The revised curriculum will include performance standards stated as expected learning outcomes.
Chinese Taipei	The curriculum does not incorporate achievement standards.
Cyprus	The curriculum does not incorporate achievement standards.
Czech Republic	The curriculum provides a description of the skills and knowledge students must have. Teachers decide if the student has met the curriculum standards and considers this in promotion. If a student fails a single subject, the student must repeat the grade.
England	Achievement standards are established as a system of levels, each level with its own description of performance. On average, at age 7 students are expected to be at level 2; at age 11 level 4; and at age 13 level 5/6. One level is regarded as two years progress. The government has set a target of 75% of 11 year olds reaching level 4 (or above) in mathematics by the year 2002.
Finland	The curriculum does not incorporate achievement standards.
Hong Kong, SAR	The achievement standards are stated as learner-centered objectives. A core of content is identified in the mathematics curriculum; exams and assessments have a portion of items from this core.
Hungary	Standards are stated as learning objectives.
Indonesia	There are instructional objectives in the curriculum but no performance standards.
Iran, Islamic Rep.	The curriculum does not incorporate achievement standards.
Israel	The curriculum does not incorporate achievement standards.
Italy	The curriculum does not incorporate achievement standards.
Japan	Achievement standards are stated in the national curriculum as learning objectives, such as "To help students…" or "To enable students to…".
Jordan	Objectives are defined in the curriculum and the minimum percent of attainment for each objective is specified (e.g., performs operations on real numbers - 80%).
Korea, Rep. of	Achievement standards will be included in the revised curriculum (to be implemented at the 8th grade in 2001).
Latvia (LSS)	The curriculum incorporates achievement standards.
Lithuania	Achievement standards are not a part of curricula, but are prepared as a separate document. The draft of the National Educational Standards was released in 1997. As of 1999, the document had not been officially approved.
Macedonia, Rep. Of	Achievement standards are stated as learning objectives.
Malaysia	Achievement standards are stated as mathematic skills in the curriculum content specifications document.
Moldova	The curriculum incorporates achievement standards.
Morocco	The curriculum does not incorporate achievement standards.
Netherlands	Achievement standards are stated as learning objectives, such as "Students develop a competence…" or "Students learn to research…".
New Zealand	Achievement standards are stated as learning outcomes expressed at eight levels of learning independent of age and grade.
Philippines	Achievement standards are stated as learning competencies.
Romania	The achievement standards are stated as learning objectives, such as "The student should be able to arrive at a conclusion based on experimental work".
Russian Federation	The requirements for content of instruction and for students' knowledge and performance (learning outcomes: "student should...") are included in the curriculum. They are recommended for schools by the Ministry of Education.
Singapore	Achievement standards are stated in terms of learning objectives and assessment guidelines (i.e. table of specifications).
Slovak Republic	Learning objectives are included in the curriculum. Performance standards are in development.
Slovenia	The curriculum states standards for student performance by grade level and subject area. If a student's achievement in a subject is under minimal standard, the student receives an unsatisfactory mark and must take a correcting exam in that subject. Students receiving three or more unsatisfactory marks must repeat the grade.
South Africa	The standards are not specific. A list of content to be covered is provided.
Thailand	The achievement standards describe what students should learn including performance levels and explicit criteria. Students must pass 50% of the standards. (The standards are set by the department that conducts the assessments and are NOT prescribed in the national curriculum.) Passing or failing the standards has no consequences for students.
Tunisia	Achievement standards are stated as learning objectives.
Turkey	Achievement standards are stated as objectives, such as "Ability to understand/know…".
United States	By 1999, all states were required to have performance standards.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by National Research Coordinators.

Exhibit R2.2 Organization of Mathematics Instruction

	Percentage of Students Whose Schools Reported Various Organizational Approaches in Mathematics Instruction to Accommodate Students with Different Abilities or Interests in Mathematics				
	All Classes Study Similar Content but at Different Levels of Difficulty	Students Are Grouped by Ability within Classes	Enrichment Mathematics Is Offered	Remedial Mathematics Is Offered	Different Classes Study Different Content
Australia	57 (4.0)	57 (4.3)	76 (3.6)	76 (4.0)	33 (3.9)
Belgium (Flemish)	66 (5.1)	11 (3.2)	36 (5.0)	81 (4.7)	100 (0.0)
Bulgaria	64 (5.1)	62 (5.1)	42 (5.1)	28 (4.4)	10 (2.5)
Canada	s 77 (3.4)	s 43 (4.3)	s 66 (3.8)	s 87 (2.5)	s 17 (3.0)
Chile	70 (3.4)	25 (2.9)	29 (2.8)	83 (3.0)	15 (3.0)
Chinese Taipei	50 (4.2)	25 (3.7)	88 (2.7)	81 (3.5)	18 (3.1)
Cyprus	57 (0.3)	35 (0.2)	12 (0.1)	52 (0.2)	5 (0.1)
Czech Republic	68 (4.3)	44 (5.0)	29 (3.9)	62 (4.3)	7 (3.0)
England	r 78 (3.6)	r 57 (4.7)	r 48 (5.0)	r 61 (4.8)	r 0 (0.0)
Finland	94 (2.4)	5 (1.3)	43 (3.9)	95 (1.8)	7 (2.5)
Hong Kong, SAR	r 62 (4.9)	17 (3.5)	63 (4.4)	59 (4.8)	r 3 (1.7)
Hungary	85 (3.0)	52 (4.3)	60 (4.5)	73 (3.7)	10 (2.7)
Indonesia	46 (4.8)	20 (3.4)	97 (1.1)	95 (1.7)	12 (2.8)
Iran, Islamic Rep.	0 (0.0)	s 39 (4.7)	s 27 (4.5)	s 80 (4.2)	0 (0.0)
Israel	r 71 (4.7)	r 51 (5.2)	r 69 (4.3)	r 66 (4.0)	r 16 (4.0)
Italy	0 (0.0)	0 (0.0)	51 (3.8)	81 (3.0)	0 (0.0)
Japan	31 (3.9)	13 (3.1)	32 (3.5)	67 (4.3)	13 (2.9)
Jordan	69 (4.3)	42 (4.6)	75 (3.8)	91 (2.5)	1 (0.0)
Korea, Rep. of	66 (3.9)	41 (4.3)	27 (3.5)	26 (3.5)	38 (4.5)
Latvia (LSS)	69 (4.6)	40 (4.7)	24 (4.1)	94 (2.0)	2 (1.2)
Lithuania ‡	0 (0.0)	36 (3.4)	72 (3.6)	67 (4.0)	0 (0.0)
Macedonia, Rep. of	56 (4.2)	25 (3.5)	92 (2.3)	96 (1.7)	3 (1.5)
Malaysia	56 (4.5)	57 (3.9)	95 (1.8)	87 (2.8)	39 (4.4)
Moldova	81 (3.5)	71 (3.5)	74 (3.7)	61 (4.5)	20 (3.5)
Morocco	67 (4.0)	5 (1.7)	6 (1.8)	47 (4.7)	5 (1.7)
Netherlands	r 55 (6.8)	r 39 (6.9)	r 90 (3.8)	r 64 (7.5)	r 60 (6.8)
New Zealand	81 (3.2)	41 (4.6)	84 (2.8)	91 (2.7)	r 5 (2.1)
Philippines	86 (3.3)	42 (4.6)	76 (3.9)	75 (3.8)	18 (3.3)
Romania	85 (3.2)	51 (4.9)	85 (3.1)	90 (2.2)	5 (1.7)
Russian Federation	32 (3.8)	47 (4.0)	90 (3.0)	53 (3.8)	25 (3.5)
Singapore	0 (0.0)	0 (0.0)	80 (3.5)	99 (0.8)	82 (3.6)
Slovak Republic	71 (3.7)	41 (4.2)	38 (4.9)	83 (3.8)	7 (2.4)
Slovenia	0 (0.0)	36 (4.0)	99 (0.5)	98 (1.1)	0 (0.0)
South Africa	s 63 (4.6)	s 33 (5.2)	s 45 (6.1)	s 57 (4.6)	s 13 (3.5)
Thailand	93 (2.4)	42 (4.0)	40 (3.7)	40 (3.9)	3 (1.2)
Tunisia	91 (2.3)	8 (2.6)	50 (4.1)	85 (3.2)	7 (1.8)
Turkey	70 (3.7)	18 (2.8)	23 (3.8)	47 (4.8)	14 (2.9)
United States	r 49 (4.7)	r 49 (4.2)	r 79 (2.8)	r 64 (3.9)	r 37 (4.2)
International Avg.	58 (0.6)	35 (0.6)	58 (0.6)	72 (0.6)	17 (0.5)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by schools.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

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

Exhibit R2.3 Detailed Information About Topics in the Intended Curriculum, Up to and Including Eighth Grade - Fractions and Number Sense

	Whole numbers – including place values, factorization and operations (+, –, x, ÷)	Understanding and representing common fractions	Computations with common fractions	Understanding and representing decimal fractions	Computations with decimal fractions	Relationships between common and decimal fractions, ordering of fractions	Rounding whole numbers and decimal fractions	Estimating the results of computations	Number lines
Australia	●	●	●	●	●	●	●	●	●
Belgium (Flemish)	●	●	●	●	●	●	●	●	●
Bulgaria	●	●	●	●	●	●	●	○	●
Canada	●	●	●	●	●	●	●	●	●
Chile	●	●	●	●	●	●	○	○	●
Chinese Taipei	●	●	●	●	●	●	●	●	●
Cyprus	●	●	●	●	●	●	●	○	●
Czech Republic	●	●	●	●	●	●	●	●	●
England	●	●	◉	●	◉	◉	◉	●	●
Finland	●	●	●	●	●	●	●	●	●
Hong Kong, SAR	●	●	●	●	●	●	●	●	●
Hungary	●	●	●	●	●	●	●	●	●
Indonesia	●	●	●	●	●	●	●	●	●
Iran, Islamic Rep.	●	●	●	●	●	●	●	●	●
Israel	●	●	●	●	●	◉	◉	⊙	●
Italy	●	●	●	●	●	●	●	●	●
Japan	●	●	●	●	●	●	●	●	●
Jordan	●	●	●	●	●	●	●	●	●
Korea, Rep. of	●	●	●	●	●	●	●	○	●
Latvia (LSS)	●	●	●	●	●	●	●	●	●
Lithuania	●	●	●	●	●	●	●	●	●
Macedonia, Rep. of	●	⊙	●	⊙	●	⊙	⊙	○	●
Malaysia	●	●	●	●	●	●	●	●	●
Moldova	●	●	●	●	●	●	●	●	●
Morocco	●	●	●	●	●	●	●	●	●
Netherlands	●	●	◉	●	●	◉	●	●	●
New Zealand	●	●	●	●	●	●	●	●	●
Philippines	●	●	●	●	●	●	●	●	●
Romania	●	●	●	●	●	●	●	●	●
Russian Federation	●	●	●	●	●	●	●	●	●
Singapore	●	●	●	●	●	●	●	●	●
Slovak Republic	–	–	–	–	–	–	–	–	–
Slovenia	●	●	●	●	●	●	●	●	●
South Africa	●	●	●	●	●	●	●	●	●
Thailand	●	●	●	●	●	●	●	●	●
Tunisia	●	●	●	●	●	●	●	●	●
Turkey	●	●	●	●	●	●	○	○	●
United States	●	●	●	●	●	●	●	●	●

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by National Research Coordinators.

Exhibit R2.3: Detailed Information About Topics in the Intended Curriculum, Up to and Including Eighth Grade - Fractions and Number Sense (Continued)

Country	Whole number powers of integers	Computations with percentages and problems involving percentages	Simple computations with negative numbers	Square roots (of perfect squares less than 144), small integer exponents	Prime factors, highest common factor, lowest common multiple, rules for divisibility	Sets, subsets, union, intersection, venn diagrams	Rate problems	Concepts of ratio and proportion; ratio and proportion problems
Australia	●	●	●	●	●	○	●	●
Belgium (Flemish)	●	●	●	●	●	●	●	●
Bulgaria	●	●	●	○	●	●	●	●
Canada	●	●	●	●	●	○	●	●
Chile	○	●	●	○	●	●	●	●
Chinese Taipei	●	●	●	●	●	○	◉	◉
Cyprus	●	●	●	●	●	○	○	●
Czech Republic	●	●	●	●	●	·	●	●
England	⊙	◉	◉	◉	⊙	○	⊙	⊙
Finland	●	○	●	○	○	○	○	○
Hong Kong, SAR	●	●	●	●	●	○	●	●
Hungary	●	●	●	●	●	●	○	●
Indonesia	●	●	●	●	●	●	○	●
Iran, Islamic Rep.	●	●	●	●	●	○	○	●
Israel	◉	●	●	○	⊙	⊙	◉	◉
Italy	●	●	●	●	●	●	●	●
Japan	●	●	●	○	○	○	●	●
Jordan	●	●	●	●	●	●	●	●
Korea, Rep. of	○	●	●	○	●	●	●	●
Latvia (LSS)	●	●	●	◉	◉	⊙	●	●
Lithuania	●	●	●	●	●	○	●	●
Macedonia, Rep. of	●	●	●	●	●	●	○	⊙
Malaysia	●	●	●	●	●	○	●	●
Moldova	●	●	●	●	●	◉	●	●
Morocco	●	●	●	●	●	○	○	○
Netherlands	●	◉	◉	●	○	○	◉	◉
New Zealand	●	●	●	●	●	●	●	●
Philippines	●	●	●	●	●	○	●	●
Romania	●	●	●	●	●	●	●	●
Russian Federation	●	●	●	●	●	·	○	●
Singapore	●	●	●	●	●	○	●	●
Slovak Republic	–	–	–	–	–	–	–	–
Slovenia	●	●	●	●	●	●	●	●
South Africa	○	●	●	●	●	○	●	●
Thailand	○	●	●	●	●	○	●	●
Tunisia	●	●	●	●	●	●	●	●
Turkey	●	●	●	●	●	●	●	●
United States	●	●	●	●	●	●	●	●

● All or almost all students (at least 90%)

◉ About half of the students

⊙ Only the more able students (top track- about 25%)

· Only the most advanced students (10% or less)

○ Not included in curriculum

– Data not available

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Exhibit R2.4 Detailed Information About Topics in the Intended Curriculum, Up to and Including Eighth Grade - Measurement

	Units of measurement; standard metric units	Reading measurement instruments	Estimates of measurement; accuracy of measurement	Conversions of units between measurement systems	Perimeter and area of simple shapes – triangles, rectangles, and circles	Perimeter and area of combined shapes	Volume of rectangular solids i.e., Volume = length x width x height	Volume of other solids (e.g., pyramids, cylinders, cones, spheres)	Computing with measurements (+, –, x, ÷)	Scales applied to maps and models
Australia	●	●	●	●	●	●	●	●	●	●
Belgium (Flemish)	●	●	●	●	●	●	●	◉	●	●
Bulgaria	●	●	●	●	●	●	●	●	●	●
Canada	●	●	●	●	●	●	●	◉	●	●
Chile	●	●	○	●	●	●	●	○	●	●
Chinese Taipei	●	◉	◉	◉	●	●	●	○	●	◉
Cyprus	●	○	○	●	●	●	●	●	○	●
Czech Republic	●	●	●	○	●	●	●	●	●	●
England	●	●	◉	◉	◉	◉	◉	⊙	●	◉
Finland	●	●	●	●	●	○	●	○	●	●
Hong Kong, SAR	●	●	●	○	●	●	●	○	●	●
Hungary	●	●	●	○	●	○	●	○	●	○
Indonesia	●	●	●	●	●	●	●	●	●	●
Iran, Islamic Rep.	●	●	●	●	●	●	●	●	●	●
Israel	●	○	·	◉	●	⊙	●	⊙	○	●
Italy	●	●	○	●	●	●	●	●	●	○
Japan	●	●	●	●	●	●	●	●	●	●
Jordan	●	●	●	●	●	●	●	●	●	●
Korea, Rep. of	●	●	●	●	●	●	●	●	●	●
Latvia (LSS)	●	●	●	●	●	◉	●	◉	●	●
Lithuania	●	●	●	●	●	●	●	●	●	●
Macedonia, Rep. of	●	○	○	○	●	●	●	●	●	○
Malaysia	●	●	●	●	●	●	●	○	●	●
Moldova	●	●	●	●	●	●	●	○	●	●
Morocco	●	●	●	●	●	●	●	●	●	○
Netherlands	●	●	⊙	○	◉	◉	●	◉	◉	●
New Zealand	●	●	●	○	●	◉	●	◉	●	●
Philippines	●	●	○	●	●	●	●	●	●	●
Romania	●	●	●	●	●	●	●	●	●	●
Russian Federation	●	●	●	○	◉	○	●	○	●	●
Singapore	●	●	●	●	●	●	●	●	●	●
Slovak Republic	–	–	–	–	–	–	–	–	–	–
Slovenia	●	●	●	●	●	●	●	●	●	●
South Africa	●	●	●	●	●	●	●	●	●	●
Thailand	●	●	●	●	●	●	●	○	●	●
Tunisia	●	●	○	●	●	●	●	●	●	●
Turkey	●	○	●	●	●	●	●	●	●	●
United States	●	●	●	●	●	●	●	●	●	●

●	All or almost all students (at least 90%)
◉	About half of the students
⊙	Only the more able students (top track-about 25%)
·	Only the most advanced students (10% or less)
○	Not included in curriculum
–	Data not available

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by National Research Coordinators.

Exhibit R2.5 Detailed Information About Topics in the Intended Curriculum, Up to and Including Eighth Grade - Data Representation, Analysis, and Probability

TIMSS 1999 8th grade Mathematics

	Collecting and graphing data from a survey	Representation and interpretation of data in graphs, charts, and tables	Arithmetic mean	Median and mode	Simple probabilities – understanding and calculations
Australia	●	●	●	●	●
Belgium (Flemish)	●	●	●	◉	●
Bulgaria	●	●	○	○	○
Canada	●	●	●	●	●
Chile	●	●	●	●	○
Chinese Taipei	●	◉	○	○	●
Cyprus	○	○	○	○	○
Czech Republic	●	●	●	●	·
England	●	●	◉	◉	◉
Finland	●	●	●	○	○
Hong Kong, SAR	●	●	○	○	○
Hungary	●	●	●	○	○
Indonesia	◉	○	●	●	●
Iran, Islamic Rep.	○	●	●	○	○
Israel	●	●	●	○	⊙
Italy	●	●	●	○	●
Japan	●	●	●	●	○
Jordan	○	●	●	●	●
Korea, Rep. of	●	●	●	○	●
Latvia (LSS)	○	◉	●	○	⊙
Lithuania	○	●	●	○	○
Macedonia, Rep. of	○	○	○	○	○
Malaysia	●	●	○	○	○
Moldova	●	●	●	●	●
Morocco	●	●	○	○	○
Netherlands	●	●	●	◉	◉
New Zealand	●	●	●	●	●
Philippines	●	●	●	●	○
Romania	○	○	●	○	○
Russian Federation	●	●	●	●	●
Singapore	●	●	●	●	○
Slovak Republic	–	–	–	–	–
Slovenia	○	●	●	○	○
South Africa	○	○	○	○	○
Thailand	●	●	○	○	○
Tunisia	●	●	●	○	○
Turkey	●	●	●	●	●
United States	●	●	●	●	●

●	All or almost all students (at least 90%)
◉	About half of the students
⊙	Only the more able students (top track- about 25%)
·	Only the most advanced students (10% or less)
○	Not included in curriculum
–	Data not available

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by National Research Coordinators.

Exhibit R2.6 Detailed Information About Topics in the Intended Curriculum, Up to and Including Eighth Grade - Geometry

	Cartesian coordinates of points in a plane	Coordinates of points on a given straight line	Simple two dimensional geometry – angles on a straight line, parallel lines, triangles and quadrilaterals	Congruence and similarity	Angles – (acute, right, supplementary, etc.)	Pythagorean theorem (without proof)	Symmetry and transformations (reflection and rotation)	Visualization of three-dimensional shapes	Geometric constructions with straight-edge and compass	Regular polygons and their properties – names (e.g., hexagon and octagon), sum of angles, etc.	Proofs (formal deductive demonstrations of geometric relationships)	Sine, cosine, and tangent in right-angle triangles	Nets of solids
Australia	●	●	●	●	●	●	●	●	●	●	○	○	●
Belgium (Flemish)	●	◉	●	●	●	○	●	●	●	○	⊙	○	●
Bulgaria	●	●	●	●	●	○	●	●	●	●	●	○	○
Canada	●	◉	●	●	●	●	●	●	●	●	○	○	●
Chile	●	○	●	○	●	●	●	○	●	○	○	○	●
Chinese Taipei	●	●	●	◉	●	●	⊙	◉	●	◉	○	○	○
Cyprus	●	●	●	○	●	●	○	○	●	●	○	○	○
Czech Republic	●	○	●	●	●	●	●	●	●	●	⊙	○	◉
England	●	◉	◉	⊙	◉	⊙	●	●	◉	◉	○	·	◉
Finland	●	○	●	○	●	○	○	●	○	○	○	○	○
Hong Kong, SAR	●	●	●	●	●	●	○	○	●	●	●	●	○
Hungary	●	○	●	○	●	●	●	○	●	●	●	○	●
Indonesia	●	●	●	●	●	●	●	●	●	●	●	○	○
Iran, Islamic Rep.	●	●	●	●	●	●	●	●	●	○	●	○	○
Israel	●	·	◉	●	●	○	·	·	○	○	⊙	○	·
Italy	●	●	●	●	●	●	●	●	●	●	●	○	●
Japan	●	●	●	●	●	○	●	●	●	●	●	○	●
Jordan	●	●	●	●	●	●	○	○	●	●	●	●	●
Korea, Rep. of	○	○	●	●	●	○	○	●	●	●	●	○	○
Latvia (LSS)	●	●	●	●	●	●	⊙	○	●	◉	○	○	○
Lithuania	●	●	●	●	●	●	○	●	●	○	○	●	○
Macedonia, Rep. of	·	●	●	●	●	●	●	○	●	●	●	○	○
Malaysia	●	●	●	●	●	●	●	●	●	●	○	○	●
Moldova	●	●	●	●	●	●	●	●	●	●	●	●	○
Morocco	○	○	●	●	●	○	●	●	●	○	●	○	○
Netherlands	●	●	●	○	●	●	◉	●	○	◉	○	○	●
New Zealand	●	●	●	●	●	○	●	●	●	◉	○	○	●
Philippines	○	○	●	●	●	○	○	○	○	○	○	○	○
Romania	●	●	●	●	●	●	●	●	●	●	●	●	●
Russian Federation	●	●	●	◉	●	●	◉	●	●	◉	●	○	○
Singapore	●	●	●	●	●	◉	●	●	●	●	○	◉	●
Slovak Republic	–	–	–	–	–	–	–	–	–	–	–	–	–
Slovenia	●	●	●	●	●	●	●	●	●	●	●	○	●
South Africa	○	○	●	●	●	●	●	●	●	●	○	○	●
Thailand	●	●	●	●	●	●	○	○	●	○	○	○	○
Tunisia	○	●	●	○	●	○	●	●	●	○	●	○	●
Turkey	●	●	●	●	●	●	●	○	●	●	○	●	●
United States	●	●	●	●	●	●	●	●	●	●	·	○	●

● All or almost all students (at least 90%)

◉ About half of the students

⊙ Only the more able students (top track- about 25%)

· Only the most advanced students (10% or less)

○ Not included in curriculum

– Data not available

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by National Research Coordinators.

Exhibit R2.7 Detailed Information About Topics in the Intended Curriculum, Up to and Including Eighth Grade - Algebra

TIMSS 1999 8th grade Mathematics

	Number patterns and simple relations	Writing expressions for general terms in number pattern sequence	Translating from verbal descriptions to symbolic expressions	Simple algebraic expressions	Evaluating simple algebraic expressions by substitution of given value of variables	Representing situations algebraically; formulas	Solving simple equations	Solving simple inequalities	Solving simultaneous equations in two variables	Interpreting linear relations	Using the graph of a relationship to interpolate/extrapolate
Australia	●	●	●	●	●	●	●	○	○	●	○
Belgium (Flemish)	●	●	●	●	●	●	●	○	○	○	○
Bulgaria	●	○	●	●	●	●	●	●	●	●	○
Canada	●	◉	●	●	●	●	●	·	○	⊙	◉
Chile	○	○	○	●	○	○	●	○	○	○	○
Chinese Taipei	●	◉	●	●	●	◉	●	⊙	●	◉	○
Cyprus	●	○	●	●	●	●	●	●	○	○	○
Czech Republic	◉	◉	●	●	●	●	●	·	○	○	○
England	●	◉	◉	◉	◉	◉	◉	⊙	·	○	○
Finland	●	○	●	●	●	●	●	○	○	○	○
Hong Kong, SAR	●	○	●	●	●	●	●	○	●	●	○
Hungary	●	○	●	●	●	●	●	●	○	●	●
Indonesia	●	●	●	●	●	●	●	●	○	○	○
Iran, Islamic Rep.	●	○	●	●	●	●	●	●	●	○	○
Israel	·	·	●	●	●	●	●	◉	◉	·	○
Italy	●	●	●	●	●	●	●	●	●	●	○
Japan	●	●	●	●	●	●	●	●	●	●	●
Jordan	●	○	●	●	●	●	●	○	●	●	○
Korea, Rep. of	●	○	●	●	●	●	●	●	●	●	●
Latvia (LSS)	●	●	●	●	●	●	●	●	●	⊙	⊙
Lithuania	●	●	●	●	●	●	●	●	○	○	○
Macedonia, Rep. of	⊙	◉	●	●	●	●	●	●	●	●	⊙
Malaysia	●	●	●	●	●	●	●	○	○	○	○
Moldova	●	●	●	●	●	●	●	●	●	●	●
Morocco	○	○	○	○	○	○	●	○	○	○	○
Netherlands	●	◉	◉	◉	⊙	◉	◉	○	○	●	●
New Zealand	●	◉	●	●	●	◉	●	○	○	●	●
Philippines	●	●	●	●	●	●	●	●	○	○	○
Romania	●	●	●	●	●	●	●	●	●	●	●
Russian Federation	○	○	●	●	●	●	●	●	●	●	○
Singapore	●	●	●	●	●	●	●	◉	●	●	●
Slovak Republic	–	–	–	–	–	–	–	–	–	–	–
Slovenia	●	●	●	●	●	●	●	●	○	●	●
South Africa	●	●	●	●	●	●	●	○	○	○	○
Thailand	○	○	●	●	●	●	●	●	○	●	●
Tunisia	●	○	●	●	●	●	●	●	○	○	○
Turkey	●	●	●	●	●	●	●	●	●	●	●
United States	●	●	●	●	●	●	●	●	·	●	·

- ● All or almost all students (at least 90%)
- ◉ About half of the students
- ⊙ Only the more able students (top track-about 25%)
- · Only the most advanced students (10% or less)
- ○ Not included in curriculum
- – Data not available

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by National Research Coordinators.

Exhibit R2.8 When Fractions and Number Sense Topics Are Taught*

	Percentage of Students					
	Taught Topics Before This Year Only		Taught Topics During This Year[1]			Not Yet Taught 50% or More of Topics
	More Than 80% of Topics	More Than 50% Up to and Including 80% of Topics	More Than 50% of Topics Each Taught More Than 5 Periods	More Than 50% of Topics Each Taught at Least 1-5 Periods	50% or Less of Topics Taught	
Australia	7 (2.3)	18 (3.6)	19 (3.5)	53 (5.2)	3 (1.3)	0 (0.0)
Belgium (Flemish)	21 (3.0)	19 (2.3)	2 (1.0)	42 (3.7)	10 (3.6)	6 (2.9)
Bulgaria s	60 (4.8)	29 (4.3)	1 (0.9)	7 (2.0)	2 (1.5)	1 (0.9)
Canada r	1 (0.6)	9 (2.0)	27 (2.7)	63 (3.3)	1 (0.4)	0 (0.3)
Chile	0 (0.0)	3 (1.3)	57 (3.9)	35 (3.7)	5 (1.6)	0 (0.0)
Chinese Taipei	90 (2.4)	8 (2.1)	0 (0.0)	2 (1.1)	0 (0.0)	0 (0.0)
Cyprus r	1 (1.1)	72 (4.2)	1 (0.0)	17 (2.9)	10 (3.3)	0 (0.0)
Czech Republic	53 (5.7)	25 (4.3)	5 (2.2)	16 (3.3)	1 (0.8)	0 (0.0)
England s	8 (2.4)	19 (3.3)	3 (0.9)	63 (4.8)	6 (2.1)	1 (0.6)
Finland	0 (0.3)	5 (1.3)	13 (3.3)	63 (3.9)	16 (3.3)	3 (1.6)
Hong Kong, SAR	18 (3.0)	56 (4.5)	2 (1.2)	18 (3.6)	5 (2.0)	1 (0.8)
Hungary	38 (4.0)	29 (3.6)	8 (2.3)	24 (3.6)	1 (0.0)	0 (0.0)
Indonesia	26 (4.1)	25 (4.2)	12 (2.8)	37 (4.6)	0 (0.5)	0 (0.0)
Iran, Islamic Rep.	3 (1.3)	27 (4.7)	1 (0.8)	63 (5.0)	5 (1.7)	0 (0.0)
Israel	38 (3.7)	37 (3.7)	3 (1.3)	18 (3.1)	4 (1.4)	1 (0.7)
Italy	39 (3.9)	42 (4.1)	4 (1.3)	14 (2.9)	1 (0.5)	0 (0.0)
Japan	51 (4.9)	30 (4.3)	1 (0.0)	16 (3.3)	2 (1.2)	0 (0.0)
Jordan	18 (3.3)	31 (3.9)	13 (2.9)	38 (4.2)	1 (0.0)	0 (0.0)
Korea, Rep. of	10 (2.4)	14 (2.8)	11 (2.5)	57 (4.0)	6 (2.0)	2 (1.3)
Latvia (LSS)	22 (3.7)	42 (4.3)	5 (2.0)	26 (4.0)	5 (1.9)	0 (0.0)
Lithuania ‡	– –	– –	– –	– –	– –	– –
Macedonia, Rep. of	81 (3.3)	5 (2.0)	1 (0.0)	1 (0.0)	1 (0.0)	12 (2.7)
Malaysia	8 (2.0)	29 (3.8)	13 (2.7)	48 (4.1)	1 (0.8)	1 (0.9)
Moldova	– –	– –	– –	– –	– –	– –
Morocco	– –	– –	– –	– –	– –	– –
Netherlands	8 (2.3)	28 (5.8)	17 (6.3)	41 (5.8)	5 (2.7)	0 (0.0)
New Zealand	0 (0.0)	1 (0.9)	14 (2.9)	83 (3.1)	1 (0.0)	2 (0.8)
Philippines	7 (2.1)	15 (3.2)	22 (3.7)	52 (4.2)	3 (1.3)	0 (0.0)
Romania	75 (3.9)	11 (2.8)	1 (0.7)	13 (2.9)	0 (0.0)	0 (0.0)
Russian Federation	– –	– –	– –	– –	– –	– –
Singapore	37 (4.2)	35 (4.3)	6 (2.0)	22 (3.7)	0 (0.0)	0 (0.0)
Slovak Republic	55 (4.5)	22 (4.2)	7 (2.7)	16 (2.6)	0 (0.0)	0 (0.0)
Slovenia	44 (4.1)	27 (4.2)	11 (2.4)	17 (3.1)	0 (0.0)	0 (0.0)
South Africa	– –	– –	– –	– –	– –	– –
Finland s	0 (0.0)	6 (2.0)	15 (4.1)	63 (4.5)	15 (4.0)	2 (1.9)
Tunisia	7 (2.3)	29 (4.0)	32 (4.6)	3 (1.5)	23 (3.7)	6 (2.2)
Turkey	16 (3.0)	28 (3.6)	8 (1.7)	35 (3.5)	13 (2.6)	0 (0.2)
United States	8 (1.4)	9 (1.4)	34 (2.8)	48 (3.2)	1 (0.7)	0 (0.1)
International Avg.	26 (0.5)	24 (0.6)	11 (0.5)	34 (0.6)	4 (0.3)	1 (0.2)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

* Categories of topic coverage for fractions and number sense are based on combined responses to questions about the individual mathematics subtopics in the content area described in exhibit 5.12.

1 For each topic in 5.12, teachers were asked if the topic was taught before this year, taught 1-5 periods this year, taught more than 5 periods this year, or not yet taught. Topics taught during this year, regardless if taught before this year, are included in this category.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

Exhibit R2.9 When Measurement Topics Are Taught*

TIMSS 1999 8th grade Mathematics

	Percentage of Students					
	Taught Topics Before This Year Only		Taught Topics During This Year¹			Not Yet Taught 50% or More of Topics
	More Than 80% of Topics	More Than 50% Up to and Including 80% of Topics	More Than 50% of Topics Each Taught More Than 5 Periods	More Than 50% of Topics Each Taught at Least 1-5 Periods	50% or Less of Topics Taught	
Australia	3 (1.5)	6 (2.3)	20 (3.7)	64 (4.6)	6 (1.6)	2 (1.3)
Belgium (Flemish)	33 (3.5)	27 (3.8)	4 (3.4)	19 (3.0)	13 (3.7)	3 (1.4)
Bulgaria s	67 (4.9)	19 (3.8)	1 (0.1)	8 (2.3)	5 (1.9)	1 (0.7)
Canada r	1 (0.5)	8 (1.6)	21 (2.9)	56 (3.4)	11 (1.4)	2 (0.8)
Chile	1 (0.9)	7 (2.0)	20 (3.2)	35 (4.2)	12 (2.4)	24 (3.5)
Chinese Taipei	20 (3.6)	53 (4.4)	3 (1.4)	5 (1.8)	17 (3.3)	2 (1.4)
Cyprus s	0 (0.0)	16 (5.4)	10 (4.6)	51 (7.0)	23 (5.4)	0 (0.0)
Czech Republic	50 (5.9)	29 (5.0)	4 (2.0)	14 (3.4)	4 (1.7)	0 (0.0)
England s	8 (2.4)	18 (2.7)	5 (1.3)	58 (3.8)	8 (1.5)	3 (0.9)
Finland	2 (1.1)	6 (1.7)	3 (1.3)	41 (4.8)	21 (3.4)	28 (4.1)
Hong Kong, SAR	15 (3.1)	28 (4.2)	5 (1.8)	41 (4.4)	10 (2.8)	1 (1.1)
Hungary	31 (3.5)	33 (3.7)	7 (2.1)	28 (3.7)	2 (1.0)	0 (0.0)
Indonesia	9 (2.2)	18 (4.0)	13 (3.3)	51 (4.7)	8 (2.5)	0 (0.0)
Iran, Islamic Rep.	18 (2.7)	30 (4.5)	2 (0.8)	35 (4.1)	10 (2.6)	4 (1.7)
Israel s	37 (4.9)	14 (3.4)	3 (1.8)	10 (3.0)	7 (2.4)	29 (5.0)
Italy	29 (3.8)	42 (4.0)	7 (2.3)	15 (2.9)	7 (1.8)	1 (0.6)
Japan	49 (4.6)	26 (4.3)	1 (0.8)	8 (2.1)	5 (2.0)	12 (2.9)
Jordan	39 (4.4)	33 (4.3)	3 (1.5)	20 (3.3)	4 (1.7)	0 (0.0)
Korea, Rep. of	11 (2.5)	19 (3.3)	8 (2.4)	49 (4.1)	7 (2.0)	6 (1.7)
Latvia (LSS)	26 (4.0)	41 (4.4)	2 (1.0)	11 (3.0)	15 (2.9)	5 (2.1)
Lithuania ‡	– –	– –	– –	– –	– –	– –
Macedonia, Rep. of r	31 (4.3)	44 (4.4)	2 (1.2)	7 (2.1)	4 (1.8)	13 (3.0)
Malaysia	18 (2.9)	18 (3.4)	7 (1.6)	46 (4.7)	9 (2.6)	2 (1.0)
Moldova	– –	– –	– –	– –	– –	– –
Morocco	– –	– –	– –	– –	– –	– –
Netherlands r	6 (3.3)	8 (2.7)	15 (6.2)	51 (6.8)	15 (3.6)	7 (4.7)
New Zealand	0 (0.0)	1 (0.8)	12 (2.6)	80 (3.3)	1 (0.9)	5 (1.8)
Philippines	5 (1.5)	1 (1.0)	20 (3.4)	53 (4.0)	6 (2.2)	15 (3.2)
Romania	69 (4.4)	20 (3.9)	1 (0.0)	10 (2.5)	1 (0.0)	0 (0.0)
Russian Federation	– –	– –	– –	– –	– –	– –
Singapore	39 (4.8)	32 (4.6)	8 (2.5)	19 (3.7)	2 (1.1)	0 (0.0)
Slovak Republic	23 (4.2)	40 (5.0)	6 (2.3)	23 (4.3)	8 (2.4)	0 (0.0)
Slovenia	29 (3.9)	34 (3.7)	8 (2.1)	26 (3.8)	3 (1.6)	0 (0.0)
South Africa	– –	– –	– –	– –	– –	– –
Thailand	4 (1.5)	11 (2.7)	13 (2.9)	55 (4.5)	6 (2.2)	10 (2.4)
Tunisia	33 (4.3)	40 (4.5)	8 (2.5)	2 (1.4)	10 (2.5)	8 (2.2)
Turkey	18 (3.3)	34 (3.8)	5 (1.5)	16 (2.3)	16 (2.9)	13 (2.8)
United States	10 (2.2)	11 (1.9)	16 (2.9)	54 (3.6)	3 (0.9)	6 (1.4)
International Avg.	22 (0.6)	23 (0.6)	8 (0.4)	32 (0.7)	8 (0.4)	6 (0.4)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

* Categories of topic coverage for measurement are based on combined responses to questions about the individual mathematics subtopics in the content area described in exhibit 5.13.

1 For each topic in 5.13, teachers were asked if the topic was taught before this year, taught 1-5 periods this year, taught more than 5 periods this year, or not yet taught. Topics taught during this year, regardless if taught before this year, are included in this category.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

Exhibit R2.10 When Data Representation, Analysis, and Probability Topics Are Taught*

	Percentage of Students					
	Taught Topics Before This Year Only		Taught Topics During This Year[1]			Not Yet Taught 50% or More of Topics
	More Than 80% of Topics	More Than 50% Up to and Including 80% of Topics	More Than 50% of Topics Each Taught More Than5 Periods	More Than 50% of Topics Each Taught at Least 1-5 Periods	50% or Less of Topics Taught	
Australia	2 (1.2)	3 (1.8)	19 (2.8)	46 (4.2)	5 (1.9)	25 (3.5)
Belgium (Flemish)	8 (1.6)	23 (3.0)	0 (0.0)	27 (4.2)	24 (3.0)	18 (4.2)
Bulgaria r	2 (1.1)	8 (2.5)	4 (1.6)	10 (2.7)	12 (2.9)	64 (5.2)
Canada r	2 (0.8)	5 (1.6)	27 (3.2)	45 (3.4)	8 (0.8)	13 (3.0)
Chile	3 (1.4)	8 (2.3)	14 (2.5)	20 (3.3)	2 (1.1)	53 (3.5)
Chinese Taipei	2 (1.2)	3 (1.4)	1 (0.8)	1 (0.7)	1 (0.0)	92 (2.1)
Cyprus r	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	100 (0.0)
Czech Republic	2 (1.7)	24 (5.1)	1 (1.0)	7 (2.1)	13 (3.8)	52 (5.3)
England s	7 (1.7)	15 (3.2)	11 (2.2)	62 (3.9)	3 (1.3)	3 (0.7)
Finland	0 (0.0)	1 (0.9)	2 (1.3)	35 (4.5)	10 (2.3)	52 (4.1)
Hong Kong, SAR	3 (1.6)	13 (3.1)	1 (0.9)	7 (2.3)	6 (2.2)	70 (4.2)
Hungary	6 (1.9)	20 (3.4)	7 (1.9)	45 (4.0)	15 (2.7)	8 (2.3)
Indonesia	2 (1.0)	0 (0.0)	21 (3.2)	70 (3.7)	1 (0.8)	6 (2.1)
Iran, Islamic Rep.	2 (1.1)	6 (1.9)	1 (0.8)	78 (4.4)	4 (1.5)	9 (3.9)
Israel r	13 (2.9)	12 (2.9)	6 (2.2)	12 (2.6)	13 (2.8)	44 (4.2)
Italy	2 (1.1)	17 (2.8)	10 (2.2)	33 (3.9)	4 (1.5)	34 (3.4)
Japan	2 (1.2)	8 (2.7)	1 (0.7)	12 (2.9)	10 (2.6)	68 (4.2)
Jordan	6 (2.1)	53 (4.3)	4 (1.8)	25 (3.9)	4 (1.7)	7 (2.6)
Korea, Rep. of	3 (1.3)	23 (3.4)	21 (3.2)	38 (4.0)	10 (2.5)	4 (1.6)
Latvia (LSS)	4 (1.8)	40 (4.3)	3 (1.3)	28 (3.9)	22 (3.8)	3 (1.7)
Lithuania ‡	– –	– –	– –	– –	– –	– –
Macedonia, Rep. of r	16 (3.5)	16 (3.4)	2 (1.3)	16 (3.5)	18 (3.4)	31 (4.1)
Malaysia	3 (1.4)	6 (2.0)	12 (2.5)	13 (2.7)	0 (0.0)	66 (3.7)
Moldova	– –	– –	– –	– –	– –	– –
Morocco	– –	– –	– –	– –	– –	– –
Netherlands	0 (0.0)	7 (2.6)	17 (5.8)	48 (6.6)	6 (2.3)	22 (5.7)
New Zealand	1 (0.8)	1 (0.9)	12 (3.0)	65 (4.1)	1 (0.8)	19 (3.1)
Philippines	1 (0.0)	1 (0.9)	9 (2.3)	28 (4.1)	0 (0.0)	61 (4.5)
Romania	28 (4.1)	46 (4.9)	1 (0.7)	19 (3.5)	4 (1.6)	2 (1.3)
Russian Federation	– –	– –	– –	– –	– –	– –
Singapore	2 (1.4)	2 (1.3)	28 (3.7)	54 (3.2)	1 (0.0)	13 (3.3)
Slovak Republic	12 (3.2)	38 (5.0)	2 (1.7)	6 (2.4)	13 (3.1)	29 (4.3)
Slovenia	21 (3.2)	27 (4.2)	4 (1.9)	17 (3.4)	22 (3.3)	9 (2.5)
South Africa	– –	– –	– –	– –	– –	– –
Thailand	6 (2.1)	3 (1.5)	18 (3.3)	30 (4.2)	1 (1.0)	42 (4.4)
Tunisia	5 (2.0)	7 (2.3)	4 (1.8)	1 (0.0)	2 (1.1)	82 (3.7)
Turkey	1 (0.9)	21 (3.5)	14 (2.5)	43 (4.5)	8 (2.2)	14 (3.5)
United States	6 (1.5)	7 (2.5)	26 (2.4)	53 (3.2)	2 (1.1)	6 (1.3)
International Avg.	5 (0.3)	14 (0.5)	9 (0.4)	30 (0.6)	7 (0.4)	34 (0.6)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

* Categories of topic coverage for data representation, analysis, and probability are based on combined responses to questions about the individual mathematics subtopics in the content area described in exhibit 5.14.

1 For each topic in 5.14, teachers were asked if the topic was taught before this year, taught 1-5 periods this year, taught more than 5 periods this year, or not yet taught. Topics taught during this year, regardless if taught before this year, are included in this category.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

Exhibit R2.11 When Geometry Topics Are Taught*

	Percentage of Students					
	Taught Topics Before This Year Only		Taught Topics During This Year¹			Not Yet Taught 50% or More of Topics
	More Than 80% of Topics	More Than 50% Up to and Including 80% of Topics	More Than 50% of Topics Each Taught More Than 5 Periods	More Than 50% of Topics Each Taught at Least 1-5 Periods	50% or Less of Topics Taught	
Australia	2 (0.9)	3 (1.4)	14 (3.4)	47 (4.6)	14 (3.1)	19 (3.9)
Belgium (Flemish)	0 (0.0)	5 (1.4)	10 (1.9)	47 (3.5)	15 (2.1)	22 (2.4)
Bulgaria	1 (0.7)	19 (3.8)	7 (2.3)	24 (4.2)	38 (6.2)	11 (3.0)
Canada r	2 (0.5)	3 (1.0)	14 (2.9)	52 (3.2)	12 (2.2)	18 (2.6)
Chile	3 (1.3)	4 (1.4)	12 (2.5)	20 (3.0)	19 (2.8)	42 (3.7)
Chinese Taipei	1 (0.0)	1 (0.5)	6 (2.1)	18 (3.3)	42 (4.1)	33 (4.1)
Cyprus r	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	14 (3.7)	86 (3.7)
Czech Republic	35 (4.6)	23 (4.8)	4 (2.3)	17 (3.1)	17 (3.8)	4 (1.9)
England s	13 (2.4)	18 (3.1)	2 (0.8)	29 (2.5)	23 (3.4)	15 (2.7)
Finland	0 (0.0)	0 (0.0)	1 (0.8)	39 (4.3)	4 (1.7)	56 (4.3)
Hong Kong, SAR	13 (2.7)	21 (3.5)	5 (2.0)	16 (2.7)	30 (4.0)	14 (3.2)
Hungary	9 (2.4)	21 (3.0)	14 (3.0)	25 (3.4)	28 (3.5)	3 (1.3)
Indonesia	6 (2.1)	2 (1.3)	9 (2.7)	42 (4.7)	18 (3.2)	22 (3.5)
Iran, Islamic Rep.	0 (0.0)	5 (3.7)	5 (1.6)	81 (4.0)	5 (1.8)	4 (1.6)
Israel r	0 (0.5)	2 (1.0)	11 (2.7)	20 (3.3)	20 (3.4)	47 (4.0)
Italy	2 (1.0)	10 (2.8)	9 (2.2)	29 (3.6)	41 (3.9)	9 (2.3)
Japan	2 (1.5)	21 (3.2)	8 (2.4)	35 (4.1)	32 (4.4)	1 (1.0)
Jordan	1 (0.0)	3 (1.4)	18 (3.6)	53 (4.1)	22 (3.5)	3 (1.6)
Korea, Rep. of	5 (1.8)	6 (1.8)	12 (2.4)	57 (4.4)	19 (3.4)	1 (0.0)
Latvia (LSS)	1 (0.8)	6 (2.1)	1 (0.9)	8 (2.3)	58 (4.7)	26 (3.9)
Lithuania ‡	– –	– –	– –	– –	– –	– –
Macedonia, Rep. of	20 (3.3)	37 (4.1)	3 (1.3)	12 (2.9)	18 (3.5)	10 (2.7)
Malaysia	2 (1.0)	1 (0.7)	17 (3.1)	45 (4.0)	8 (2.5)	28 (3.3)
Moldova	– –	– –	– –	– –	– –	– –
Morocco	– –	– –	– –	– –	– –	– –
Netherlands	3 (1.3)	17 (4.5)	15 (5.1)	24 (5.1)	25 (4.8)	17 (4.9)
New Zealand	0 (0.0)	0 (0.0)	7 (2.1)	67 (3.5)	3 (1.6)	22 (3.3)
Philippines	2 (1.2)	2 (1.1)	8 (2.3)	30 (3.7)	1 (0.8)	57 (4.3)
Romania	30 (4.6)	30 (4.4)	0 (0.0)	19 (3.2)	21 (3.2)	0 (0.0)
Russian Federation	– –	– –	– –	– –	– –	– –
Singapore	1 (0.0)	1 (0.0)	24 (4.1)	62 (4.4)	5 (2.0)	7 (2.4)
Slovak Republic	6 (2.3)	21 (3.8)	1 (0.8)	6 (2.4)	19 (4.0)	47 (4.4)
Slovenia	11 (2.7)	23 (3.6)	13 (2.8)	30 (3.9)	24 (3.2)	0 (0.0)
South Africa	– –	– –	– –	– –	– –	– –
Thailand	4 (1.8)	5 (1.7)	12 (2.9)	53 (4.5)	13 (2.4)	14 (3.3)
Tunisia	1 (1.0)	9 (2.6)	4 (1.7)	2 (1.1)	12 (2.7)	72 (4.0)
Turkey	4 (1.3)	11 (2.5)	7 (2.2)	45 (4.0)	27 (3.3)	5 (1.7)
United States	3 (1.0)	7 (1.4)	14 (2.2)	42 (2.9)	10 (2.0)	25 (2.9)
International Avg.	6 (0.3)	10 (0.5)	9 (0.4)	33 (0.6)	20 (0.6)	22 (0.5)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

* Categories of topic coverage for geometry are based on combined responses to questions about the individual mathematics subtopics in the content area described in exhibit 5.15.

1 For each topic in 5.15, teachers were asked if the topic was taught before this year, taught 1-5 periods this year, taught more than 5 periods this year, or not yet taught. Topics taught during this year, regardless if taught before this year, are included in this category.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

Exhibit R2.12 When Algebra Topics Are Taught*

		Percentage of Students					
		Taught Topics Before This Year Only		Taught Topics During This Year[1]			Not Yet Taught 50% or More of Topics
		More Than 80% of Topics	More Than 50% Up to and Including 80% of Topics	More Than 50% of Topics Each Taught More Than5 Periods	More Than 50% of Topics Each Taught at Least 1-5 Periods	50% or Less of Topics Taught	
Australia		1 (0.9)	2 (1.2)	46 (4.9)	45 (4.9)	3 (1.5)	3 (1.6)
Belgium (Flemish)	r	1 (0.7)	9 (1.9)	20 (2.9)	43 (3.6)	11 (2.1)	16 (3.2)
Bulgaria	r	22 (3.6)	18 (4.1)	24 (4.6)	32 (6.3)	3 (1.5)	1 (0.5)
Canada	r	1 (0.5)	1 (0.4)	54 (3.0)	38 (2.6)	0 (0.0)	6 (2.3)
Chile		0 (0.0)	1 (0.5)	31 (3.5)	35 (3.8)	2 (0.9)	32 (3.9)
Chinese Taipei		28 (3.6)	57 (4.0)	4 (1.7)	8 (2.1)	2 (1.1)	1 (0.0)
Cyprus	r	0 (0.0)	3 (1.9)	29 (4.9)	65 (5.1)	3 (0.2)	0 (0.0)
Czech Republic		2 (1.2)	3 (1.5)	69 (5.0)	20 (4.4)	5 (2.4)	2 (1.7)
England	s	0 (0.0)	8 (2.4)	21 (2.9)	60 (3.3)	4 (1.3)	7 (1.4)
Finland		0 (0.0)	1 (1.3)	10 (2.3)	32 (4.1)	4 (2.0)	52 (4.5)
Hong Kong, SAR		4 (1.6)	19 (3.3)	25 (4.0)	43 (3.9)	10 (2.7)	1 (0.0)
Hungary		11 (2.4)	18 (3.3)	40 (4.6)	29 (3.8)	2 (1.2)	0 (0.0)
Indonesia		3 (1.3)	8 (2.3)	21 (3.4)	58 (4.6)	7 (2.2)	3 (1.8)
Iran, Islamic Rep.		0 (0.0)	4 (1.5)	11 (2.8)	76 (4.1)	9 (3.9)	0 (0.0)
Israel		2 (0.8)	10 (2.2)	49 (3.5)	28 (3.5)	9 (2.2)	1 (0.9)
Italy		0 (0.0)	1 (0.0)	67 (3.7)	28 (3.3)	0 (0.0)	4 (1.5)
Japan		5 (2.3)	30 (4.2)	38 (3.9)	25 (4.0)	2 (1.1)	0 (0.0)
Jordan		1 (0.8)	14 (2.9)	15 (3.2)	43 (4.3)	21 (4.1)	6 (2.1)
Korea, Rep. of		5 (1.7)	9 (2.5)	36 (4.0)	48 (4.0)	1 (0.0)	1 (0.7)
Latvia (LSS)		6 (1.9)	8 (2.6)	58 (4.5)	28 (3.8)	0 (0.5)	0 (0.0)
Lithuania ‡		– –	– –	– –	– –	– –	– –
Macedonia, Rep. of	r	2 (1.2)	46 (4.3)	14 (2.5)	23 (3.9)	11 (3.1)	4 (1.8)
Malaysia		1 (0.9)	0 (0.0)	29 (3.6)	68 (3.8)	0 (0.0)	1 (1.0)
Moldova		– –	– –	– –	– –	– –	– –
Morocco		– –	– –	– –	– –	– –	– –
Netherlands		1 (0.1)	2 (1.1)	32 (6.4)	34 (6.2)	12 (3.9)	19 (6.0)
New Zealand		0 (0.0)	0 (0.0)	35 (4.0)	56 (4.3)	0 (0.0)	8 (2.4)
Philippines		1 (0.6)	2 (1.2)	20 (3.6)	45 (4.3)	1 (0.6)	32 (3.8)
Romania		10 (2.7)	16 (3.5)	23 (3.6)	51 (4.2)	0 (0.0)	0 (0.0)
Russian Federation		– –	– –	– –	– –	– –	– –
Singapore		2 (1.1)	18 (3.4)	32 (3.9)	48 (4.8)	1 (1.0)	0 (0.0)
Slovak Republic		1 (1.0)	10 (3.2)	63 (4.8)	23 (3.6)	3 (1.5)	0 (0.0)
Slovenia		4 (1.6)	14 (3.1)	39 (4.1)	42 (4.6)	1 (1.0)	0 (0.0)
South Africa		– –	– –	– –	– –	– –	– –
Thailand		5 (1.7)	4 (1.2)	14 (3.0)	58 (4.2)	1 (1.0)	18 (3.6)
Tunisia	r	8 (2.7)	21 (4.1)	20 (3.5)	4 (1.9)	13 (3.1)	33 (4.4)
Turkey		4 (1.4)	10 (2.6)	31 (3.7)	49 (3.5)	0 (0.0)	5 (1.7)
United States		3 (1.2)	0 (0.3)	62 (2.7)	32 (2.6)	0 (0.2)	2 (0.9)
International Avg.		4 (0.3)	11 (0.4)	33 (0.7)	40 (0.7)	4 (0.3)	8 (0.4)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

* Categories of topic coverage for algebra are based on combined responses to questions about the individual mathematics subtopics in the content area described in exhibit 5.16.

1 For each topic in 5.16, teachers were asked if the topic was taught before this year, taught 1-5 periods this year, taught more than 5 periods this year, or not yet taught. Topics taught during this year, regardless if taught before this year, are included in this category.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

REFERENCE 3

Teachers and Instruction

Exhibit R3.1 Teachers' Major Area of Study in Their BA, MA, or Teacher Training Certification

	Percentage of Students Whose Teachers Report Having the Major Area of Study[1]				
	Mathematics	Mathematics Education	Science or Science Education	Education	Other
Australia	61 (4.4)	33 (4.1)	37 (3.6)	44 (4.0)	40 (4.3)
Belgium (Flemish)	89 (2.6)	38 (3.8)	73 (3.5)	42 (2.9)	37 (3.5)
Bulgaria	94 (1.9)	0 (0.0)	20 (3.9)	10 (3.0)	9 (3.0)
Canada	22 (2.7)	19 (2.2)	24 (2.8)	49 (3.2)	68 (2.9)
Chile	74 (3.0)	51 (4.0)	39 (4.0)	72 (3.2)	41 (3.8)
Chinese Taipei	82 (3.7)	39 (4.2)	11 (2.1)	32 (3.6)	23 (3.9)
Cyprus	92 (2.3)	26 (3.2)	4 (1.1)	x x	r 13 (3.2)
Czech Republic	85 (3.8)	34 (5.6)	53 (6.0)	34 (5.5)	53 (4.9)
England	47 (3.3)	32 (2.9)	s 20 (2.6)	s 44 (3.4)	s 41 (3.5)
Finland	73 (4.4)	8 (2.0)	51 (4.6)	20 (3.6)	17 (3.3)
Hong Kong, SAR	57 (4.2)	30 (3.9)	38 (4.4)	36 (3.8)	47 (4.5)
Hungary	97 (1.3)	13 (2.6)	74 (3.0)	8 (2.2)	37 (3.7)
Indonesia	67 (4.1)	49 (4.6)	23 (4.6)	29 (4.8)	12 (2.8)
Iran, Islamic Rep.	48 (4.0)	32 (3.9)	8 (2.2)	1 (0.8)	10 (2.6)
Israel	65 (3.5)	47 (3.3)	27 (3.3)	33 (3.7)	r 30 (3.1)
Italy	22 (3.3)	0 (0.0)	66 (3.4)	0 (0.0)	16 (3.1)
Japan	79 (3.6)	27 (3.6)	4 (1.7)	15 (3.2)	21 (3.5)
Jordan	73 (3.4)	17 (3.2)	6 (1.9)	4 (1.4)	8 (2.5)
Korea, Rep. of	55 (4.2)	61 (4.0)	4 (1.5)	19 (3.2)	9 (2.2)
Latvia (LSS)	85 (3.4)	69 (4.3)	89 (2.8)	89 (3.0)	82 (3.8)
Lithuania ‡	92 (2.3)	0 (0.0)	– –	– –	– –
Macedonia, Rep. of	96 (1.7)	84 (2.7)	82 (3.2)	60 (4.1)	31 (4.4)
Malaysia	57 (4.4)	32 (3.8)	35 (4.0)	30 (3.7)	38 (3.9)
Moldova	73 (2.7)	0 (0.0)	52 (4.6)	36 (4.6)	35 (4.9)
Morocco	84 (4.3)	17 (2.5)	9 (1.8)	20 (2.2)	9 (1.8)
Netherlands	68 (4.9)	16 (4.2)	25 (5.0)	12 (4.3)	14 (4.4)
New Zealand	43 (3.9)	8 (2.5)	36 (3.7)	18 (3.3)	48 (4.3)
Philippines	78 (3.7)	23 (3.6)	13 (2.5)	26 (3.6)	34 (4.0)
Romania	93 (2.0)	43 (4.8)	21 (4.0)	48 (4.8)	26 (4.3)
Russian Federation	89 (2.9)	83 (3.1)	39 (4.0)	81 (3.1)	67 (3.9)
Singapore	78 (3.6)	32 (4.0)	38 (4.2)	48 (4.8)	47 (4.3)
Slovak Republic	92 (2.0)	23 (4.1)	50 (4.8)	21 (3.9)	54 (4.6)
Slovenia	74 (3.6)	33 (3.7)	62 (4.6)	14 (2.6)	18 (3.5)
South Africa	73 (3.3)	32 (3.7)	61 (4.2)	53 (4.3)	45 (4.2)
Thailand	61 (4.2)	5 (1.6)	15 (3.5)	5 (1.8)	27 (4.1)
Tunisia	68 (3.9)	38 (3.9)	34 (4.3)	9 (2.7)	19 (3.1)
Turkey	80 (2.9)	44 (3.9)	29 (3.8)	29 (3.6)	19 (3.5)
United States	41 (3.4)	37 (3.4)	16 (2.4)	54 (3.4)	r 46 (3.6)
International Avg.	71 (0.6)	31 (0.6)	35 (0.6)	32 (0.6)	32 (0.6)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

1 Teachers who responded that they majored in more than one area are reflected in all categories that apply.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

Exhibit R3.2 Overleaf

Exhibit R3.2 Teachers' Confidence in Their Preparation to Teach Mathematics Topics

	Percentage of Students Whose Teachers Report Feeling Very Well Prepared to Teach Topic[1]					
	Fractions, decimals and percentages	Ratios, and proportions	Measurement - units, instruments, and accuracy	Perimeter, area, and volume	Geometric figures - definitions and properties	Geometric figures - symmetry, motions and transformations, congruence and similarity
Australia	90 (2.9)	80 (3.8)	85 (3.5)	92 (2.6)	80 (4.0)	72 (4.3)
Belgium (Flemish)	97 (1.4)	93 (1.7)	62 (4.1)	92 (2.0)	93 (2.1)	89 (3.1)
Bulgaria	82 (6.3)	79 (6.1)	59 (5.6)	80 (5.8)	77 (5.5)	65 (5.9)
Canada	91 (2.1)	89 (2.4)	r 83 (2.7)	93 (2.2)	77 (2.8)	r 62 (3.4)
Chile	63 (3.3)	56 (3.7)	39 (3.8)	54 (3.3)	50 (3.8)	28 (3.7)
Chinese Taipei	80 (3.3)	83 (2.9)	65 (3.8)	77 (3.4)	77 (3.1)	70 (3.5)
Cyprus	100 (0.0)	100 (0.0)	91 (2.7)	100 (0.0)	100 (0.0)	78 (3.4)
Czech Republic	99 (1.3)	98 (1.3)	74 (5.0)	99 (1.3)	96 (2.1)	96 (2.0)
England	– –	– –	– –	– –	– –	– –
Finland	89 (2.1)	84 (3.0)	81 (2.7)	88 (2.3)	79 (2.8)	77 (3.0)
Hong Kong, SAR	75 (3.6)	76 (3.7)	67 (4.1)	86 (3.0)	66 (4.0)	53 (4.3)
Hungary	64 (3.7)	59 (3.5)	56 (3.7)	64 (3.7)	59 (3.9)	55 (3.8)
Indonesia	97 (1.7)	78 (3.5)	66 (5.1)	93 (2.2)	68 (4.1)	70 (4.3)
Iran, Islamic Rep.	89 (2.5)	93 (2.0)	69 (3.8)	92 (2.2)	87 (2.8)	75 (3.4)
Israel	91 (2.2)	75 (3.3)	70 (2.9)	90 (2.4)	92 (2.2)	73 (3.6)
Italy	79 (3.2)	80 (3.1)	55 (3.6)	86 (2.6)	84 (2.7)	45 (3.9)
Japan	15 (3.2)	20 (3.2)	9 (2.0)	26 (3.7)	23 (3.6)	20 (3.5)
Jordan	95 (2.0)	95 (1.9)	85 (3.1)	89 (2.9)	89 (2.7)	74 (4.0)
Korea, Rep. of	57 (3.7)	52 (3.9)	38 (3.8)	63 (3.2)	72 (3.2)	63 (3.7)
Latvia (LSS)	88 (3.0)	83 (3.2)	43 (4.4)	85 (3.3)	79 (3.3)	51 (4.4)
Lithuania ‡	– –	– –	– –	– –	– –	– –
Macedonia, Rep. of	99 (0.6)	99 (0.8)	92 (2.3)	99 (0.9)	97 (1.5)	93 (2.0)
Malaysia	91 (2.9)	87 (3.2)	83 (3.2)	92 (2.8)	79 (3.6)	73 (3.7)
Moldova	73 (3.7)	78 (3.5)	61 (4.3)	77 (3.9)	70 (4.0)	47 (4.2)
Morocco	91 (1.6)	91 (1.8)	56 (3.2)	65 (3.2)	90 (1.8)	80 (2.4)
Netherlands	90 (5.8)	90 (5.9)	69 (5.5)	90 (5.8)	82 (6.3)	79 (6.2)
New Zealand	94 (1.8)	84 (3.4)	91 (2.6)	97 (1.4)	82 (3.5)	80 (3.3)
Philippines	91 (2.0)	86 (3.2)	70 (4.3)	87 (2.8)	55 (4.0)	28 (4.0)
Romania	99 (0.5)	98 (1.3)	86 (3.0)	99 (0.5)	98 (1.2)	89 (2.8)
Russian Federation	– –	– –	– –	– –	– –	– –
Singapore	80 (3.8)	82 (3.4)	76 (4.3)	90 (2.9)	79 (3.6)	69 (4.0)
Slovak Republic	98 (1.5)	100 (0.0)	94 (2.3)	99 (0.7)	99 (0.9)	87 (3.4)
Slovenia	59 (3.7)	50 (4.2)	41 (4.2)	60 (3.7)	62 (3.8)	40 (3.9)
South Africa	83 (2.4)	75 (3.3)	59 (4.6)	68 (4.5)	82 (2.7)	62 (3.9)
Thailand	29 (3.7)	31 (3.5)	24 (4.0)	39 (3.7)	34 (4.5)	34 (4.0)
Tunisia	56 (4.4)	48 (3.9)	37 (4.1)	59 (4.2)	67 (3.5)	41 (4.1)
Turkey	91 (2.4)	94 (1.5)	60 (3.5)	93 (2.1)	88 (2.3)	72 (3.6)
United States	99 (0.8)	97 (1.1)	84 (2.0)	97 (1.1)	86 (2.7)	75 (2.9)
International Avg.	82 (0.5)	79 (0.5)	65 (0.6)	82 (0.5)	77 (0.6)	65 (0.6)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

1 Does not include students whose teachers report that they do not teach the topic.

2 Percentage of students averaged across topics.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

	Percentage of Students Whose Teachers Report Feeling Very Well Prepared to Teach Topic[1]						
	Coordinate geometry	Algebraic representation	Evaluate and perform operations on algebraic expressions	Solving linear equations and inequalities	Representation and interpretation of data in graphs, charts, and tables	Simple probabilities - understanding and calculations	Average[2]
Australia	87 (3.2)	83 (3.7)	85 (3.5)	84 (3.4)	86 (3.4)	84 (3.3)	84 (2.7)
Belgium (Flemish)	71 (3.9)	85 (3.1)	86 (2.6)	83 (3.3)	64 (2.9)	30 (4.6)	80 (1.4)
Bulgaria	29 (4.7)	62 (6.0)	80 (5.8)	81 (5.7)	49 (5.6)	36 (5.4)	66 (4.8)
Canada	r 64 (3.6)	r 83 (2.5)	82 (2.5)	r 74 (2.8)	79 (2.9)	r 70 (3.3)	79 (1.7)
Chile	31 (3.6)	38 (3.8)	39 (4.1)	46 (3.8)	41 (4.0)	39 (3.4)	44 (2.8)
Chinese Taipei	81 (3.2)	82 (2.9)	85 (2.9)	84 (3.0)	74 (3.7)	73 (3.7)	78 (2.6)
Cyprus	64 (4.4)	95 (1.7)	99 (0.9)	100 (0.0)	78 (3.7)	57 (4.6)	89 (0.9)
Czech Republic	84 (4.2)	88 (3.6)	95 (2.4)	97 (1.9)	75 (5.1)	52 (5.6)	88 (1.8)
England	– –	– –	– –	– –	– –	– –	– –
Finland	80 (3.0)	86 (2.6)	89 (2.0)	88 (1.7)	73 (3.4)	63 (4.0)	81 (1.9)
Hong Kong, SAR	82 (3.4)	85 (3.2)	87 (3.0)	74 (3.9)	58 (4.4)	58 (3.9)	72 (2.6)
Hungary	50 (4.3)	53 (4.0)	65 (3.8)	67 (3.7)	– –	– –	59 (3.3)
Indonesia	86 (3.6)	90 (2.6)	81 (3.5)	90 (2.6)	69 (3.9)	80 (3.1)	81 (2.1)
Iran, Islamic Rep.	78 (3.2)	87 (2.3)	89 (2.5)	81 (3.1)	77 (3.7)	47 (4.1)	81 (1.8)
Israel	84 (2.7)	84 (2.9)	94 (2.2)	96 (1.7)	86 (2.8)	74 (3.5)	84 (1.6)
Italy	64 (4.0)	62 (3.8)	79 (2.9)	71 (3.2)	70 (3.1)	53 (4.2)	69 (2.3)
Japan	25 (3.9)	28 (4.4)	33 (4.3)	37 (4.4)	19 (3.3)	19 (3.7)	23 (2.6)
Jordan	77 (3.7)	84 (3.1)	93 (2.1)	94 (2.0)	91 (2.4)	93 (2.2)	88 (1.7)
Korea, Rep. of	49 (3.4)	56 (3.9)	74 (3.3)	83 (2.9)	55 (3.8)	67 (3.9)	61 (2.5)
Latvia (LSS)	81 (3.7)	93 (2.1)	90 (2.7)	90 (2.7)	70 (3.9)	22 (3.7)	73 (2.1)
Lithuania ‡	– –	– –	– –	– –	– –	– –	– –
Macedonia, Rep. of	82 (3.4)	99 (1.0)	100 (0.0)	99 (0.7)	81 (3.3)	65 (4.2)	92 (1.0)
Malaysia	82 (3.6)	89 (3.1)	88 (3.2)	89 (2.9)	79 (3.7)	46 (4.6)	81 (2.5)
Moldova	66 (4.3)	71 (4.2)	78 (3.8)	76 (3.8)	54 (4.6)	32 (4.8)	64 (3.2)
Morocco	72 (2.6)	72 (2.8)	74 (3.5)	91 (1.8)	59 (3.2)	59 (3.5)	75 (1.3)
Netherlands	88 (5.9)	87 (6.0)	77 (6.4)	87 (5.9)	85 (5.8)	77 (6.3)	84 (5.3)
New Zealand	87 (2.9)	91 (2.4)	87 (2.8)	87 (3.0)	87 (2.6)	86 (2.5)	88 (1.9)
Philippines	35 (4.5)	73 (3.5)	82 (3.0)	62 (3.8)	62 (3.9)	28 (4.0)	64 (2.3)
Romania	32 (5.2)	68 (4.7)	98 (1.0)	96 (1.6)	82 (3.7)	54 (4.7)	85 (1.3)
Russian Federation	– –	– –	– –	– –	– –	– –	– –
Singapore	79 (3.6)	85 (3.3)	86 (3.1)	89 (2.9)	80 (3.6)	46 (5.2)	78 (2.7)
Slovak Republic	90 (3.1)	95 (1.8)	99 (1.0)	99 (1.0)	75 (3.7)	45 (5.2)	89 (1.5)
Slovenia	50 (4.3)	47 (4.1)	64 (4.0)	71 (3.7)	38 (3.8)	22 (4.0)	50 (2.9)
South Africa	53 (4.6)	85 (2.3)	81 (3.0)	81 (3.1)	67 (4.5)	62 (4.4)	71 (1.9)
Thailand	30 (5.4)	31 (5.0)	33 (5.0)	39 (4.5)	34 (4.2)	32 (5.1)	32 (3.0)
Tunisia	42 (4.8)	52 (5.0)	58 (3.9)	71 (3.8)	47 (4.5)	38 (4.6)	51 (2.6)
Turkey	87 (2.3)	83 (3.0)	83 (2.7)	90 (2.5)	74 (3.8)	85 (2.9)	83 (1.6)
United States	82 (2.6)	94 (1.6)	95 (1.3)	93 (1.5)	94 (1.5)	90 (2.1)	90 (1.2)
International Avg.	66 (0.7)	76 (0.6)	80 (0.6)	81 (0.5)	68 (0.7)	55 (0.7)	73 (0.4)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Exhibit R3.3 Shortages of Teachers Qualified to Teach Mathematics Affecting Capacity to Provide Instruction

	None		A Little		Some		A Lot	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Australia	60 (4.2)	533 (6.7)	32 (3.9)	513 (9.3)	5 (1.5)	520 (17.4)	3 (1.6)	484 (29.4)
Belgium (Flemish)	84 (3.6)	557 (4.5)	12 (3.3)	554 (22.4)	2 (1.2)	~ ~	1 (0.9)	~ ~
Bulgaria	25 (4.1)	497 (9.6)	4 (1.1)	491 (20.6)	6 (1.9)	495 (14.7)	65 (4.6)	519 (8.4)
Canada	54 (3.1)	536 (3.1)	27 (3.2)	531 (4.3)	16 (2.4)	514 (7.7)	3 (0.8)	525 (18.6)
Chile	34 (3.5)	418 (9.6)	39 (3.7)	383 (6.0)	20 (3.3)	378 (6.3)	7 (1.9)	366 (5.2)
Chinese Taipei	43 (4.3)	591 (5.1)	36 (4.4)	584 (7.3)	12 (3.0)	590 (11.4)	9 (2.2)	551 (13.3)
Cyprus	63 (0.2)	473 (2.4)	28 (0.2)	483 (2.9)	4 (0.0)	490 (3.7)	6 (0.1)	486 (11.6)
Czech Republic	90 (2.9)	521 (4.7)	6 (2.6)	506 (15.6)	3 (1.8)	527 (26.2)	1 (0.9)	~ ~
England r	71 (4.1)	508 (5.8)	19 (3.6)	482 (7.3)	8 (2.8)	485 (17.1)	2 (1.2)	~ ~
Finland	82 (3.3)	519 (3.1)	12 (3.0)	527 (6.0)	3 (1.3)	524 (8.2)	2 (1.1)	~ ~
Hong Kong, SAR	55 (4.5)	596 (6.0)	28 (4.2)	555 (9.6)	10 (2.6)	583 (15.9)	7 (2.1)	602 (15.1)
Hungary	84 (2.7)	531 (4.0)	5 (1.8)	552 (22.2)	4 (1.4)	558 (18.1)	8 (2.0)	504 (17.3)
Indonesia	16 (3.2)	425 (16.5)	33 (4.2)	402 (8.6)	35 (4.6)	398 (9.7)	16 (3.1)	395 (20.3)
Iran, Islamic Rep.	27 (3.5)	429 (5.5)	23 (3.4)	416 (8.1)	29 (4.2)	425 (6.3)	21 (3.3)	416 (7.7)
Israel	56 (4.4)	464 (6.9)	35 (4.3)	466 (7.7)	7 (2.1)	470 (31.8)	3 (1.2)	437 (57.3)
Italy	38 (4.1)	478 (5.5)	36 (3.6)	483 (7.6)	20 (3.3)	473 (9.0)	6 (1.7)	487 (13.3)
Japan	65 (3.9)	579 (2.1)	17 (2.8)	583 (4.2)	8 (2.4)	577 (6.0)	10 (2.5)	572 (5.5)
Jordan	9 (2.5)	426 (11.2)	5 (2.1)	444 (31.8)	4 (1.7)	407 (13.2)	82 (3.4)	428 (4.0)
Korea, Rep. of	19 (3.2)	589 (5.4)	48 (3.9)	587 (2.5)	22 (3.8)	586 (4.4)	11 (2.7)	591 (4.9)
Latvia (LSS)	39 (4.7)	499 (6.7)	21 (3.8)	515 (5.5)	16 (3.9)	508 (11.7)	23 (4.2)	499 (7.8)
Lithuania ‡	91 (2.5)	483 (4.6)	3 (1.4)	467 (10.1)	3 (1.6)	453 (21.3)	3 (1.4)	495 (18.9)
Macedonia, Rep. of	78 (3.4)	452 (4.9)	5 (2.0)	433 (24.5)	10 (2.3)	413 (18.2)	7 (2.2)	431 (20.9)
Malaysia	27 (3.5)	536 (9.5)	23 (3.7)	525 (11.3)	16 (3.3)	517 (14.6)	34 (4.2)	504 (7.7)
Moldova	16 (2.7)	470 (8.4)	10 (2.6)	473 (18.6)	16 (3.1)	473 (11.7)	58 (4.0)	468 (5.1)
Morocco	23 (3.2)	339 (5.3)	29 (3.2)	334 (4.5)	27 (3.7)	334 (4.1)	21 (3.9)	343 (5.3)
Netherlands r	52 (6.5)	546 (11.8)	23 (5.3)	541 (15.4)	19 (6.8)	518 (22.8)	5 (2.0)	560 (22.0)
New Zealand	58 (3.5)	497 (6.9)	26 (3.9)	476 (10.7)	12 (2.6)	465 (13.8)	4 (1.9)	530 (27.1)
Philippines	27 (3.9)	369 (14.5)	30 (3.9)	327 (9.7)	25 (3.6)	338 (12.8)	19 (3.4)	340 (9.4)
Romania	86 (2.5)	475 (6.9)	2 (1.1)	~ ~	4 (1.7)	421 (17.7)	8 (2.0)	467 (21.7)
Russian Federation	51 (3.9)	526 (7.2)	9 (2.3)	523 (24.4)	10 (2.0)	526 (15.2)	30 (3.8)	526 (10.6)
Singapore	58 (4.1)	608 (9.0)	26 (4.1)	599 (10.9)	12 (2.8)	607 (13.9)	4 (1.6)	592 (17.5)
Slovak Republic	79 (4.0)	538 (4.0)	6 (2.3)	502 (11.6)	8 (2.3)	522 (15.4)	8 (2.8)	511 (6.2)
Slovenia	36 (3.9)	526 (4.8)	7 (2.0)	525 (8.5)	15 (2.6)	534 (4.5)	42 (3.9)	533 (5.0)
South Africa	23 (3.2)	295 (15.6)	25 (3.7)	275 (12.5)	26 (3.8)	273 (10.4)	27 (3.7)	260 (14.4)
Thailand	13 (2.9)	470 (18.5)	15 (3.3)	474 (9.6)	35 (4.4)	465 (8.2)	37 (4.3)	467 (8.7)
Tunisia	7 (2.4)	467 (8.6)	7 (2.2)	457 (11.9)	9 (2.5)	448 (7.6)	76 (3.8)	446 (2.8)
Turkey	6 (1.9)	450 (21.7)	12 (2.5)	437 (16.7)	20 (3.7)	425 (6.6)	62 (4.0)	427 (5.1)
United States r	62 (4.2)	514 (5.3)	23 (3.5)	497 (6.2)	13 (2.6)	461 (9.3)	3 (1.0)	446 (15.1)
International Avg.	47 (0.6)	493 (1.4)	20 (0.5)	484 (2.6)	14 (0.5)	478 (2.4)	19 (0.5)	477 (3.0)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by schools.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, at the beginning of the next school year.

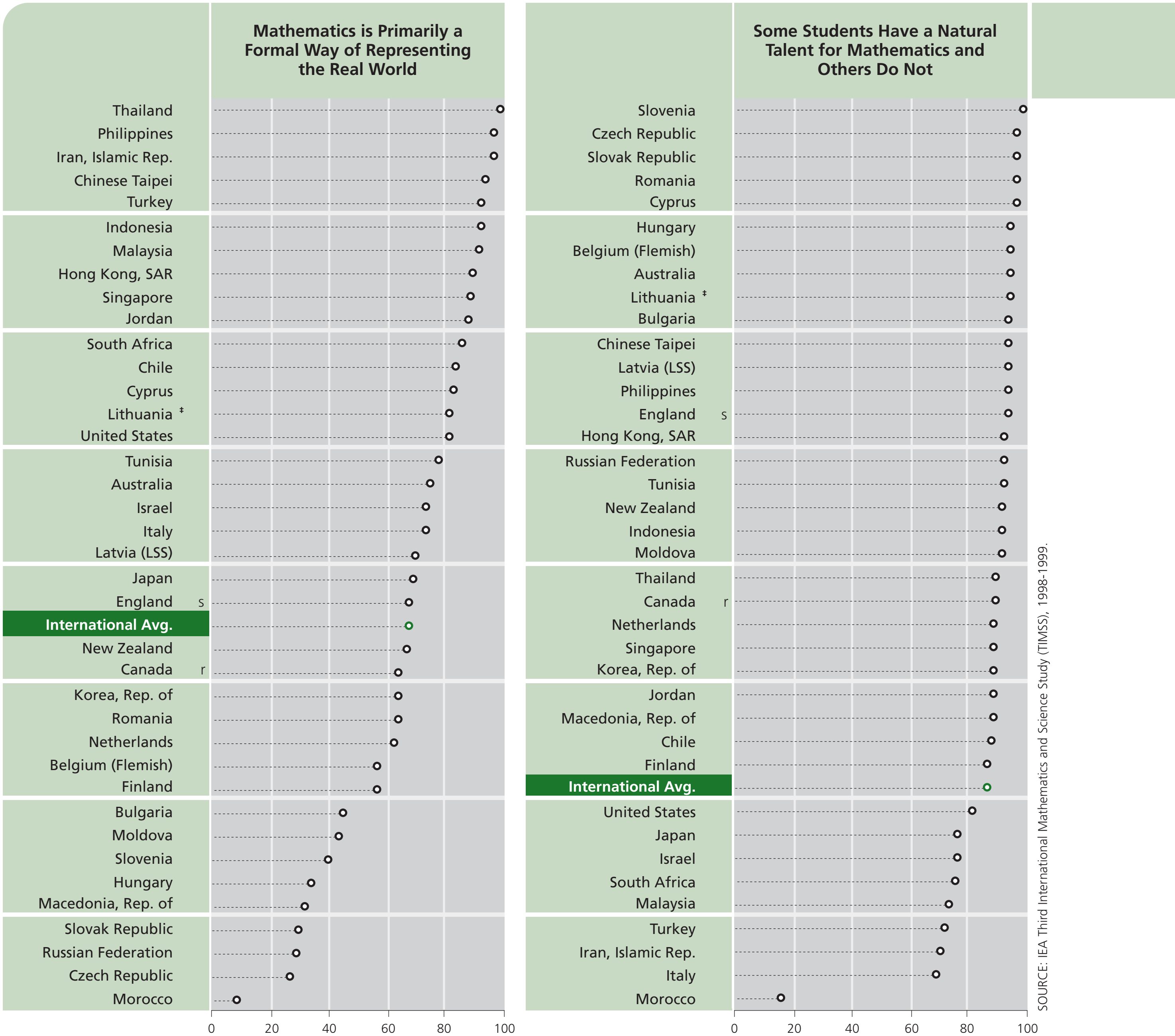
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

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

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

Exhibit R3.4 Overleaf

Exhibit R3.4 Percentage of Students Whose Mathematics Teachers Agree or Strongly Agree with Statements About the Nature of Mathematics and Mathematics Teaching



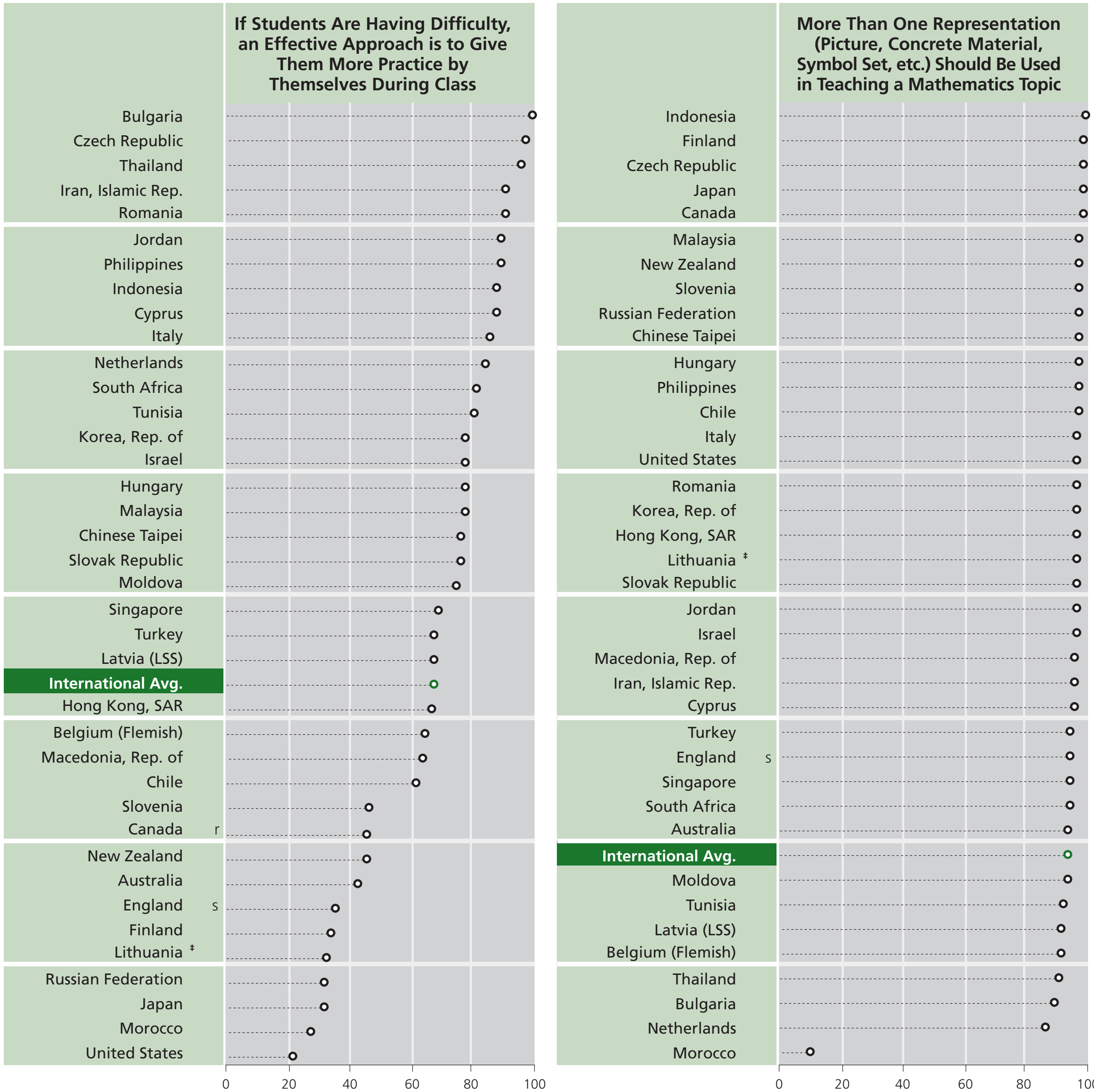
SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, at the beginning of the next school year.

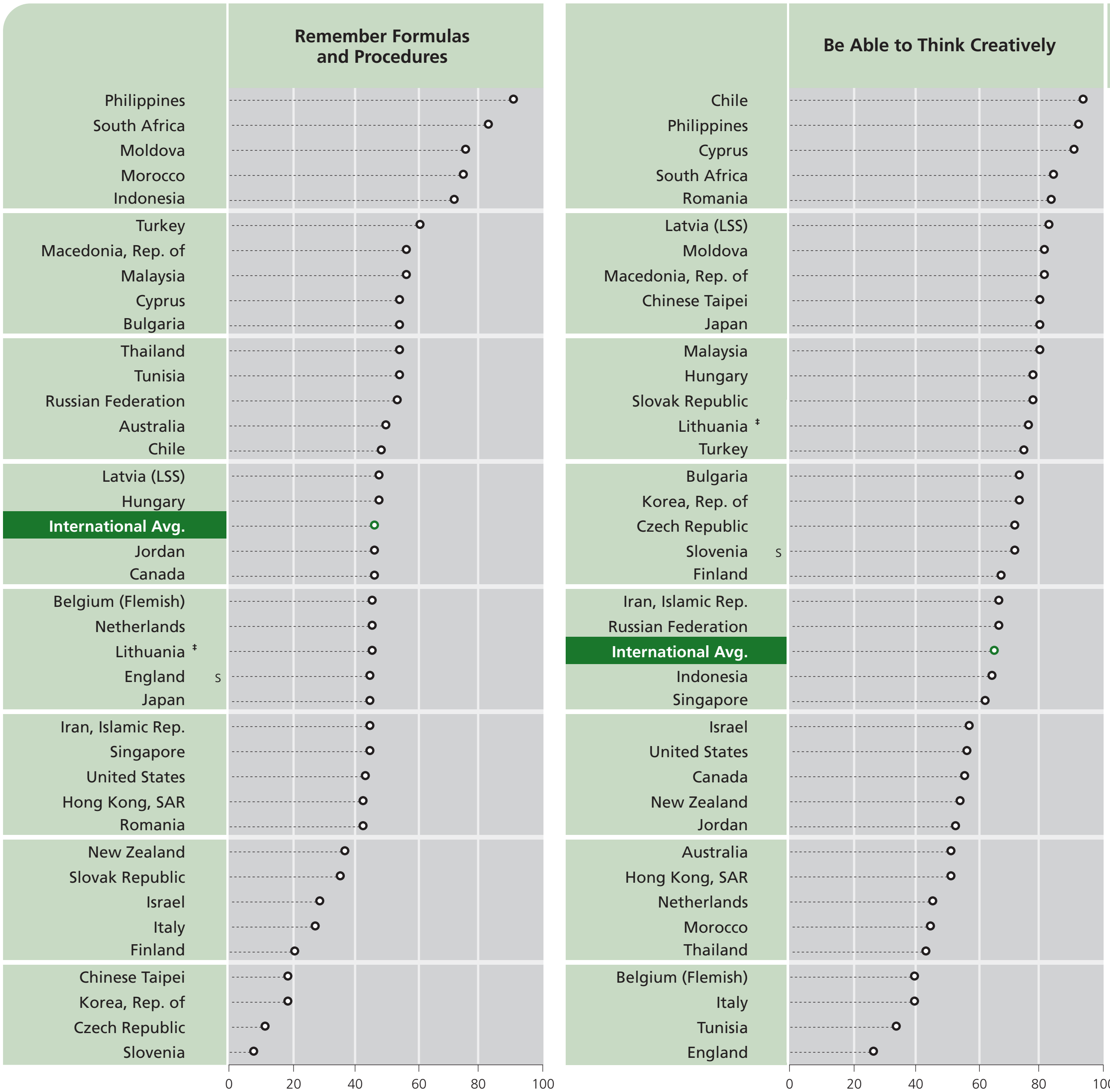
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Exhibit R3.4: Percentage of Students Whose Mathematics Teachers Agree or Strongly Agree with Statements About the Nature of Mathematics and Mathematics Teaching (Continued)



SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Exhibit R3.5 Percentage of Students Whose Mathematics Teachers Think Particular Abilities Are Very Important for Students' Success in Mathematics in School



SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

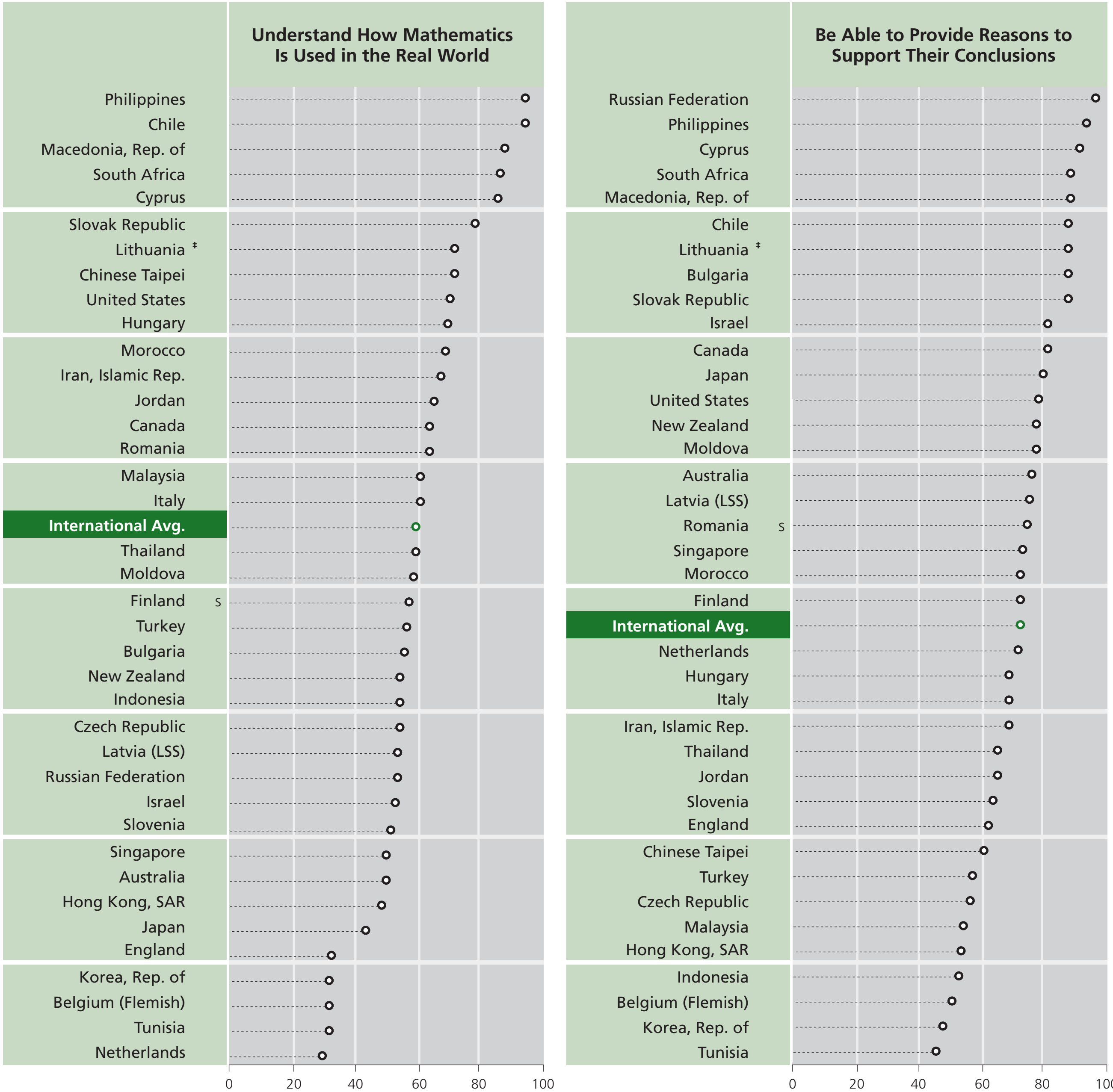
Background data provided by teachers.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, at the beginning of the next school year.

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

Exhibit R3.5: Percentage of Students Whose Mathematics Teachers Think Particular Abilities Are Very Important for Students' Success in Mathematics in School (Continued)

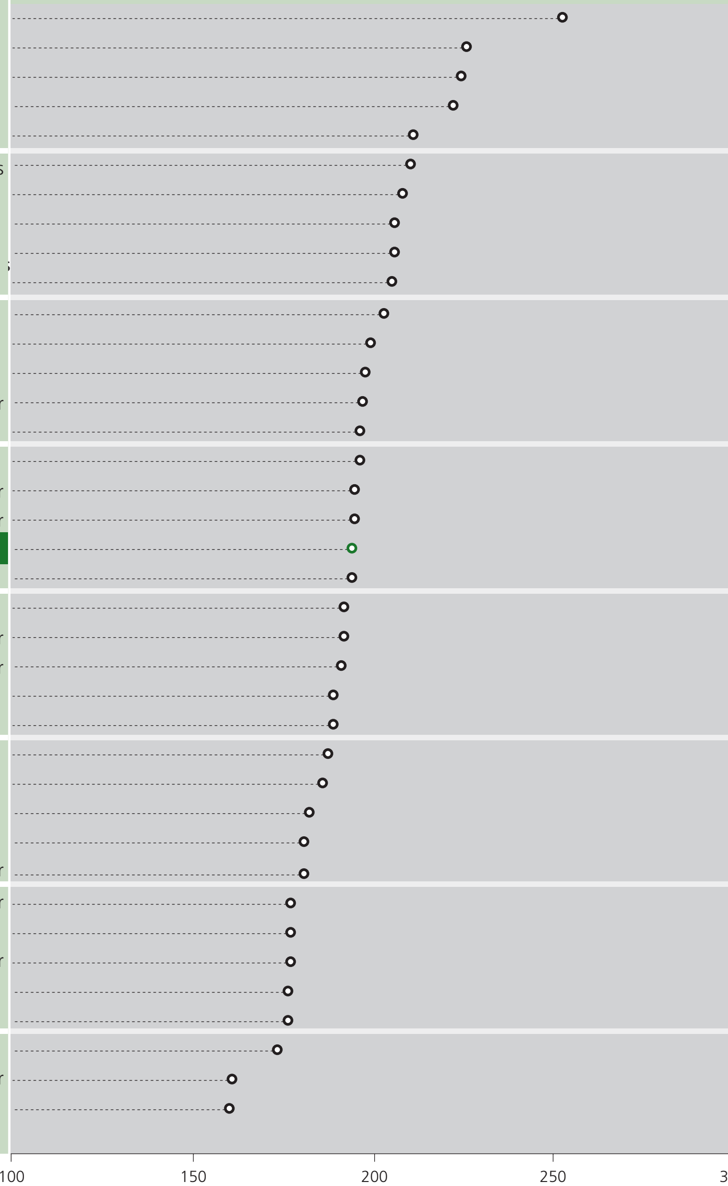
TIMSS 1999 8th grade Mathematics



SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Exhibit R3.6 Average Number of Instructional Days in the School Year

Average Number of Instructional Days in the School Year[1]



Country		Days (s.e.)
Indonesia		251 (2.2)
Korea, Rep. of		225 (0.7)
Japan		223 (0.6)
Chinese Taipei		221 (0.4)
Italy		210 (0.0)
Iran, Islamic Rep.	s	209 (3.0)
Morocco		207 (2.1)
Tunisia		205 (2.1)
Moldova		205 (1.4)
Philippines		204 (1.3)
Thailand		202 (0.8)
Malaysia		198 (1.3)
Czech Republic		197 (0.8)
Australia	r	196 (0.7)
Lithuania	‡	195 (0.0)
Russian Federation		195 (1.2)
South Africa	r	194 (1.9)
Slovak Republic	r	194 (2.1)
International Avg.		**193 (0.2)**
Chile		193 (0.7)
Jordan		191 (0.5)
Netherlands	r	191 (2.0)
England	r	190 (0.3)
New Zealand		188 (0.6)
Canada		188 (0.3)
Finland		186 (0.3)
Hungary		185 (0.4)
Turkey		181 (0.2)
Singapore		180 (0.0)
United States	r	180 (0.4)
Latvia (LSS)	r	176 (1.4)
Macedonia, Rep. of		176 (0.2)
Hong Kong, SAR	r	176 (2.7)
Slovenia		175 (0.0)
Belgium (Flemish)		175 (0.0)
Bulgaria		172 (1.2)
Cyprus	r	160 (0.0)
Romania		159 (1.4)
Israel		x x

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by schools.

1 Days reported averaged across students.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, at the beginning at the next school year.

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

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

Exhibit R3.7 Instructional Time in School

	Yearly Amount of Instructional Time in Hours Averaged Across Students	Yearly Amount of Total Time in School in Hours Averaged Across Students	Percent of Total Hours Spent on Instruction[1]
Philippines	s 1481 (28.9)	s 1551 (57.7)	x x
Chinese Taipei	1374 (13.7)	1742 (15.0)	79 (0.8)
Indonesia	r 1355 (35.2)	r 1586 (49.4)	r 86 (1.0)
Thailand	r 1280 (16.9)	r 1524 (18.1)	r 84 (0.8)
Italy	1124 (7.4)	1228 (9.2)	92 (0.5)
Morocco	s 1113 (24.4)	s 1178 (38.6)	s 96 (1.0)
Chile	s 1110 (20.4)	s 1277 (25.1)	s 88 (0.9)
Korea, Rep. of	1067 (17.7)	1442 (27.9)	76 (1.2)
United States	s 1061 (15.8)	s 1303 (23.1)	x x
Japan	1057 (11.5)	1593 (27.5)	69 (1.3)
Malaysia	1057 (11.0)	1140 (9.7)	93 (0.5)
Bulgaria	s 1049 (18.3)	s 1202 (22.3)	s 88 (1.0)
Australia	r 1021 (9.2)	s 1313 (15.6)	s 78 (0.8)
Netherlands	s 1018 (15.3)	s 1269 (29.0)	s 81 (1.2)
Moldova	s 1012 (22.2)	s 1310 (24.5)	s 77 (1.4)
Jordan	r 1003 (20.7)	1196 (16.5)	r 84 (1.0)
Romania	r 1002 (10.4)	r 1165 (29.7)	r 88 (1.7)
Hong Kong, SAR	s 988 (26.7)	s 1385 (44.2)	s 71 (1.0)
Belgium (Flemish)	980 (0.0)	1120 (0.0)	87 (0.0)
Canada	979 (6.1)	1358 (13.6)	73 (0.7)
Slovak Republic	s 969 (18.8)	s 1203 (25.1)	x x
Finland	969 (11.7)	1133 (5.7)	86 (0.9)
Tunisia	r 961 (19.7)	r 1177 (34.3)	s 85 (1.5)
New Zealand	958 (6.8)	r 1315 (12.3)	r 74 (0.7)
Hungary	956 (14.3)	1301 (22.8)	75 (1.4)
England	r 953 (4.8)	r 1271 (10.0)	r 76 (0.6)
Czech Republic	948 (10.4)	1249 (16.9)	77 (1.0)
Latvia (LSS)	s 905 (23.2)	s 1212 (24.1)	s 77 (1.4)
Lithuania ‡	897 (0.0)	– –	– –
Singapore	880 (11.2)	1213 (21.1)	73 (1.4)
Russian Federation	s 870 (17.0)	s 1153 (18.5)	s 75 (1.1)
Cyprus	r 832 (0.0)	r 960 (0.0)	r 87 (0.0)
Slovenia	770 (0.0)	875 (0.0)	88 (0.0)
Macedonia, Rep. of	s 745 (17.7)	s 974 (22.6)	x x
Iran, Islamic Rep.	x x	x x	x x
Israel	x x	x x	x x
South Africa	x x	s 1285 (31.8)	x x
Turkey	x x	x x	x x
International Avg.	1027 (2.9)	1269 (4.4)	82 (0.2)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by schools.

1 Computed as the ratio of instructional hours to total hours averaged across students.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, at the beginning at 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 data are not available.

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

Exhibit R3.8 How Teachers Spend Their Formally Scheduled School Time

	Percentage of Formally Scheduled School Time Averaged Across Students				
	Teaching Mathematics, Science, and Other Subjects	Teaching Mathematics	Curriculum Planning[1]	Administrative Duties	Other Activities[2]
Australia	80 (1.2)	61 (2.3)	3 (0.6)	5 (1.0)	12 (1.0)
Belgium (Flemish)	r 85 (1.1)	r 70 (1.7)	r 3 (0.5)	r 1 (0.3)	r 10 (0.8)
Bulgaria	71 (3.6)	63 (3.2)	9 (2.1)	5 (1.0)	15 (1.2)
Canada	78 (1.0)	43 (1.3)	7 (0.4)	2 (0.5)	14 (1.0)
Chile	75 (1.3)	59 (1.6)	8 (0.6)	4 (0.6)	13 (0.7)
Chinese Taipei	55 (2.0)	55 (2.0)	9 (0.9)	4 (0.9)	32 (1.6)
Cyprus	r 92 (1.3)	r 92 (1.3)	r 2 (0.4)	r 1 (0.4)	r 6 (0.8)
Czech Republic	70 (2.1)	46 (2.1)	12 (1.6)	3 (0.5)	15 (1.0)
England	s 87 (0.9)	s 80 (1.3)	s 1 (0.3)	s 2 (0.3)	s 10 (0.8)
Finland	85 (0.6)	47 (1.4)	2 (0.3)	1 (0.4)	12 (0.4)
Hong Kong, SAR	x x	x x	x x	x x	x x
Hungary	68 (1.3)	46 (1.5)	9 (0.7)	5 (0.4)	17 (0.9)
Indonesia	65 (2.0)	63 (2.1)	12 (1.0)	8 (0.9)	16 (1.2)
Iran, Islamic Rep.	67 (2.0)	64 (2.0)	10 (1.2)	1 (0.2)	22 (1.7)
Israel	r 80 (1.5)	r 72 (1.7)	r 8 (0.7)	r 3 (0.8)	r 9 (0.7)
Italy	87 (1.1)	52 (0.8)	7 (0.8)	0 (0.1)	6 (0.6)
Japan	68 (1.8)	63 (1.9)	7 (0.8)	4 (0.4)	21 (1.4)
Jordan	67 (1.4)	65 (1.5)	11 (0.6)	4 (0.3)	17 (0.9)
Korea, Rep. of	54 (1.3)	54 (1.3)	11 (0.6)	14 (0.8)	21 (0.9)
Latvia (LSS)	72 (2.1)	64 (2.4)	4 (0.8)	3 (0.9)	21 (1.5)
Lithuania ‡	65 (1.5)	61 (1.6)	10 (0.8)	5 (1.2)	20 (0.9)
Macedonia, Rep. of	52 (1.2)	48 (1.5)	21 (1.0)	5 (0.2)	22 (0.9)
Malaysia	65 (1.0)	52 (1.5)	11 (0.4)	6 (0.3)	19 (0.8)
Moldova	56 (1.8)	r 50 (2.0)	15 (1.2)	r 6 (1.0)	24 (1.2)
Morocco	88 (1.3)	88 (1.3)	2 (0.4)	1 (0.3)	9 (1.2)
Netherlands [3]	s 88 (0.9)	s 75 (2.6)	– –	– –	s 12 (0.9)
New Zealand	83 (1.2)	68 (2.1)	3 (0.6)	4 (0.7)	10 (0.8)
Philippines	70 (1.9)	57 (2.2)	8 (0.9)	3 (0.6)	20 (1.4)
Romania	60 (2.0)	54 (1.8)	10 (0.8)	5 (0.9)	25 (1.5)
Russian Federation [4]	– –	– –	– –	– –	– –
Singapore	73 (0.8)	55 (1.8)	– –	3 (0.3)	24 (0.7)
Slovak Republic	69 (1.9)	51 (2.2)	12 (1.1)	6 (0.8)	12 (0.7)
Slovenia	65 (1.1)	58 (1.5)	16 (0.9)	5 (0.4)	13 (0.6)
South Africa	r 71 (1.9)	r 52 (2.2)	r 6 (0.7)	r 7 (0.7)	r 16 (1.3)
Thailand	60 (1.3)	51 (1.4)	16 (0.8)	4 (0.6)	21 (1.0)
Tunisia	57 (1.4)	56 (1.4)	22 (1.1)	2 (0.6)	19 (1.1)
Turkey	67 (1.6)	61 (1.7)	12 (0.8)	3 (0.8)	18 (0.9)
United States	75 (1.3)	65 (1.7)	13 (0.8)	2 (0.4)	11 (0.8)
International Avg.	71 (0.3)	60 (0.3)	9 (0.2)	4 (0.1)	16 (0.2)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

1 Includes individual curriculum planning and cooperative curriculum planning.

2 Includes student supervision (other than teaching), student counseling/appraisal, other non-student contact time, and other activities.

3 Netherlands: Data in other activities category reflects the total reported for curriculum planning, administrative duties and other activities.

4 Russian Federation: Formally scheduled school time is for instruction only; teachers are not formally scheduled for other activities.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

Exhibit R3.9 Asking Students to Do Problem-Solving Activities or Computation During Mathematics Lessons

TIMSS 1999 8th grade Mathematics

	Percentage of Students Whose Teachers Report Most or Every Lesson				
	Explain Reasoning Behind an Idea	Represent and Analyze Relationships Using Tables, Charts, or Graphs	Work on Problems for Which There Is No Immediately Obvious Method of Solution	Write Equations to Represent Relationships	Practice Computational Skills
Australia	62 (4.2)	15 (2.9)	10 (2.4)	32 (4.1)	55 (4.4)
Belgium (Flemish)	67 (3.5)	2 (0.8)	5 (3.1)	12 (2.0)	76 (2.7)
Bulgaria	93 (2.1)	23 (3.7)	25 (4.3)	40 (5.3)	69 (4.9)
Canada	76 (2.7)	20 (2.6)	18 (2.8)	44 (2.8)	64 (3.3)
Chile	69 (3.5)	23 (3.2)	27 (3.1)	20 (3.2)	81 (2.8)
Chinese Taipei	54 (4.1)	39 (4.4)	11 (2.1)	57 (4.2)	54 (4.5)
Cyprus	r 91 (2.7)	r 13 (3.6)	r 8 (2.6)	r 64 (5.1)	r 57 (5.1)
Czech Republic	94 (2.6)	21 (4.0)	22 (4.2)	69 (5.4)	81 (4.4)
England	s 70 (3.0)	s 13 (2.7)	s 6 (2.1)	s 22 (3.4)	52 (3.6)
Finland	75 (3.6)	19 (3.6)	16 (3.0)	15 (3.0)	84 (3.2)
Hong Kong, SAR	33 (4.1)	17 (3.5)	18 (3.5)	60 (3.5)	78 (3.1)
Hungary	79 (3.4)	31 (3.6)	22 (3.5)	69 (3.8)	90 (2.4)
Indonesia	45 (4.4)	45 (4.1)	14 (3.2)	67 (4.5)	93 (2.4)
Iran, Islamic Rep.	55 (4.5)	26 (3.7)	31 (4.0)	23 (3.7)	71 (3.5)
Israel	75 (3.3)	35 (3.7)	17 (3.3)	59 (3.5)	56 (3.6)
Italy	84 (3.0)	44 (3.8)	45 (3.6)	30 (3.4)	65 (3.4)
Japan	82 (3.2)	62 (4.1)	41 (4.4)	80 (3.0)	62 (4.5)
Jordan	73 (3.8)	36 (4.5)	16 (3.2)	35 (3.9)	91 (2.6)
Korea, Rep. of	65 (3.2)	38 (4.0)	28 (3.5)	65 (3.9)	55 (4.3)
Latvia (LSS)	61 (4.6)	17 (3.7)	12 (2.9)	40 (4.3)	91 (2.5)
Lithuania ‡	73 (4.2)	23 (3.5)	17 (3.4)	41 (4.3)	92 (2.3)
Macedonia, Rep. of	79 (3.4)	32 (3.8)	26 (3.2)	49 (4.2)	80 (3.6)
Malaysia	49 (4.0)	32 (3.8)	41 (3.6)	45 (3.9)	88 (2.8)
Moldova	93 (2.2)	13 (3.1)	20 (3.4)	27 (3.4)	82 (3.4)
Morocco	57 (2.9)	5 (1.4)	11 (1.7)	53 (3.0)	74 (2.6)
Netherlands	65 (5.6)	28 (5.6)	33 (6.4)	23 (5.4)	40 (4.8)
New Zealand	56 (4.0)	10 (2.6)	10 (2.8)	17 (3.0)	67 (3.9)
Philippines	70 (3.9)	33 (3.8)	25 (3.7)	40 (4.2)	95 (1.8)
Romania	93 (2.2)	30 (4.5)	27 (4.2)	33 (4.2)	91 (2.4)
Russian Federation	84 (3.3)	11 (2.5)	13 (2.9)	40 (3.7)	88 (2.3)
Singapore	44 (4.9)	14 (3.2)	15 (3.4)	29 (3.8)	51 (4.4)
Slovak Republic	89 (3.2)	11 (2.9)	25 (4.3)	52 (4.9)	87 (3.4)
Slovenia	77 (3.3)	41 (3.6)	43 (4.0)	82 (3.0)	84 (2.8)
South Africa	63 (3.5)	27 (3.4)	28 (4.0)	44 (4.1)	30 (3.8)
Thailand	54 (3.9)	12 (2.5)	21 (3.4)	25 (3.7)	92 (2.1)
Tunisia	81 (3.4)	35 (3.8)	10 (2.5)	20 (3.7)	56 (4.2)
Turkey	69 (4.0)	55 (3.5)	24 (3.3)	63 (2.9)	79 (3.3)
United States	72 (3.1)	24 (2.6)	19 (2.6)	54 (2.8)	66 (3.7)
International Avg.	70 (0.6)	26 (0.6)	21 (0.6)	43 (0.6)	73 (0.6)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

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

Exhibit R3.10 Trends in Asking Students to Do Problem-Solving Activities During Most or Every Mathematics Lesson

TIMSS 1999 8th grade Mathematics

	Explain Reasoning Behind an Idea		Represent and Analyze Relationships Using Tables, Charts, or Graphs		Work on Problems for Which There Is No Immediately Obvious Method of Solution		Write Equations to Represent Relationships		Practice Computational Skills	
	Percent of Students 1999	1995-1999 Difference	Percent of Students 1999	1995-1999 Difference	Percent of Students 1999	1995-1999 Difference	Percent of Students 1999	1995-1999 Difference	Percent of Students 1999	1995-1999 Difference
Australia	62 (4.2)	r 7 (5.9) ●	15 (2.9)	r 7 (3.4) ●	10 (2.4)	r 5 (2.9) ●	32 (4.1)	r 17 (4.8) ▲	55 (4.4)	r 4 (5.5) ●
Belgium (Flemish)	67 (3.5)	-5 (5.8) ●	2 (0.8)	2 (0.8) ●	5 (3.1)	2 (3.5) ●	12 (2.0)	6 (2.8) ●	76 (2.7)	9 (4.7) ●
Canada	76 (2.7)	r 5 (5.3) ●	20 (2.6)	14 (3.3) ▲	18 (2.8)	6 (4.4) ●	44 (2.8)	16 (4.5) ▲	64 (3.3)	4 (5.7) ●
Cyprus	91 (2.7)	r 2 (4.7) ●	13 (3.6)	r -12 (5.9) ●	8 (2.6)	r -11 (5.3) ●	64 (5.1)	r 15 (8.1) ●	57 (5.1)	r 0 (8.1) ●
Czech Republic	94 (2.6)	12 (5.2) ●	21 (4.0)	0 (6.3) ●	22 (4.2)	3 (5.0) ●	69 (5.4)	7 (8.0) ●	81 (4.4)	4 (6.5) ●
England	70 (3.0)	s 5 (4.4) ●	13 (2.7)	s -4 (3.8) ●	6 (2.1)	s 1 (2.5) ●	22 (3.4)	s 1 (4.4) ●	52 (3.6)	s 10 (4.5) ●
Hong Kong, SAR	33 (4.1)	0 (6.9) ●	17 (3.5)	1 (5.1) ●	18 (3.5)	8 (5.0) ●	60 (3.5)	20 (6.2) ▲	78 (3.1)	23 (6.7) ▲
Hungary	79 (3.4)	-7 (4.7) ●	31 (3.6)	8 (5.0) ●	22 (3.5)	7 (4.7) ●	69 (3.8)	1 (5.5) ●	90 (2.4)	4 (3.6) ●
Iran, Islamic Rep.	55 (4.5)	-4 (7.2) ●	26 (3.7)	r 7 (5.8) ●	31 (4.0)	15 (5.4) ●	23 (3.7)	2 (5.7) ●	71 (3.5)	28 (6.4) ▲
Israel †	74 (3.6)	r 49 (7.7) ▲	34 (4.1)	r -24 (9.6) ●	15 (3.5)	r -59 (7.2) ▼	58 (3.8)	r 14 (9.7) ●	53 (4.0)	r 8 (10.7) ●
Italy	84 (3.5)	3 (4.9) ●	42 (4.5)	3 (6.5) ●	45 (4.1)	19 (5.9) ▲	27 (4.0)	9 (5.2) ●	62 (4.4)	7 (6.4) ●
Japan	82 (3.2)	5 (4.7) ●	62 (4.1)	6 (5.9) ●	41 (4.4)	18 (5.7) ▲	80 (3.0)	9 (5.2) ●	– –	– –
Korea, Rep. of	65 (3.2)	-11 (4.9) ●	38 (4.0)	-2 (6.2) ●	28 (3.5)	3 (5.2) ●	65 (3.9)	10 (6.0) ●	55 (4.3)	27 (5.6) ▲
Latvia (LSS)	61 (4.6)	r -15 (5.9) ●	17 (3.7)	r -9 (5.9) ●	12 (2.9)	r -14 (5.2) ●	40 (4.3)	-1 (6.4) ●	– –	– –
Lithuania	73 (4.2)	0 (5.6) ●	23 (3.5)	15 (4.2) ▲	17 (3.4)	5 (4.5) ●	41 (4.3)	-2 (6.2) ●	92 (2.3)	-6 (2.5) ●
Netherlands	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –
New Zealand	56 (4.0)	-7 (6.1) ●	10 (2.6)	3 (3.6) ●	10 (2.8)	5 (3.3) ●	17 (3.0)	7 (3.9) ●	67 (3.9)	20 (6.2) ▲
Romania	93 (2.2)	-1 (2.8) ●	30 (4.5)	6 (5.8) ●	27 (4.2)	-13 (6.0) ●	33 (4.2)	11 (5.6) ●	91 (2.4)	3 (3.6) ●
Russian Federation	84 (3.3)	-7 (4.1) ●	11 (2.5)	6 (3.1) ●	13 (2.9)	2 (3.7) ●	40 (3.7)	9 (5.9) ●	88 (2.3)	1 (3.7) ●
Singapore	44 (4.9)	2 (7.0) ●	14 (3.2)	-1 (4.5) ●	15 (3.4)	8 (4.1) ●	29 (3.8)	4 (5.4) ●	51 (4.4)	1 (6.3) ●
Slovak Republic	89 (3.2)	4 (4.6) ●	11 (2.9)	1 (3.9) ●	25 (4.3)	4 (5.5) ●	52 (4.9)	-10 (6.5) ●	87 (3.4)	24 (5.7) ▲
Slovenia	77 (3.3)	r 31 (5.9) ▲	41 (3.6)	r 19 (5.3) ▲	43 (4.0)	r -1 (6.6) ●	82 (3.0)	r 16 (5.4) ▲	84 (2.8)	r 5 (5.2) ●
Thailand †	54 (3.9)	r 23 (6.6) ▲	12 (2.5)	s 8 (3.2) ●	21 (3.4)	s 2 (6.2) ●	25 (3.7)	r 8 (5.9) ●	92 (2.1)	r 5 (4.9) ●
United States	72 (3.1)	r 5 (4.8) ●	24 (2.6)	r 12 (3.8) ▲	19 (2.6)	r 7 (3.7) ●	54 (2.8)	r 17 (5.0) ▲	66 (3.7)	r 8 (5.8) ●
International Avg. §	72 (0.8)	1 (1.2) ●	23 (0.8)	4 (1.1) ▲	21 (0.8)	4 (1.1) ▲	45 (0.8)	7 (1.2) ▲	71 (0.8)	8 (1.2) ▲

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

Background data provided by teachers.

† Countries with unapproved sampling procedures at the classroom level in 1995.

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian-Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

Background data for Bulgaria and South Africa are unavailable for 1995.

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

A dash (–) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students, based on the lower response rate in either 1995 or 1999. An "s" indicates teacher response data available for 50-69% of students, based on the lower response rate in either 1995 or 1999.

Exhibit R3.11 Students Using Things from Everyday Life in Solving Mathematics Problems

TIMSS 1999 8th grade Mathematics

Country	Almost Always		Pretty Often		Once in a While		Never	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Australia	16 (0.7)	512 (5.9)	37 (1.2)	525 (5.3)	38 (1.0)	535 (5.6)	10 (0.7)	515 (9.4)
Belgium (Flemish)	7 (0.7)	531 (13.8)	20 (0.8)	560 (4.4)	47 (1.1)	567 (4.0)	27 (1.1)	552 (4.8)
Bulgaria	11 (0.8)	476 (6.5)	19 (1.6)	516 (6.6)	46 (1.3)	523 (6.6)	24 (1.3)	511 (7.7)
Canada	19 (0.7)	518 (3.6)	33 (0.8)	534 (4.3)	36 (0.9)	536 (2.7)	11 (0.7)	531 (4.6)
Chile	26 (0.7)	400 (4.6)	24 (0.6)	398 (4.7)	29 (0.7)	400 (6.8)	22 (0.8)	374 (5.5)
Chinese Taipei	11 (0.5)	596 (6.2)	31 (0.8)	600 (4.0)	43 (0.8)	590 (4.4)	15 (0.7)	540 (6.5)
Cyprus	16 (1.1)	476 (6.0)	37 (1.0)	491 (2.8)	32 (1.0)	474 (2.9)	15 (0.8)	455 (5.1)
Czech Republic	11 (0.9)	522 (8.1)	36 (1.4)	530 (4.2)	37 (1.5)	519 (5.0)	16 (1.2)	499 (8.3)
England	14 (0.8)	486 (6.3)	41 (1.3)	499 (5.2)	34 (1.0)	505 (4.9)	11 (0.8)	489 (8.2)
Finland	6 (0.7)	510 (8.2)	21 (1.1)	526 (4.2)	57 (1.2)	524 (2.8)	16 (0.9)	507 (5.7)
Hong Kong, SAR	6 (0.3)	573 (8.0)	24 (0.8)	583 (6.5)	56 (0.9)	587 (4.0)	15 (0.7)	570 (6.1)
Hungary	6 (0.5)	495 (8.2)	18 (0.8)	525 (6.3)	49 (1.0)	540 (4.0)	27 (1.2)	531 (5.5)
Indonesia	4 (0.3)	380 (12.6)	15 (0.8)	385 (8.1)	46 (1.2)	424 (5.4)	35 (1.2)	388 (6.1)
Iran, Islamic Rep.	13 (0.5)	406 (8.3)	18 (0.6)	420 (4.9)	38 (0.9)	433 (4.3)	32 (1.0)	422 (4.2)
Israel	22 (1.0)	449 (7.3)	26 (1.0)	466 (5.2)	34 (0.9)	489 (4.9)	18 (0.9)	468 (5.6)
Italy	10 (0.6)	456 (7.7)	19 (0.8)	494 (6.2)	38 (1.0)	489 (4.0)	33 (1.2)	471 (4.5)
Japan	2 (0.2)	~ ~	17 (0.7)	590 (3.5)	55 (0.8)	583 (2.1)	27 (1.0)	564 (3.3)
Jordan	31 (1.1)	419 (5.8)	30 (0.9)	438 (4.6)	28 (0.9)	450 (5.7)	12 (0.6)	426 (6.9)
Korea, Rep. of	3 (0.3)	580 (7.5)	12 (0.6)	602 (3.2)	47 (0.8)	595 (2.3)	37 (0.8)	573 (2.7)
Latvia (LSS)	36 (1.1)	510 (4.2)	34 (0.9)	503 (4.9)	26 (0.8)	505 (5.1)	4 (0.4)	490 (6.9)
Lithuania ‡	– –	– –	– –	– –	– –	– –	– –	– –
Macedonia, Rep. of	26 (0.9)	445 (5.9)	31 (1.0)	461 (4.9)	31 (1.1)	451 (4.3)	12 (0.7)	445 (6.6)
Malaysia	6 (0.4)	522 (8.9)	17 (0.7)	522 (5.4)	40 (1.1)	526 (4.9)	37 (1.2)	511 (4.8)
Moldova	14 (1.0)	456 (7.4)	26 (1.3)	468 (5.2)	43 (1.5)	479 (4.7)	17 (0.9)	470 (6.6)
Morocco r	25 (0.9)	325 (5.0)	30 (0.7)	340 (8.8)	23 (0.9)	362 (5.3)	22 (1.0)	341 (6.9)
Netherlands	7 (0.6)	544 (10.2)	20 (0.9)	549 (8.5)	49 (1.6)	542 (8.1)	23 (1.5)	530 (8.4)
New Zealand	20 (0.9)	462 (6.8)	39 (1.0)	501 (5.2)	35 (0.9)	504 (5.6)	7 (0.5)	473 (10.0)
Philippines	40 (1.1)	346 (6.3)	25 (0.8)	351 (8.2)	25 (0.7)	350 (7.1)	10 (0.5)	335 (8.9)
Romania	13 (0.8)	451 (7.7)	18 (0.9)	473 (6.1)	46 (1.3)	487 (5.8)	23 (1.0)	470 (7.7)
Russian Federation	14 (0.8)	506 (6.7)	23 (1.2)	538 (8.3)	46 (1.4)	533 (6.0)	17 (0.9)	521 (6.3)
Singapore	16 (0.8)	578 (7.8)	34 (0.9)	606 (6.9)	36 (1.1)	617 (6.3)	14 (0.8)	599 (6.1)
Slovak Republic	13 (0.7)	528 (5.5)	35 (1.3)	542 (4.4)	41 (1.1)	535 (4.4)	11 (0.8)	514 (6.2)
Slovenia	11 (0.8)	514 (6.7)	24 (1.1)	537 (4.3)	52 (1.2)	535 (3.2)	13 (0.8)	518 (5.8)
South Africa	36 (1.0)	261 (5.6)	24 (0.9)	281 (10.3)	18 (0.7)	307 (11.0)	21 (1.3)	270 (9.6)
Thailand	8 (0.4)	463 (8.7)	24 (0.9)	476 (6.5)	45 (0.9)	474 (5.0)	24 (1.0)	450 (5.5)
Tunisia	17 (0.7)	444 (3.2)	22 (0.7)	452 (4.6)	37 (0.9)	451 (3.5)	24 (0.8)	443 (2.5)
Turkey	11 (0.6)	419 (5.7)	15 (0.6)	442 (5.2)	45 (0.9)	437 (5.2)	29 (1.1)	425 (4.9)
United States	23 (0.9)	489 (5.1)	31 (0.8)	509 (3.8)	34 (0.7)	515 (4.1)	12 (0.7)	493 (6.8)
International Avg.	15 (0.1)	474 (1.4)	26 (0.2)	493 (0.9)	39 (0.2)	497 (0.9)	19 (0.2)	478 (1.0)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available. A tilde (~) indicates insufficient data to report achievement.

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

Exhibit R3.12 Students' Reports on Frequency of Calculator Use in Mathematics Class*

TIMSS 1999 8th grade Mathematics

	Almost Always		Pretty Often		Once in a While		Never	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Australia	51 (2.0)	531 (5.7)	36 (1.4)	525 (5.5)	9 (1.0)	508 (10.4)	3 (1.2)	488 (25.9)
Belgium (Flemish)	16 (1.3)	553 (6.4)	30 (1.6)	567 (6.0)	49 (2.1)	560 (4.5)	5 (1.2)	528 (11.4)
Bulgaria	5 (0.6)	486 (14.2)	7 (0.8)	505 (10.4)	35 (2.0)	520 (6.2)	52 (2.3)	512 (7.3)
Canada	44 (1.9)	532 (3.2)	35 (1.2)	535 (3.0)	17 (1.5)	523 (4.1)	3 (0.9)	523 (14.8)
Chile	14 (1.3)	387 (8.1)	12 (0.8)	395 (7.8)	30 (1.3)	401 (5.8)	43 (2.2)	390 (5.2)
Chinese Taipei	2 (0.2)	~ ~	7 (0.4)	543 (7.9)	45 (1.0)	591 (4.0)	46 (1.1)	591 (5.0)
Cyprus	6 (0.6)	453 (8.2)	18 (1.0)	472 (4.8)	41 (1.1)	484 (3.1)	35 (1.8)	478 (3.0)
Czech Republic	14 (2.1)	520 (7.5)	27 (1.7)	530 (6.8)	48 (2.5)	518 (4.6)	12 (2.0)	507 (8.0)
England	30 (1.6)	518 (6.5)	53 (1.4)	500 (4.3)	16 (1.1)	460 (5.9)	1 (0.3)	~ ~
Finland	19 (2.1)	520 (6.0)	32 (1.6)	519 (3.4)	46 (2.5)	523 (3.2)	2 (0.6)	~ ~
Hong Kong, SAR	26 (1.4)	591 (5.0)	51 (1.0)	582 (4.5)	21 (1.4)	575 (5.2)	2 (0.5)	~ ~
Hungary	13 (1.2)	538 (7.5)	22 (1.4)	536 (7.7)	39 (2.0)	535 (4.5)	27 (2.5)	522 (6.3)
Indonesia	2 (0.3)	~ ~	11 (1.0)	395 (7.9)	46 (1.8)	423 (5.8)	41 (2.4)	385 (6.3)
Iran, Islamic Rep.	5 (0.3)	385 (11.0)	6 (0.4)	420 (8.6)	21 (1.0)	432 (4.5)	68 (1.3)	424 (3.8)
Israel	45 (1.8)	463 (4.9)	25 (0.9)	481 (5.0)	22 (1.2)	480 (6.6)	8 (1.0)	453 (14.8)
Italy	35 (1.9)	485 (4.4)	22 (0.9)	483 (5.3)	26 (1.5)	477 (5.6)	16 (1.7)	473 (7.6)
Japan	0 (0.1)	~ ~	3 (0.4)	545 (8.2)	28 (2.1)	580 (3.7)	68 (2.3)	580 (2.4)
Jordan	12 (0.8)	380 (5.9)	16 (0.8)	410 (6.5)	29 (1.1)	445 (4.5)	43 (1.8)	450 (4.5)
Korea, Rep. of	0 (0.1)	~ ~	1 (0.2)	~ ~	13 (0.5)	574 (5.1)	86 (0.7)	590 (2.3)
Latvia (LSS)	9 (1.2)	501 (7.4)	14 (1.2)	515 (7.8)	39 (1.8)	502 (4.8)	38 (2.5)	506 (3.8)
Lithuania ‡	– –	– –	– –	– –	– –	– –	– –	– –
Macedonia, Rep. of	13 (1.0)	436 (7.1)	15 (1.1)	461 (6.4)	33 (1.5)	457 (5.2)	40 (2.2)	454 (4.3)
Malaysia	1 (0.2)	~ ~	4 (0.5)	515 (14.6)	23 (1.2)	522 (5.6)	72 (1.6)	520 (4.6)
Moldova	13 (0.8)	469 (7.3)	19 (1.0)	470 (5.4)	38 (1.3)	475 (4.7)	29 (1.8)	468 (6.4)
Morocco r	14 (0.9)	312 (9.7)	23 (1.0)	328 (6.3)	21 (0.8)	345 (8.2)	42 (1.2)	355 (3.8)
Netherlands	67 (2.0)	547 (6.5)	29 (1.6)	533 (9.5)	4 (0.6)	494 (16.4)	0 (0.1)	~ ~
New Zealand	43 (1.8)	492 (6.6)	38 (1.5)	493 (4.8)	16 (1.6)	494 (9.4)	3 (0.9)	499 (27.5)
Philippines	9 (0.6)	297 (7.4)	14 (0.7)	324 (8.4)	28 (1.1)	354 (7.6)	49 (1.6)	359 (6.1)
Romania	4 (0.5)	422 (12.4)	6 (0.6)	456 (11.8)	23 (1.5)	483 (7.6)	67 (2.0)	479 (5.5)
Russian Federation	16 (1.2)	508 (8.7)	19 (1.0)	528 (8.4)	47 (1.3)	533 (6.3)	18 (1.7)	532 (7.6)
Singapore	36 (1.5)	610 (7.4)	50 (1.0)	610 (6.1)	14 (1.2)	572 (6.5)	1 (0.2)	~ ~
Slovak Republic	21 (1.7)	540 (6.7)	26 (1.4)	544 (6.0)	40 (2.2)	526 (4.3)	14 (1.8)	531 (7.8)
Slovenia	6 (0.8)	506 (11.1)	11 (1.0)	520 (6.4)	42 (1.9)	532 (4.1)	41 (2.6)	536 (3.3)
South Africa	45 (1.8)	261 (7.9)	21 (0.9)	296 (10.6)	15 (1.0)	306 (15.5)	19 (1.4)	268 (13.4)
Thailand	3 (0.4)	451 (16.0)	7 (0.5)	467 (9.6)	35 (1.1)	482 (6.1)	55 (1.6)	460 (5.2)
Tunisia	5 (0.4)	425 (6.0)	7 (0.4)	433 (6.3)	28 (1.2)	447 (3.1)	60 (1.5)	453 (2.9)
Turkey	5 (0.3)	385 (9.2)	5 (0.4)	404 (7.6)	27 (1.1)	432 (5.9)	63 (1.4)	439 (4.3)
United States	42 (2.3)	516 (5.1)	28 (1.1)	506 (4.6)	22 (1.5)	493 (4.8)	8 (1.2)	471 (7.4)
International Avg.	19 (0.2)	469 (2.0)	20 (0.2)	482 (1.1)	29 (0.2)	488 (1.2)	32 (0.3)	476 (2.2)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

* The use of calculators on TIMSS was not allowed in 1995 or in 1999.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available. A tilde (~) indicates insufficient data to report achievement.

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

Exhibit R3.13 Trends in Students' Reports on Frequency of Calculator Use in Mathematics Class*

TIMSS 1999 8th grade Mathematics

	Almost Always		Pretty Often		Once in a While		Never	
	Percent of Students 1999	1995-1999 Difference	Percent of Students 1999	1995-1999 Difference	Percent of Students 1999	1995-1999 Difference	Percent of Students 1999	1995-1999 Difference
Australia	51 (2.0)	-3 (2.7) ●	36 (1.4)	5 (1.8) ●	9 (1.0)	-1 (1.3) ●	3 (1.2)	-1 (1.6) ●
Belgium (Flemish)	16 (1.3)	6 (2.1) ●	30 (1.6)	10 (3.0) ▲	49 (2.1)	13 (3.2) ▲	5 (1.2)	-29 (4.3) ▼
Canada	44 (1.9)	6 (2.9) ●	35 (1.2)	2 (1.7) ●	17 (1.5)	-5 (2.1) ●	3 (0.9)	-3 (1.5) ●
Cyprus	6 (0.6)	-4 (1.1) ▼	18 (1.0)	-3 (1.4) ●	41 (1.1)	2 (1.7) ●	35 (1.8)	5 (2.7) ●
Czech Republic	14 (2.1)	-11 (2.8) ▼	27 (1.7)	-10 (2.7) ▼	48 (2.5)	14 (3.5) ▲	12 (2.0)	7 (2.3) ●
England	30 (1.6)	-16 (2.4) ▼	53 (1.4)	7 (2.1) ▲	16 (1.1)	7 (1.4) ▲	1 (0.3)	1 (0.3) ●
Hong Kong, SAR	26 (1.4)	-23 (2.8) ▼	51 (1.0)	18 (2.1) ▲	21 (1.4)	12 (1.8) ▲	2 (0.5)	-7 (2.3) ●
Hungary	13 (1.2)	-4 (1.8) ●	22 (1.4)	-2 (1.9) ●	39 (2.0)	0 (2.8) ●	27 (2.5)	6 (3.3) ●
Iran, Islamic Rep.	5 (0.3)	1 (0.6) ●	6 (0.4)	2 (0.6) ▲	21 (1.0)	8 (1.4) ▲	68 (1.3)	-11 (1.9) ▼
Israel †	48 (2.0)	3 (3.9) ●	25 (1.0)	-2 (1.9) ●	21 (1.4)	-1 (2.6) ●	7 (1.1)	0 (2.1) ●
Italy	37 (2.2)	7 (3.2) ●	23 (1.1)	-1 (2.0) ●	25 (1.7)	0 (2.7) ●	16 (2.2)	-6 (4.1) ●
Japan	0 (0.1)	0 (0.1) ●	3 (0.4)	0 (0.8) ●	28 (2.1)	7 (2.8) ●	68 (2.3)	-7 (3.3) ●
Korea, Rep. of	0 (0.1)	-1 (0.2) ●	1 (0.2)	0 (0.4) ●	13 (0.5)	7 (0.7) ▲	86 (0.7)	-7 (0.8) ▼
Latvia (LSS)	9 (1.2)	-14 (2.3) ▼	14 (1.2)	-21 (1.8) ▼	39 (1.8)	12 (2.3) ▲	38 (2.5)	24 (2.8) ▲
Lithuania	– –	– –	– –	– –	– –	– –	– –	– –
Netherlands	67 (2.0)	13 (2.9) ▲	29 (1.6)	-7 (2.3) ●	4 (0.6)	-5 (1.4) ▼	0 (0.1)	-1 (0.2) ●
New Zealand	43 (1.8)	8 (2.7) ●	38 (1.5)	0 (2.0) ●	16 (1.6)	-5 (2.3) ●	3 (0.9)	-3 (1.4) ●
Romania	4 (0.5)	-5 (0.9) ▼	6 (0.6)	-3 (0.8) ▼	23 (1.5)	-2 (2.0) ●	67 (2.0)	10 (2.6) ▲
Russian Federation	16 (1.2)	-13 (2.0) ▼	19 (1.0)	-6 (1.9) ●	47 (1.3)	10 (2.7) ▲	18 (1.7)	9 (2.2) ▲
Singapore	36 (1.5)	7 (2.3) ▲	50 (1.0)	-4 (1.6) ●	14 (1.2)	-3 (1.9) ●	1 (0.2)	0 (0.5) ●
Slovak Republic	21 (1.7)	-14 (2.5) ▼	26 (1.4)	-12 (2.0) ▼	40 (2.2)	15 (2.8) ▲	14 (1.8)	10 (1.9) ▲
Slovenia	6 (0.8)	-1 (1.1) ●	11 (1.0)	1 (1.4) ●	42 (1.9)	3 (2.9) ●	41 (2.6)	-3 (4.0) ●
Thailand †	3 (0.4)	1 (0.5) ●	7 (0.5)	2 (1.0) ●	35 (1.1)	2 (2.0) ●	55 (1.6)	-4 (2.7) ●
United States	42 (2.3)	-3 (3.5) ●	28 (1.1)	3 (1.6) ●	22 (1.5)	2 (2.2) ●	8 (1.2)	-2 (2.0) ●
International Avg. §	23 (0.3)	-3 (0.5) ▼	25 (0.3)	-1 (0.4) ●	27 (0.3)	4 (0.5) ▲	25 (0.4)	0 (0.5) ●

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

Background data provided by students.

* The use of calculators on TIMSS was not allowed in 1995 or in 1999.

† Countries with unapproved sampling procedures at the classroom level in 1995.

§ International average is for countries that participated and met sampling guidelines in both 1995 and 1999.

Trend notes: Because coverage fell below 65% in 1995 and 1999, Latvia is annotated LSS for Latvian-Speaking Schools only. Lithuania tested later in 1999 than in 1995, at the beginning of the next school year. In 1995, Italy and Israel were unable to cover their International Desired Population; 1999 data are based on their comparable populations.

Background data for Bulgaria and South Africa are unavailable for 1995.

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

A dash (–) indicates data are not available.

Exhibit R3.14 Ways in Which Calculators Are Used*

TIMSS 1999 8th grade Mathematics

	Percentage of Students					
	Never or Hardly Ever Use Calculators	Ways in Which Students Use Calculators At Least Once or Twice a Week				
		Checking Answers	Tests and Exams	Routine Computations	Solving Complex Problems	Exploring Number Concepts
Australia	6 (2.1)	81 (4.0)	61 (4.0)	88 (3.0)	81 (3.3)	57 (4.7)
Belgium (Flemish)	7 (2.5)	55 (4.6)	34 (3.5)	45 (4.7)	53 (4.5)	27 (4.0)
Bulgaria	25 (3.9)	30 (4.3)	10 (2.9)	43 (5.6)	33 (5.2)	20 (5.5)
Canada	3 (1.0)	82 (2.3)	58 (2.9)	r 80 (2.8)	91 (1.8)	r 69 (3.0)
Chile	32 (3.2)	35 (3.0)	9 (2.1)	41 (3.3)	33 (3.4)	24 (2.9)
Chinese Taipei	55 (4.6)	5 (1.7)	2 (1.0)	9 (2.5)	9 (2.5)	8 (2.3)
Cyprus	30 (4.1)	r 44 (4.8)	r 1 (0.1)	r 43 (4.4)	r 28 (4.9)	r 14 (3.3)
Czech Republic	5 (2.3)	60 (4.9)	18 (3.6)	49 (4.9)	60 (5.0)	22 (4.6)
England	0 (0.4)	s 74 (3.6)	s 32 (3.4)	s 76 (3.0)	s 72 (3.8)	s 41 (4.1)
Finland	8 (2.3)	56 (4.3)	23 (3.8)	65 (4.5)	68 (4.1)	32 (4.1)
Hong Kong, SAR	1 (0.9)	85 (2.8)	58 (4.2)	88 (2.8)	74 (3.6)	39 (3.9)
Hungary	20 (3.1)	53 (3.5)	13 (2.8)	34 (3.7)	49 (3.9)	15 (2.9)
Indonesia	37 (4.8)	11 (2.7)	6 (2.2)	12 (3.1)	27 (4.3)	17 (2.9)
Iran, Islamic Rep.	59 (4.5)	9 (2.5)	2 (1.1)	13 (4.1)	5 (2.1)	8 (2.2)
Israel	3 (0.7)	78 (3.2)	69 (3.6)	80 (2.9)	r 66 (3.6)	r 44 (3.4)
Italy	13 (2.1)	66 (2.8)	14 (2.8)	58 (3.2)	68 (3.4)	21 (3.3)
Japan	81 (3.3)	0 (0.0)	1 (0.7)	5 (2.0)	4 (1.7)	1 (1.0)
Jordan	38 (4.4)	20 (3.9)	2 (1.1)	21 (3.7)	23 (3.8)	13 (2.8)
Korea, Rep. of	72 (3.4)	1 (0.9)	1 (0.9)	2 (1.2)	5 (1.7)	2 (1.2)
Latvia (LSS)	33 (3.5)	23 (3.5)	2 (1.0)	26 (3.8)	32 (3.9)	12 (2.8)
Lithuania ‡	8 (2.3)	69 (4.1)	15 (3.2)	56 (4.2)	70 (3.9)	32 (4.0)
Macedonia, Rep. of	49 (4.0)	32 (4.0)	1 (0.8)	31 (4.2)	24 (3.2)	15 (2.6)
Malaysia	67 (4.4)	9 (2.4)	0 (0.0)	7 (2.0)	11 (2.4)	4 (1.5)
Moldova	21 (3.3)	59 (4.1)	11 (3.0)	48 (4.0)	45 (3.9)	21 (3.4)
Morocco	30 (2.7)	29 (2.4)	8 (1.5)	40 (2.7)	18 (2.9)	20 (2.9)
Netherlands	1 (0.1)	91 (2.9)	68 (5.4)	97 (1.8)	90 (3.0)	65 (6.3)
New Zealand	5 (2.1)	76 (3.7)	46 (4.2)	85 (3.2)	73 (3.6)	59 (4.1)
Philippines	56 (4.1)	17 (2.7)	7 (2.2)	10 (2.8)	15 (3.1)	10 (2.2)
Romania	64 (4.4)	16 (3.1)	1 (0.0)	17 (3.5)	6 (1.9)	5 (2.1)
Russian Federation	14 (2.7)	58 (3.9)	3 (1.3)	47 (4.4)	46 (3.8)	15 (3.0)
Singapore	0 (0.0)	88 (3.0)	61 (4.5)	85 (3.5)	93 (2.5)	67 (3.9)
Slovak Republic	3 (1.7)	61 (4.3)	15 (3.5)	57 (4.5)	72 (4.6)	55 (4.7)
Slovenia	31 (4.2)	26 (4.0)	4 (1.8)	23 (3.7)	23 (3.6)	7 (2.0)
South Africa	18 (2.9)	53 (3.9)	41 (4.5)	46 (4.2)	53 (4.0)	52 (3.3)
Thailand	62 (4.1)	11 (2.0)	1 (0.9)	13 (2.9)	13 (2.6)	9 (2.4)
Tunisia	36 (3.9)	20 (3.3)	3 (1.6)	15 (3.0)	5 (1.7)	7 (1.9)
Turkey	59 (4.8)	15 (2.8)	3 (1.1)	12 (2.6)	17 (2.9)	10 (2.4)
United States	5 (1.2)	69 (3.5)	45 (3.2)	62 (3.9)	75 (3.2)	59 (3.2)
International Avg.	28 (0.5)	44 (0.6)	20 (0.4)	43 (0.6)	43 (0.6)	26 (0.5)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

* The use of calculators on TIMSS was not allowed in 1995 or in 1999.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

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

Exhibit R3.15 Amount of Mathematics Homework

TIMSS 1999 8th grade Mathematics

	Percentage of Students Taught By Teachers						
	Assigning Homework Three Times A Week or More Often		Assigning Homework Once or Twice A Week		Assigning Homework Less Than Once a Week		Never Assigning Homework
	30 Minutes or Less	More Than 30 Minutes	30 Minutes or Less	More Than 30 Minutes	30 Minutes or Less	More Than 30 Minutes	
Australia	60 (3.9)	6 (2.0)	25 (3.6)	6 (2.0)	2 (1.1)	1 (0.9)	1 (0.6)
Belgium (Flemish)	15 (2.7)	2 (0.9)	48 (4.9)	9 (2.0)	18 (3.3)	3 (1.2)	5 (3.2)
Bulgaria	31 (4.5)	44 (5.6)	16 (3.5)	6 (1.7)	1 (0.6)	1 (0.5)	1 (1.0)
Canada	58 (3.5)	16 (2.6)	22 (2.8)	3 (1.5)	1 (0.7)	0 (0.0)	0 (0.0)
Chile	16 (2.6)	7 (2.2)	39 (3.9)	13 (2.8)	19 (2.9)	2 (1.0)	4 (1.7)
Chinese Taipei	21 (3.1)	25 (3.6)	27 (3.4)	23 (3.4)	2 (1.1)	2 (1.1)	0 (0.0)
Cyprus	55 (5.1)	44 (4.9)	2 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Czech Republic	15 (3.7)	0 (0.2)	69 (5.1)	2 (1.3)	13 (3.8)	0 (0.0)	0 (0.0)
England	3 (1.4)	1 (0.6)	48 (3.9)	46 (4.1)	2 (0.8)	1 (0.3)	0 (0.0)
Finland	79 (3.0)	9 (2.3)	11 (2.2)	1 (0.8)	0 (0.0)	0 (0.0)	0 (0.0)
Hong Kong, SAR	30 (4.0)	19 (3.1)	26 (3.1)	23 (3.7)	2 (1.2)	1 (0.0)	0 (0.0)
Hungary	81 (2.9)	17 (3.0)	2 (1.0)	1 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Indonesia	23 (4.1)	36 (4.2)	15 (3.2)	25 (4.2)	0 (0.0)	1 (0.8)	0 (0.0)
Iran, Islamic Rep. s	2 (1.5)	23 (4.0)	6 (1.9)	67 (4.5)	1 (0.0)	2 (0.9)	0 (0.0)
Israel	35 (3.6)	53 (3.4)	6 (1.8)	2 (1.0)	1 (0.5)	1 (0.3)	1 (0.9)
Italy	15 (2.6)	68 (3.8)	5 (1.7)	12 (2.5)	0 (0.0)	0 (0.0)	0 (0.0)
Japan	14 (2.7)	3 (1.4)	27 (4.0)	8 (2.1)	34 (4.3)	6 (2.0)	9 (2.3)
Jordan	61 (4.0)	28 (3.7)	8 (2.4)	4 (1.2)	0 (0.0)	0 (0.0)	0 (0.0)
Korea, Rep. of	24 (3.3)	9 (2.3)	29 (3.4)	15 (2.7)	14 (2.6)	6 (2.0)	2 (0.7)
Latvia (LSS)	70 (3.9)	20 (3.7)	7 (2.5)	1 (0.9)	2 (1.4)	0 (0.0)	0 (0.0)
Lithuania ‡	73 (4.0)	24 (3.6)	2 (1.5)	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)
Macedonia, Rep. of	44 (4.3)	36 (4.4)	16 (3.1)	4 (1.7)	1 (0.6)	0 (0.0)	0 (0.0)
Malaysia	24 (3.5)	66 (3.9)	3 (1.5)	6 (2.0)	1 (0.0)	0 (0.0)	0 (0.0)
Moldova	38 (4.3)	54 (4.2)	2 (1.2)	4 (2.1)	0 (0.0)	2 (1.3)	0 (0.0)
Morocco	21 (2.6)	11 (1.9)	8 (1.5)	9 (2.1)	11 (1.8)	40 (3.5)	1 (0.4)
Netherlands	73 (4.4)	9 (2.6)	13 (3.3)	3 (1.3)	1 (0.6)	0 (0.0)	1 (0.6)
New Zealand	58 (3.9)	2 (1.4)	32 (3.5)	3 (1.2)	2 (1.1)	0 (0.0)	1 (0.8)
Philippines	74 (3.2)	14 (3.0)	10 (2.6)	0 (0.0)	2 (1.1)	0 (0.0)	0 (0.0)
Romania	21 (3.7)	73 (3.9)	1 (1.0)	4 (1.2)	0 (0.0)	1 (0.5)	0 (0.0)
Russian Federation	42 (4.5)	57 (4.6)	0 (0.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Singapore	26 (4.2)	54 (4.3)	8 (2.1)	12 (2.4)	0 (0.0)	0 (0.0)	0 (0.0)
Slovak Republic	81 (3.5)	2 (1.5)	12 (3.2)	1 (0.0)	3 (1.8)	0 (0.0)	1 (0.0)
Slovenia	79 (3.1)	17 (2.8)	3 (1.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
South Africa	64 (4.1)	22 (3.2)	10 (2.6)	4 (1.4)	0 (0.0)	0 (0.0)	0 (0.0)
Thailand	23 (3.6)	57 (4.4)	4 (1.5)	16 (3.3)	0 (0.0)	0 (0.0)	0 (0.0)
Tunisia	35 (4.2)	24 (3.9)	3 (1.2)	8 (2.3)	3 (1.5)	26 (3.6)	2 (1.3)
Turkey	10 (2.4)	12 (2.4)	35 (4.1)	39 (4.3)	4 (1.4)	0 (0.3)	0 (0.0)
United States	63 (2.8)	27 (2.4)	7 (1.6)	1 (0.6)	1 (0.7)	0 (0.0)	1 (0.7)
International Avg.	41 (0.6)	26 (0.5)	16 (0.5)	10 (0.4)	4 (0.2)	2 (0.2)	1 (0.1)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

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

Exhibit R3.16 Assigning Mathematics Homework Based on Projects and Investigations*

		Sometimes or Always		Never or Rarely	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement
Australia		27 (4.1)	526 (7.2)	73 (4.1)	527 (6.1)
Belgium (Flemish)		3 (1.1)	567 (19.0)	97 (1.1)	567 (3.9)
Bulgaria		7 (2.1)	544 (28.1)	93 (2.1)	510 (6.4)
Canada	r	24 (2.9)	531 (4.9)	76 (2.9)	535 (3.4)
Chile		28 (3.6)	397 (8.0)	72 (3.6)	390 (5.5)
Chinese Taipei		4 (1.6)	577 (22.9)	96 (1.6)	585 (4.1)
Cyprus	r	16 (3.7)	488 (5.6)	84 (3.7)	475 (2.3)
Czech Republic		3 (1.7)	537 (9.7)	97 (1.7)	520 (4.6)
England	s	14 (2.5)	518 (9.1)	86 (2.5)	509 (5.6)
Finland		10 (2.6)	542 (10.7)	90 (2.6)	518 (2.6)
Hong Kong, SAR		3 (1.4)	636 (14.9)	97 (1.4)	581 (4.4)
Hungary		5 (1.8)	509 (8.4)	95 (1.8)	532 (3.9)
Indonesia		23 (3.5)	418 (12.0)	77 (3.5)	399 (6.7)
Iran, Islamic Rep.		10 (2.2)	422 (12.5)	90 (2.2)	422 (3.5)
Israel		18 (3.0)	469 (9.9)	82 (3.0)	469 (5.1)
Italy		30 (3.5)	468 (6.9)	70 (3.5)	484 (4.7)
Japan		1 (0.7)	~ ~	99 (0.7)	579 (1.8)
Jordan		28 (3.9)	423 (7.7)	72 (3.9)	428 (4.6)
Korea, Rep. of		16 (2.9)	586 (5.6)	84 (2.9)	588 (2.3)
Latvia (LSS)		6 (2.0)	525 (20.7)	94 (2.0)	504 (3.6)
Lithuania ‡		12 (2.8)	503 (11.8)	88 (2.8)	479 (4.9)
Macedonia, Rep. of		13 (3.0)	422 (15.2)	87 (3.0)	450 (4.8)
Malaysia		18 (3.3)	514 (11.1)	82 (3.3)	520 (5.0)
Moldova		29 (4.3)	483 (9.1)	71 (4.3)	462 (4.9)
Morocco		24 (3.0)	344 (7.1)	76 (3.0)	335 (2.7)
Netherlands		10 (5.3)	510 (44.2)	90 (5.3)	540 (6.9)
New Zealand		27 (3.5)	529 (10.0)	73 (3.5)	481 (5.9)
Philippines		46 (4.5)	345 (9.0)	54 (4.5)	343 (8.4)
Romania		24 (4.3)	474 (13.7)	76 (4.3)	473 (7.0)
Russian Federation		34 (3.7)	539 (8.4)	66 (3.7)	520 (6.9)
Singapore		20 (3.6)	616 (14.5)	80 (3.6)	602 (6.8)
Slovak Republic		6 (2.2)	562 (16.5)	94 (2.2)	530 (3.9)
Slovenia		11 (2.8)	526 (10.4)	89 (2.8)	531 (2.7)
South Africa		40 (3.7)	252 (6.6)	60 (3.7)	291 (9.2)
Thailand		43 (3.8)	476 (9.2)	57 (3.8)	461 (6.5)
Tunisia		15 (3.1)	445 (6.3)	85 (3.1)	446 (2.7)
Turkey		27 (3.3)	434 (9.1)	73 (3.3)	426 (4.9)
United States		24 (2.8)	499 (8.3)	76 (2.8)	504 (4.9)
International Avg.		18 (0.5)	491 (2.2)	82 (0.5)	487 (0.8)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by teachers.

* Based on average response to questions about assigning homework based on small investigation(s) or gathering data, working individually on long term projects or experiments, and working as a small group on long term projects or experiments.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 tilde (~) indicates insufficient data to report achievement.

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

Exhibit R3.17 Frequency of Having a Quiz or Test in Mathematics Class

TIMSS 1999 8th grade Mathematics

	Almost Always		Pretty Often		Once in a While or Never	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Australia	18 (1.1)	506 (7.2)	40 (1.1)	531 (5.4)	42 (1.6)	529 (5.8)
Belgium (Flemish)	19 (0.9)	534 (4.1)	56 (1.7)	568 (4.1)	25 (1.6)	558 (8.8)
Bulgaria	10 (0.7)	484 (8.5)	20 (1.5)	532 (10.4)	70 (1.6)	512 (5.0)
Canada	25 (1.6)	516 (3.9)	50 (1.4)	534 (2.9)	25 (1.1)	541 (4.1)
Chile	47 (1.1)	392 (4.2)	32 (0.8)	399 (5.6)	21 (0.9)	389 (6.0)
Chinese Taipei	27 (1.2)	589 (5.1)	46 (1.0)	590 (4.2)	27 (1.5)	576 (6.5)
Cyprus	16 (0.8)	459 (4.9)	65 (1.0)	487 (1.9)	19 (1.0)	461 (4.1)
Czech Republic	7 (1.2)	494 (10.9)	33 (1.7)	522 (4.9)	60 (2.3)	522 (4.5)
England	14 (0.9)	463 (5.6)	46 (1.6)	500 (4.8)	40 (1.9)	507 (5.4)
Finland	9 (0.8)	494 (6.0)	30 (1.2)	515 (3.7)	61 (1.4)	527 (2.8)
Hong Kong, SAR	9 (0.7)	569 (7.3)	37 (1.6)	579 (4.9)	54 (2.2)	587 (5.2)
Hungary	7 (0.5)	508 (8.3)	18 (0.9)	533 (4.6)	75 (1.1)	534 (4.0)
Indonesia	13 (0.7)	415 (6.6)	42 (1.3)	408 (5.6)	45 (1.5)	396 (5.5)
Iran, Islamic Rep.	23 (0.9)	411 (5.1)	27 (0.9)	421 (5.1)	49 (1.3)	430 (3.5)
Israel	23 (0.9)	439 (5.3)	39 (1.0)	473 (4.3)	39 (1.3)	486 (5.5)
Italy	9 (0.8)	452 (8.7)	19 (0.9)	476 (6.3)	72 (1.3)	485 (3.7)
Japan	12 (1.4)	571 (6.1)	30 (1.5)	582 (3.2)	58 (2.1)	579 (2.6)
Jordan	30 (1.1)	427 (5.3)	35 (1.0)	432 (5.6)	35 (1.1)	441 (4.5)
Korea, Rep. of	7 (0.5)	587 (6.9)	18 (0.8)	601 (4.5)	75 (1.2)	584 (1.9)
Latvia (LSS)	3 (0.4)	476 (13.2)	11 (0.8)	502 (7.5)	86 (0.9)	507 (3.6)
Lithuania ‡	– –	– –	– –	– –	– –	– –
Macedonia, Rep. of	17 (0.7)	417 (6.4)	34 (1.1)	463 (4.8)	49 (1.2)	457 (4.8)
Malaysia	12 (0.5)	522 (6.1)	31 (1.0)	527 (5.9)	56 (1.3)	515 (4.5)
Moldova	30 (1.5)	471 (5.4)	40 (1.3)	475 (5.2)	30 (1.2)	464 (4.1)
Morocco r	33 (1.5)	333 (4.2)	32 (1.1)	335 (4.6)	35 (1.3)	353 (4.4)
Netherlands	14 (1.5)	510 (10.5)	47 (1.9)	538 (6.7)	39 (1.7)	555 (8.2)
New Zealand	24 (1.6)	466 (7.8)	35 (1.2)	503 (6.1)	41 (1.7)	499 (5.6)
Philippines	44 (1.3)	350 (7.2)	30 (1.0)	360 (6.9)	27 (1.1)	329 (6.4)
Romania	30 (1.3)	467 (6.6)	39 (1.3)	486 (6.4)	30 (1.5)	474 (7.5)
Russian Federation	26 (1.1)	517 (6.6)	50 (1.3)	541 (6.5)	24 (1.3)	510 (6.5)
Singapore	19 (0.9)	597 (8.3)	45 (1.0)	609 (6.5)	36 (1.4)	602 (6.4)
Slovak Republic	8 (0.7)	496 (7.2)	49 (1.6)	540 (4.3)	43 (1.7)	535 (4.3)
Slovenia	26 (1.1)	508 (4.0)	47 (1.1)	536 (3.3)	27 (1.3)	544 (4.6)
South Africa	42 (1.6)	261 (6.6)	31 (1.0)	287 (11.0)	27 (1.1)	287 (10.0)
Thailand	32 (1.2)	464 (5.8)	33 (0.7)	467 (5.1)	36 (1.1)	472 (6.5)
Tunisia	55 (1.1)	449 (2.9)	36 (0.9)	449 (3.1)	9 (0.6)	441 (5.0)
Turkey	13 (0.7)	411 (7.2)	11 (0.6)	423 (7.2)	76 (1.0)	437 (4.2)
United States	40 (1.6)	491 (3.7)	46 (1.3)	520 (4.3)	14 (0.9)	493 (6.1)
International Avg.	21 (0.2)	473 (1.2)	36 (0.2)	493 (0.9)	43 (0.2)	490 (0.9)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by students.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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 data are not available.

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

REFERENCE 4

School Contexts for Learning and Instruction

Exhibit R4.1 Shortages or Inadequacies in General Facilities and Materials That Affect Schools' Capacity to Provide Mathematics Instruction Some or A Lot

TIMSS 1999 8th grade Mathematics

	Percentage of Students Affected by Shortage or Inadequacy				
	Instructional Materials	Budget for Supplies	School Buildings/ Grounds	Heating/Cooling and Lighting	Instructional Space
Australia	26 (3.7)	22 (4.1)	32 (4.1)	21 (3.5)	27 (4.0)
Belgium (Flemish)	6 (2.2)	5 (2.1)	20 (3.3)	4 (1.8)	20 (4.2)
Bulgaria	92 (2.2)	80 (5.8)	71 (4.3)	72 (4.1)	63 (5.0)
Canada	45 (2.8)	43 (2.8)	29 (2.8)	11 (1.9)	25 (2.4)
Chile	23 (3.1)	34 (3.0)	38 (3.6)	22 (2.9)	31 (3.8)
Chinese Taipei	45 (4.4)	45 (4.0)	59 (4.1)	41 (3.9)	51 (4.0)
Cyprus	7 (0.1)	7 (0.1)	61 (0.2)	30 (0.3)	45 (0.3)
Czech Republic	22 (5.0)	52 (5.5)	15 (3.3)	5 (1.4)	11 (3.3)
England	r 37 (4.9)	r 31 (4.5)	r 42 (5.3)	r 17 (3.6)	r 38 (5.1)
Finland	31 (4.0)	10 (2.8)	49 (4.1)	16 (3.6)	41 (3.7)
Hong Kong, SAR	35 (3.9)	21 (3.9)	57 (4.8)	24 (3.4)	57 (4.6)
Hungary	27 (3.9)	25 (3.7)	32 (3.8)	17 (3.4)	39 (4.2)
Indonesia	45 (4.4)	36 (4.3)	39 (4.1)	36 (4.6)	44 (3.9)
Iran, Islamic Rep.	26 (4.0)	61 (3.7)	68 (4.0)	50 (4.7)	54 (3.9)
Israel	15 (3.1)	18 (3.3)	42 (4.5)	28 (3.8)	33 (4.4)
Italy	28 (3.5)	28 (3.6)	31 (3.7)	15 (2.7)	35 (3.4)
Japan	17 (2.9)	14 (3.0)	29 (3.8)	31 (3.5)	34 (3.5)
Jordan	74 (4.1)	64 (4.3)	75 (3.9)	74 (3.7)	69 (3.7)
Korea, Rep. of	37 (3.9)	29 (4.0)	51 (4.5)	52 (4.2)	55 (4.2)
Latvia (LSS)	80 (3.8)	87 (3.3)	72 (4.0)	65 (4.9)	65 (4.2)
Lithuania ‡	82 (3.3)	65 (3.9)	31 (4.0)	45 (4.1)	56 (3.8)
Macedonia, Rep. of	38 (4.3)	75 (3.8)	74 (3.7)	52 (4.2)	63 (4.4)
Malaysia	38 (4.3)	44 (4.2)	40 (4.6)	26 (3.4)	40 (4.2)
Moldova	97 (0.9)	95 (1.8)	77 (3.9)	91 (2.4)	69 (4.0)
Morocco	59 (4.0)	77 (3.4)	58 (4.3)	45 (4.1)	45 (4.0)
Netherlands	r 10 (4.0)	r 19 (6.4)	r 45 (7.0)	r 9 (2.8)	r 26 (5.3)
New Zealand	24 (3.6)	27 (3.5)	37 (4.2)	6 (2.1)	29 (3.9)
Philippines	67 (4.0)	52 (4.4)	56 (3.9)	49 (3.9)	52 (4.3)
Romania	54 (4.6)	74 (3.8)	50 (4.8)	36 (4.1)	46 (4.3)
Russian Federation	92 (2.4)	81 (3.1)	73 (3.6)	63 (4.4)	69 (3.2)
Singapore	10 (2.2)	7 (2.0)	23 (2.6)	11 (2.4)	26 (3.3)
Slovak Republic	44 (4.4)	67 (4.0)	31 (4.6)	12 (2.9)	42 (5.0)
Slovenia	55 (4.2)	68 (4.0)	60 (4.5)	49 (4.3)	62 (4.2)
South Africa	67 (4.1)	66 (4.1)	61 (4.3)	59 (4.1)	57 (3.7)
Thailand	86 (3.0)	84 (2.9)	81 (3.2)	63 (4.1)	78 (3.1)
Tunisia	83 (3.2)	77 (3.5)	87 (2.8)	48 (4.5)	76 (3.7)
Turkey	80 (3.6)	60 (4.0)	78 (3.6)	74 (3.5)	75 (4.0)
United States	r 22 (2.9)	r 27 (4.1)	r 33 (3.4)	r 17 (3.5)	r 33 (3.4)
International Avg.	45 (0.6)	47 (0.6)	50 (0.7)	36 (0.6)	47 (0.6)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by schools.

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

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, at the beginning of the next school year.

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

Exhibit R4.2 Shortages or Inadequacies in Equipment and Materials for Mathematics Instruction That Affect Schools' Capacity to Provide Instruction in Mathematics Some or A Lot

TIMSS 1999 8th grade Mathematics

	Percentage of Students Affected by Shortage or Inadequacy				
	Computers for Mathematics Instruction	Computer Software for Mathematics Instruction	Calculators for Mathematics Instruction	Library Materials Relevant to Mathematics Instruction	Audio-Visual Resources for Mathematics Instruction
Australia	49 (4.7)	50 (4.7)	11 (2.7)	20 (3.4)	22 (3.9)
Belgium (Flemish)	30 (3.3)	25 (3.4)	2 (1.1)	15 (3.0)	19 (3.0)
Bulgaria	86 (3.0)	80 (3.5)	53 (5.0)	78 (3.6)	72 (4.2)
Canada	47 (2.9)	59 (2.7)	26 (3.0)	34 (3.7)	34 (3.4)
Chile	46 (3.6)	50 (3.7)	35 (3.5)	47 (3.4)	49 (3.9)
Chinese Taipei	57 (4.3)	66 (4.2)	47 (4.7)	56 (4.4)	63 (4.2)
Cyprus	54 (0.2)	r 45 (0.3)	12 (0.2)	21 (0.2)	30 (0.2)
Czech Republic	37 (4.0)	33 (4.0)	8 (3.0)	16 (3.8)	14 (3.5)
England	r 51 (5.2)	r 53 (5.0)	r 23 (3.8)	r 29 (4.5)	r 30 (4.5)
Finland	49 (4.1)	54 (3.9)	13 (3.2)	14 (3.2)	19 (3.8)
Hong Kong, SAR	61 (4.8)	70 (4.2)	16 (3.1)	32 (3.4)	45 (4.5)
Hungary	49 (4.5)	54 (4.7)	22 (3.4)	18 (3.4)	31 (4.0)
Indonesia	37 (4.8)	37 (4.7)	38 (4.6)	52 (4.8)	43 (4.8)
Iran, Islamic Rep.	71 (4.4)	73 (4.2)	63 (4.2)	75 (3.6)	69 (4.7)
Israel	45 (5.0)	47 (4.2)	25 (4.1)	41 (4.2)	45 (4.3)
Italy	38 (3.8)	50 (3.7)	18 (3.3)	32 (3.8)	42 (3.6)
Japan	33 (4.2)	42 (4.2)	7 (2.2)	12 (2.8)	25 (3.9)
Jordan	63 (4.3)	61 (4.3)	42 (4.5)	59 (4.6)	67 (4.5)
Korea, Rep. of	64 (4.0)	71 (3.8)	42 (3.9)	58 (4.5)	70 (4.0)
Latvia (LSS)	73 (4.3)	73 (4.4)	37 (4.4)	67 (3.9)	69 (4.7)
Lithuania ‡	76 (3.7)	79 (3.6)	45 (4.2)	56 (4.0)	72 (3.9)
Macedonia, Rep. of	88 (2.9)	90 (2.5)	84 (3.1)	88 (2.7)	90 (2.5)
Malaysia	40 (4.4)	42 (4.6)	29 (3.6)	47 (4.0)	48 (4.2)
Moldova	81 (3.2)	79 (3.6)	78 (3.5)	90 (1.9)	90 (2.4)
Morocco	54 (4.8)	54 (4.8)	55 (4.8)	62 (4.4)	67 (4.8)
Netherlands	r 46 (6.8)	r 50 (6.6)	r 2 (1.2)	r 18 (5.0)	r 18 (4.3)
New Zealand	47 (4.2)	47 (4.3)	21 (3.4)	20 (3.6)	26 (3.6)
Philippines	57 (3.8)	58 (3.8)	54 (3.8)	66 (3.8)	65 (3.9)
Romania	85 (3.3)	83 (3.5)	69 (4.1)	68 (4.3)	69 (4.4)
Russian Federation	89 (2.2)	87 (2.9)	69 (4.3)	71 (3.8)	82 (3.5)
Singapore	30 (4.2)	44 (4.8)	5 (1.8)	13 (2.8)	17 (3.4)
Slovak Republic	85 (3.3)	87 (2.9)	35 (4.8)	41 (5.0)	60 (3.8)
Slovenia	51 (4.2)	50 (4.3)	18 (3.4)	39 (3.6)	42 (4.0)
South Africa	76 (3.2)	74 (3.6)	67 (4.1)	74 (3.5)	75 (3.9)
Thailand	74 (3.8)	75 (3.7)	54 (3.8)	88 (3.0)	88 (3.0)
Tunisia	38 (4.0)	39 (4.1)	34 (4.1)	40 (4.2)	42 (4.2)
Turkey	67 (4.1)	68 (4.0)	37 (3.7)	78 (3.3)	79 (3.9)
United States	r 47 (4.2)	r 48 (4.1)	r 16 (3.4)	r 29 (4.0)	r 25 (3.2)
International Avg.	57 (0.7)	59 (0.7)	35 (0.6)	46 (0.6)	50 (0.6)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by schools.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

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

Exhibit R4.3 Availability of Computers for Instructional Purposes

		Percentage of Students by Number of Students per Computer[1]				Percentage of Students in Schools Without Any Computers
		Fewer than 15 Students per Computer	15-30 Students per Computer	31-50 Students per Computer	More than 50 Students per Computer	
Australia	r	100 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Belgium (Flemish)	r	83 (3.0)	9 (2.2)	1 (0.8)	4 (1.7)	4 (1.6)
Bulgaria		48 (5.9)	9 (2.3)	4 (1.5)	2 (1.1)	37 (5.3)
Canada		100 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Chile		70 (2.8)	6 (1.9)	2 (1.1)	4 (1.0)	18 (3.0)
Chinese Taipei		90 (2.5)	9 (2.6)	1 (0.8)	0 (0.0)	0 (0.0)
Cyprus		6 (0.1)	9 (0.1)	16 (0.1)	48 (0.2)	22 (0.2)
Czech Republic		89 (3.0)	2 (1.4)	5 (2.4)	0 (0.0)	3 (1.2)
England	r	100 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Finland		98 (1.2)	1 (0.0)	0 (0.0)	0 (0.0)	1 (0.0)
Hong Kong, SAR	r	86 (3.3)	3 (1.5)	4 (1.8)	3 (1.3)	5 (2.2)
Hungary		98 (1.1)	0 (0.0)	0 (0.0)	0 (0.0)	2 (1.1)
Indonesia		6 (1.4)	12 (3.6)	3 (1.0)	22 (4.4)	57 (4.5)
Iran, Islamic Rep.		1 (1.1)	1 (0.6)	1 (0.7)	5 (1.7)	92 (2.1)
Israel	s	92 (2.8)	4 (2.4)	1 (0.0)	0 (0.0)	3 (1.7)
Italy		64 (3.4)	19 (2.9)	7 (2.2)	3 (1.3)	6 (1.6)
Japan		92 (2.7)	5 (1.8)	0 (0.0)	0 (0.0)	3 (1.9)
Jordan		44 (3.4)	9 (2.5)	1 (0.0)	1 (0.8)	45 (3.7)
Korea, Rep. of		75 (3.6)	14 (3.2)	6 (1.8)	5 (1.8)	1 (0.0)
Latvia (LSS)	r	88 (3.0)	2 (1.7)	1 (1.1)	1 (0.1)	7 (2.3)
Lithuania ‡		81 (3.2)	8 (2.4)	1 (0.9)	1 (1.0)	8 (2.2)
Macedonia, Rep. of		20 (2.8)	26 (3.6)	5 (2.1)	3 (1.6)	45 (3.8)
Malaysia		6 (2.2)	10 (2.2)	7 (2.0)	26 (3.6)	50 (4.0)
Moldova		81 (3.6)	6 (2.0)	0 (0.0)	0 (0.0)	13 (3.0)
Morocco		3 (1.4)	4 (1.5)	8 (2.2)	16 (2.8)	68 (3.6)
Netherlands	s	99 (1.0)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)
New Zealand		99 (0.6)	0 (0.0)	0 (0.0)	1 (0.0)	0 (0.0)
Philippines		14 (2.2)	8 (2.2)	6 (2.0)	31 (3.9)	42 (4.2)
Romania		14 (3.2)	13 (2.9)	2 (1.2)	5 (1.8)	65 (4.3)
Russian Federation		37 (4.9)	6 (2.0)	1 (0.0)	3 (1.5)	53 (4.8)
Singapore		98 (1.3)	2 (1.3)	0 (0.0)	0 (0.0)	0 (0.0)
Slovak Republic		21 (3.9)	10 (3.0)	4 (2.0)	4 (1.9)	61 (4.7)
Slovenia		95 (1.9)	3 (1.6)	0 (0.0)	1 (0.9)	1 (0.0)
South Africa		18 (2.9)	4 (1.6)	2 (0.9)	5 (1.5)	72 (3.0)
Thailand		58 (4.3)	16 (2.9)	5 (1.8)	10 (2.7)	11 (2.7)
Tunisia		0 (0.0)	0 (0.0)	1 (0.7)	6 (2.2)	93 (2.3)
Turkey	s	21 (4.1)	2 (1.1)	2 (1.1)	2 (1.3)	73 (4.1)
United States	s	97 (1.8)	3 (1.8)	0 (0.0)	0 (0.0)	0 (0.0)
International Avg.		60 (0.4)	6 (0.3)	3 (0.2)	6 (0.3)	25 (0.4)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by schools.

1 Ratio of grade 8 enrollment to total computers for instructional use by grade 8 teachers and students.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

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

Exhibit R4.4 Schools' Access to the Internet

		Percentage of Students by Level of Access			
		Access to World Wide Web (with or without e-mail)	Access to E-mail Only	No Internet Access but Planning to Get Internet Access by 2001	No Access and No Immediate Plans to Obtain Access
Australia	r	94 (1.9)	0 (0.0)	6 (1.9)	0 (0.0)
Belgium (Flemish)		73 (4.0)	1 (0.7)	24 (3.9)	2 (1.2)
Bulgaria		18 (6.5)	0 (0.0)	39 (5.0)	43 (5.2)
Canada		96 (1.2)	1 (0.5)	3 (1.0)	0 (0.3)
Chile		23 (3.5)	3 (1.3)	59 (4.3)	16 (2.8)
Chinese Taipei		89 (2.8)	5 (1.9)	6 (2.0)	0 (0.0)
Cyprus	r	23 (0.1)	0 (0.0)	49 (0.2)	28 (0.2)
Czech Republic		34 (5.1)	2 (1.7)	45 (5.4)	19 (3.8)
England	r	86 (3.4)	1 (0.1)	13 (3.3)	0 (0.0)
Finland		100 (0.5)	0 (0.0)	0 (0.5)	0 (0.0)
Hong Kong, SAR	r	85 (3.7)	0 (0.0)	15 (3.7)	0 (0.0)
Hungary		46 (4.2)	3 (1.6)	42 (4.2)	9 (2.5)
Indonesia		0 (0.4)	0 (0.0)	15 (3.4)	85 (3.4)
Iran, Islamic Rep.		0 (0.0)	0 (0.0)	39 (4.4)	61 (4.4)
Israel	r	68 (4.0)	0 (0.0)	26 (4.0)	6 (2.3)
Italy		41 (4.2)	4 (1.6)	54 (4.2)	2 (1.2)
Japan		29 (3.9)	2 (1.1)	29 (4.0)	41 (4.2)
Jordan		2 (1.4)	1 (0.0)	28 (3.8)	70 (3.7)
Korea, Rep. of		48 (4.4)	0 (0.0)	46 (4.3)	6 (1.9)
Latvia (LSS)	r	48 (4.2)	9 (2.9)	20 (3.7)	23 (4.2)
Lithuania ‡		64 (3.7)	0 (0.0)	24 (3.4)	12 (2.7)
Macedonia, Rep. of		1 (0.9)	0 (0.0)	51 (4.5)	48 (4.4)
Malaysia		16 (3.3)	2 (1.0)	60 (4.4)	22 (3.5)
Moldova		2 (1.2)	0 (0.0)	14 (2.6)	84 (2.9)
Morocco		0 (0.0)	0 (0.0)	8 (2.2)	92 (2.2)
Netherlands	r	81 (7.1)	3 (1.9)	15 (7.0)	1 (0.7)
New Zealand		87 (3.0)	1 (0.6)	12 (2.9)	1 (0.0)
Philippines		9 (2.6)	1 (1.0)	48 (4.2)	41 (3.9)
Romania		3 (1.6)	1 (0.7)	41 (4.2)	55 (4.1)
Russian Federation		5 (1.4)	0 (0.0)	16 (2.8)	79 (2.4)
Singapore		89 (3.0)	1 (0.9)	10 (2.8)	0 (0.0)
Slovak Republic		6 (2.1)	0 (0.0)	26 (4.1)	68 (4.4)
Slovenia		85 (3.6)	4 (1.9)	11 (3.1)	0 (0.0)
South Africa		7 (1.9)	0 (0.5)	33 (4.0)	60 (4.2)
Thailand		17 (2.5)	0 (0.0)	31 (3.6)	52 (3.5)
Tunisia		1 (0.0)	0 (0.0)	86 (3.2)	13 (3.1)
Turkey		3 (1.3)	1 (0.7)	46 (3.9)	50 (4.1)
United States	r	91 (3.1)	0 (0.0)	9 (2.8)	0 (0.0)
International Avg.		41 (0.5)	1 (0.2)	29 (0.6)	29 (0.5)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Background data provided by schools.

‡ Lithuania tested the same cohort of students as other countries, but later in 1999, 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.

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

APPENDIX A

Overview of TIMSS Procedures: Mathematics Achievement

A

History

TIMSS 1999 represents the continuation of a long series of studies conducted by the International Association for the Evaluation of Educational Achievement (IEA). Since its inception in 1959, the IEA has conducted more than 15 studies of cross-national achievement in the curricular areas of mathematics, science, language, civics, and reading. IEA conducted its First International Science Study (FISS) in 1970-71 and the Second International Science Study (SISS) in 1983-84. The First and Second International Mathematics Studies (FIMS and SIMS) were conducted in 1964 and 1980-82, respectively. The Third International Mathematics and Science Study (TIMSS), conducted in 1994-1995, was the largest and most complex IEA study to date, and included both mathematics and science at third and fourth grades, seventh and eighth grades, and the final year of secondary school.

In 1999, TIMSS again assessed eighth-grade students in both mathematics and science to measure trends in student achievement since 1995. TIMSS 1999 was also known as TIMSS-Repeat, or TIMSS-R.

Participants in TIMSS

Of the 42 countries that participated in TIMSS[1] at the eighth grade in 1995, 26 availed themselves of the opportunity to measure changes in the achievement of their students by also taking part in 1999 (see Exhibit A.1). Twelve additional countries participated in 1999, for a total of 38 countries. Of those taking part in 1999, 19 had also participated in 1995 at the fourth grade.[2] Since fourth-grade students in 1995 were in eighth grade in 1999, these countries can compare the eighth-grade performance of this cohort of students with their performance at the fourth grade, as well as with the eighth-grade performance of students in other countries.

A.1

1 Results for 41 countries are reported in the 1995 international reports. Italy also completed the 1995 testing, but too late to be included in the international reports. It is counted as a 1995 country in this report and included in all trend exhibits in the 1999 international reports. Unweighted data for the Philippines were reported in an appendix to the international reports in 1995. These data were not included in trend exhibits in the 1999 international reports.

2 Two of the 19 countries with fourth-grade data from 1995 (Israel and Thailand) did not satisfy guidelines for sampling procedures at the classroom level and were not included in the comparisons for fourth and eighth grade.

Exhibit A.1 Countries Participating in TIMSS 1999 and 1995

	TIMSS 1999	TIMSS 1995 (Grade 8)	TIMSS 1995 (Grade 4)
Australia	●	●	●
Austria		●	●
Belgium (Flemish)	●	●	
Belgium (French)		●	
Bulgaria	●	●	
Canada	●	●	●
Chile	●		
Chinese Taipei	●		
Colombia		●	
Cyprus	●	●	●
Czech Republic	●	●	●
Denmark		●	
England	●	●	●
Finland	●		
France		●	
Germany		●	
Greece		●	●
Hong Kong, SAR	●	●	●
Hungary	●	●	●
Iceland		●	●
Indonesia	●		
Iran, Islamic Republic	●	●	●
Ireland		●	●
Israel	●	●	●
Italy	●	●	●
Japan	●	●	●
Jordan	●		
Korea, Republic of	●	●	●
Kuwait		●	●
Latvia	●	●	●
Lithuania	●	●	
Macedonia, Republic of	●		
Malaysia	●		
Moldova	●		
Morocco	●		
Netherlands	●	●	●
New Zealand	●	●	●
Norway		●	●
Philippines	●		
Portugal		●	●
Romania	●	●	
Russian Federation	●	●	
Scotland		●	●
Singapore	●	●	●
Slovak Republic	●	●	
Slovenia	●	●	●
South Africa	●	●	
Spain		●	
Sweden		●	
Switzerland		●	
Thailand	●	●	●
Tunisia	●		
Turkey	●		
United States	●	●	●

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Developing the TIMSS 1999 Mathematics Test

The TIMSS curriculum framework underlying the mathematics tests was developed for TIMSS in 1995 by groups of mathematics educators with input from the TIMSS National Research Coordinators (NRCs). As shown in Exhibit A.2, the mathematics curriculum framework contains three dimensions or aspects. The *content* aspect represents the subject matter content of school mathematics. The *performance expectations* aspect describes, in a non-hierarchical way, the many kinds of performances or behaviors that might be expected of students in school mathematics. The *perspectives* aspect focuses on the development of students' attitudes, interest, and motivation in mathematics. Because the frameworks were developed to include content, performance expectations, and perspectives for the entire span of curricula from the beginning of schooling through the completion of secondary school, some aspects may not be reflected in the eighth-grade TIMSS assessment.[3] Working within the framework, mathematics test specifications for TIMSS in 1995 were developed that included items representing a wide range of mathematics topics and eliciting a range of skills from the students. The 1995 tests were developed through an international consensus involving input from experts in mathematics and measurement specialists, ensuring they reflected current thinking and priorities in the mathematics.

About one-third of the items in the 1995 assessment were kept secure to measure trends over time; the remaining items were released for public use. An essential part of the development of the 1999 assessment, therefore, was to replace the released items with items of similar content, format, and difficulty. With the assistance of the Science and Mathematics Item Replacement Committee, a group of internationally prominent mathematics and science educators nominated by participating countries to advise on subject-matter issues in the assessment, over 300 mathematics and science items were developed as potential replacements. After an extensive process of review and field testing, 114 items were selected for use as replacements in the 1999 mathematics assessment.

Exhibit A.3 presents the five content areas included in the 1999 mathematics test and the numbers of items and score points in each area. Distributions are also included for the five performance categories derived from the performance expectations aspect of the curriculum framework. Exhibit A.4 shows how the trend and replacement items were distributed across these content areas and performance categories. About one-fourth of the items were in the free-response format, requiring students to generate and write their own answers. Designed to take about

3 The complete TIMSS curriculum frameworks can be found in Robitaille, D.F., et al. (1993), *TIMSS Monograph No.1: Curriculum Frameworks for Mathematics and Science*, Vancouver, BC: Pacific Educational Press.

one-third of students' test time, some free-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 tests, correct answers to most questions were worth one point. Consistent with the approach of allotting students longer response time for the constructed-response questions than for multiple-choice questions, however, responses to some of these questions (particularly those requiring extended responses) were evaluated for partial credit, with a fully correct answer being awarded two points (see later section on scoring). The total number of score points available for analysis thus somewhat exceeds the number of items.

Every effort was made to help ensure that the tests represented the curricula of the participating countries and that the items exhibited no bias towards or against particular countries. The final forms of the test were endorsed by the NRCs of the participating countries.[4] 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.

4 For a full discussion of the TIMSS 1999 test development effort, please see Garden, R.A. and Smith, T.A. (2000), "TIMSS Test Development" in M.O. Martin, K.D. Gregory and S.E. Stemler (eds.), *TIMSS 1999 Technical Report*, Chestnut Hill, MA: Boston College.

Exhibit A.2 The Three Aspects and Major Categories of the Mathematics Frameworks

TIMSS 1999 8th grade Mathematics

Content	Performance Expectations	Perspectives
Numbers	Knowing	Attitudes
Measurement	Using Routine Procedures	Careers
Geometry	Investigating and Problem Solving	Participation
Proportionality	Mathematical Reasoning	Increasing Interest
Functions, Relations, and Equations	Communicating	Habits of Mind
Data Representation		
Probability and Statistics		
Elementary Analysis, Validation, and Structure		

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Exhibit A.3 Distribution of Mathematics Items by Content Reporting Category and Performance Category

TIMSS 1999 8th grade Mathematics

Content Category	Percentage of Items	Total Number of Items	Number of Multiple-Choice Items	Number of Free-Response Items[1]	Number of Score Points[2]
Fractions and Number Sense	38	61	47	14	62
Measurement	15	24	15	9	26
Data Representation, Analysis and Probability	13	21	19	2	22
Geometry	13	21	20	1	21
Algebra	22	35	24	11	38
Total	100	162	125	37	169

Performance Category	Percentage of Items	Total Number of Items	Number of Multiple-Choice Items	Number of Free-Response Items[1]	Number of Score Points[2]
Knowing	19	30	28	2	30
Using Routine Procedures	23	38	28	10	39
Using Complex Procedures	24	39	34	5	40
Investigating and Solving Problems	31	51	34	17	53
Communicating and Reasoning	2	4	1	3	7
Total	100	162	125	37	169

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

1 Free-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 free-response items were evaluated for partial credit with a fully correct answer awarded up to two points. Thus, the number of score points exceeds the number of items in the test.

Exhibit A.4 Distribution of Mathematics Trend and Replacement Items by Content Reporting Category and Performance Category

Content Category	Trend Items		Replacement Items		Total Items	
	Number of Items	Number of Points	Number of Items	Number of Points	Number of Items	Number of Points
Fractions and Number Sense	17	17	44	45	61	62
Measurement	6	6	18	20	24	26
Data Representation, Analysis and Probability	8	8	13	14	21	22
Geometry	6	6	15	15	21	21
Algebra	11	11	24	27	35	38
Total	48	48	114	121	162	169

Performance Category	Trend Items		Replacement Items		Total Items	
	Number of Items	Number of Points	Number of Items	Number of Points	Number of Items	Number of Points
Knowing	16	16	14	14	30	30
Using Routine Procedures	8	8	30	31	38	39
Using Complex Procedures	13	13	26	27	39	40
Investigating and Solving Problems	11	11	40	42	51	53
Communicating and Reasoning	–	–	4	7	4	7
Total	48	48	114	121	162	169

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

TIMSS Test 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 used a rotated design that included both the mathematics and science items. Thus, the same students participated in both the mathematics and science testing. As in 1995, the 1999 assessment consisted of eight booklets, each requiring 90 minutes of response time. Each participating student was assigned one booklet only. In accordance with the design, the mathematics and science items were assembled into 26 clusters (labeled A through Z). The secure trend items were in clusters A through H, and items replacing the released 1995 items in clusters I through Z. Eight of the clusters were designed to take 12 minutes to complete; 10 of the clusters, 22 minutes; and 8 clusters, 10 minutes. In all, the design provided 396 testing minutes, 198 for mathematics and 198 for science. Cluster A was a core cluster assigned to all booklets. The remaining clusters were assigned to the booklets in accordance with the rotated design so that representative samples of students responded to each cluster.[5]

Background Questionnaires

TIMSS in 1999 administered a broad array of questionnaires to collect data on the educational context for student achievement and to measure trends since 1995. *National Research Coordinators*, with the assistance of their curriculum experts, provided detailed information on the organization, emphases, and content coverage of the mathematics and science curriculum. The *students* who were tested answered questions pertaining to their attitudes towards mathematics and science, their academic self-concept, classroom activities, home background, and out-of-school activities. The mathematics and science *teachers* of sampled students responded to questions about teaching emphasis on the topics in the curriculum frameworks, instructional practices, professional training and education, and their views on mathematics and science. The heads of *schools* responded to questions about school staffing and resources, mathematics and science course offerings, and teacher support.

5 The 1999 TIMSS test design is identical to the design for 1995, which is fully documented in Adams, R. and Gonzalez, E. (1996), "TIMSS Test Design" in M.O. Martin and D.L. Kelly (eds.), *Third International Mathematics and Science Study Technical Report, Volume I*, Chestnut Hill, MA: Boston College.

Translation and Verification

The TIMSS instruments were prepared in English and translated into 33 languages, with 10 of the 38 countries collecting data in two languages. In addition, it sometimes was necessary to modify the international versions for cultural reasons, even in the nine countries that tested in English. This process represented an enormous effort for the national centers, with many checks along the way. The translation effort included (1) developing explicit guidelines for translation and cultural adaptation; (2) translation of the instruments by the national centers in accordance with the guidelines, 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.[6]

Population Definition and Sampling

TIMSS in 1995 had as its target population students enrolled in the two adjacent grades that contained the largest proportion of 13-year-old students at the time of testing, which were seventh- and eighth-grade students in most countries. TIMSS in 1999 used the same definition to identify the target grades, but assessed students in the upper of the two grades only, which was the eighth grade in most countries.[7]

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 staff from Statistics Canada. NRCs received training in how to select the school and student samples and in the use of the sampling software. In consultation with the TIMSS sampling referee (Keith Rust, Westat, Inc.), staff from Statistics Canada reviewed the national sampling plans, sampling data, sampling frames, and sample execution. The sampling documentation was used by the International Study Center, in consultation with Statistics Canada and the sampling referee, to evaluate the quality of the samples.

6 More details about the translation verification procedures can be found in O'Connor, K., and Malak, B. (2000), "Translation and Cultural Adaptation of the TIMSS Instruments" in M.O. Martin, K.D. Gregory and S.E. Stemler (eds.), *TIMSS 1999 Technical Report*, Chestnut Hill, MA: Boston College.

7 The sample design for TIMSS is described in detail in Foy, P., and Joncas, M. (2000), "TIMSS Sample Design" in M.O. Martin, K.D. Gregory and S.E. Stemler (eds.), *TIMSS 1999 Technical Report*, Chestnut Hill, MA: Boston College.

In a few situations where it was not possible to test the entire internationally desired population (all students in the upper of the two adjacent grades with the greatest proportion of 13-year-olds), countries were permitted to define a national desired population that excluded part of the internationally desired population. Exhibit A.5 shows any differences in coverage between the international and national desired populations. Almost all participants achieved 100 percent coverage (36 out of 38), with Lithuania and Latvia the exceptions. Consequently, the results for Lithuania are annotated in exhibits in this report, and because coverage fell below 65 percent for Latvia, the Latvian results have been labeled "Latvia (LSS)," for Latvian-Speaking Schools. Although achieving 100 percent coverage of their populations in 1999, both Italy and Israel had less than complete coverage in 1995 – Italy because four of its provinces did not take part, and Israel because it did not test the Arabic-speaking population. Comparisons between 1995 and 1999 for these countries are based on the subsets of the 1999 populations that were comparable to the populations tested in 1995.

A.5

Within the desired population, countries could define a population that excluded a small percentage (less than 10 percent) of certain kinds of schools or students that would be very difficult or resource-intensive to test (e.g., schools for students with special needs or schools that were very small or located in extremely rural areas). Exhibit A.5 also shows that the degree of such exclusions was small. Only Israel exceeded the 10 percent limit, and this is annotated in the exhibits in this report.

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 mathematics class at the eighth grade. All of the students in that class were to participate in the TIMSS testing. This approach was designed to yield a representative sample of about 3,750 students per country. Typically, between 450 and 3,750 students responded to each achievement item in each country, depending on the booklets in which the items appeared.

Exhibits A.6 and A.7 present achieved sample sizes for schools and students, respectively, for participating countries. Exhibit A.8 shows the participation rates for schools, students, and overall, both with and without the use of replacement schools. All countries achieved the minimum acceptable participation rates – 85 percent of both the schools

A.6–A.8

and students, or a combined rate (the product of school and student participation) of 75 percent – although Belgium (Flemish), England, Hong Kong, and the Netherlands did so only after including replacement schools.

Because of scheduling difficulties, Lithuania was unable to test its eighth-grade students in May 1999 as planned. Instead, the students were tested in September 1999, when they had moved into the ninth grade. The results for Lithuania are annotated accordingly in exhibits in this report.

Whereas all countries achieved a high degree of compliance with sampling guidelines in 1999, three of them (Israel, South Africa, and Thailand) had experienced difficulties with sampling at the classroom level in 1995. Accordingly, results for these three countries are reported in a separate panel of the exhibits in these reports that deal with trends from 1995.

Exhibit A.5 Coverage of TIMSS 1999 Target Population

	International Desired Population		National Desired Population		
	Coverage	Notes on Coverage	School-Level Exclusions	Within-Sample Exclusions	Overall Exclusions
Australia	100%		1%	1%	2%
Belgium (Flemish)	100%		1%	0%	1%
Bulgaria	100%		5%	0%	5%
Canada	100%		4%	2%	6%
Chile	100%		3%	0%	3%
Chinese Taipei	100%		1%	1%	2%
Cyprus	100%		0%	1%	1%
Czech Republic	100%		5%	0%	5%
England	100%		2%	3%	5%
Finland	100%		3%	0%	4%
Hong Kong, SAR	100%		1%	0%	1%
Hungary	100%		4%	0%	4%
Indonesia	100%		0%	0%	0%
Iran, Islamic Rep. of	100%		4%	0%	4%
Israel	100%		8%	8%	16%
Italy	100%		4%	2%	7%
Japan	100%		1%	0%	1%
Jordan	100%		2%	1%	3%
Korea, Rep. of	100%		2%	2%	4%
Latvia (LSS)	61%	Latvian-speaking students only	4%	0%	4%
Lithuania	87%	Lithuanian-speaking students only	5%	0%	5%
Macedonia, Rep. of	100%		1%	0%	1%
Malaysia	100%		5%	0%	5%
Moldova	100%		2%	0%	2%
Morocco	100%		1%	0%	1%
Netherlands	100%		1%	0%	1%
New Zealand	100%		2%	1%	2%
Philippines	100%		3%	0%	3%
Romania	100%		4%	0%	4%
Russian Federation	100%		1%	1%	2%
Singapore	100%		0%	0%	0%
Slovak Republic	100%		7%	0%	7%
Slovenia	100%		3%	0%	3%
South Africa	100%		2%	0%	2%
Thailand	100%		3%	0%	3%
Tunisia	100%		0%	0%	0%
Turkey	100%		2%	0%	2%
United States	100%		0%	4%	4%

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Exhibit A.6 School Sample Sizes

	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
Australia	184	182	152	18	170
Belgium (Flemish)	150	150	106	29	135
Bulgaria	172	169	163	0	163
Canada	410	398	376	9	385
Chile	186	185	181	4	185
Chinese Taipei	150	150	150	0	150
Cyprus	61	61	61	0	61
Czech Republic	150	142	136	6	142
England	150	150	76	52	128
Finland	160	160	155	4	159
Hong Kong, SAR	180	180	135	2	137
Hungary	150	150	147	0	147
Indonesia	150	150	132	18	150
Iran, Islamic Rep. of	170	170	164	6	170
Israel	150	139	137	2	139
Italy	180	180	170	10	180
Japan	150	150	140	0	140
Jordan	150	147	146	1	147
Korea, Rep. of	150	150	150	0	150
Latvia (LSS)	150	148	143	2	145
Lithuania	150	150	150	0	150
Macedonia, Rep. of	150	150	149	0	149
Malaysia	150	150	148	2	150
Moldova	150	150	145	5	150
Morocco	174	174	172	1	173
Netherlands	150	148	86	40	126
New Zealand	156	156	145	7	152
Philippines	150	150	148	2	150
Romania	150	150	147	0	147
Russian Federation	190	190	186	3	189
Singapore	145	145	145	0	145
Slovak Republic	150	150	143	2	145
Slovenia	150	150	147	2	149
South Africa	225	219	183	11	194
Thailand	150	150	143	7	150
Tunisia	150	149	126	23	149
Turkey	204	204	202	2	204
United States	250	246	202	19	221

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Exhibit A.7 Student Sample Sizes

TIMSS 1999 8th grade Mathematics

	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
Australia	90%	4600	96	53	4451	419	4032
Belgium (Flemish)	97%	5387	12	0	5375	116	5259
Bulgaria	96%	3461	63	0	3398	126	3272
Canada	96%	9490	84	245	9161	391	8770
Chile	96%	6283	119	18	6146	239	5907
Chinese Taipei	99%	5889	30	42	5817	45	5772
Cyprus	97%	3296	38	32	3226	110	3116
Czech Republic	96%	3640	24	0	3616	163	3453
England	90%	3400	27	115	3258	298	2960
Finland	96%	3060	17	13	3030	110	2920
Hong Kong, SAR	98%	5310	18	1	5291	112	5179
Hungary	95%	3350	0	0	3350	167	3183
Indonesia	97%	6162	106	1	6055	207	5848
Iran, Islamic Rep. of	98%	5497	104	0	5393	92	5301
Israel	94%	4670	29	187	4454	259	4195
Italy	97%	3531	23	86	3422	94	3328
Japan	95%	4996	15	12	4969	224	4745
Jordan	99%	5300	130	42	5128	76	5052
Korea, Rep. of	100%	6285	29	128	6128	14	6114
Latvia (LSS)	93%	3128	16	4	3108	235	2873
Lithuania	89%	2668	0	0	2668	307	2361
Macedonia, Rep. of	98%	4096	0	0	4096	73	4023
Malaysia	99%	5713	98	0	5615	38	5577
Moldova	98%	3824	23	0	3801	90	3711
Morocco	92%	5841	42	0	5799	397	5402
Netherlands	95%	3099	12	0	3087	125	2962
New Zealand	94%	3966	96	22	3848	235	3613
Philippines	92%	7591	461	0	7130	529	6601
Romania	98%	3514	36	0	3478	53	3425
Russian Federation	97%	4557	48	34	4475	143	4332
Singapore	98%	5100	37	0	5063	97	4966
Slovak Republic	98%	3695	149	0	3546	49	3497
Slovenia	95%	3287	0	4	3283	174	3109
South Africa	93%	9071	256	0	8815	669	8146
Thailand	99%	5831	59	0	5772	40	5732
Tunisia	98%	5189	45	0	5144	93	5051
Turkey	99%	7972	49	0	7923	82	7841
United States	94%	9981	115	142	9724	652	9072

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Exhibit A.8 Overall Participation Rates

	School Participation		Student Participation	Overall Participation	
	Before Replacement	After Replacement		Before Replacement	After Replacement
Australia	83%	93%	90%	75%	84%
Belgium (Flemish)	72%	89%	97%	70%	87%
Bulgaria	97%	97%	96%	93%	93%
Canada	92%	95%	96%	88%	92%
Chile	98%	100%	96%	94%	96%
Chinese Taipei	100%	100%	99%	99%	99%
Cyprus	100%	100%	97%	97%	97%
Czech Republic	94%	100%	96%	90%	96%
England	49%	85%	90%	45%	77%
Finland	97%	100%	96%	93%	96%
Hong Kong, SAR	75%	76%	98%	74%	75%
Hungary	98%	98%	95%	93%	93%
Indonesia	84%	100%	97%	81%	97%
Iran, Islamic Rep. of	96%	100%	98%	95%	98%
Israel	98%	100%	94%	93%	94%
Italy	94%	100%	97%	91%	97%
Japan	93%	93%	95%	89%	89%
Jordan	99%	100%	99%	98%	99%
Korea, Rep. of	100%	100%	100%	100%	100%
Latvia (LSS)	96%	98%	93%	89%	91%
Lithuania	100%	100%	89%	89%	89%
Macedonia, Rep. of	99%	99%	98%	98%	98%
Malaysia	99%	100%	99%	98%	99%
Moldova	96%	100%	98%	94%	98%
Morocco	99%	99%	92%	91%	92%
Netherlands	62%	85%	95%	59%	81%
New Zealand	93%	97%	94%	87%	91%
Philippines	98%	100%	92%	91%	92%
Romania	98%	98%	98%	97%	97%
Russian Federation	98%	100%	97%	95%	97%
Singapore	100%	100%	98%	98%	98%
Slovak Republic	95%	96%	98%	93%	94%
Slovenia	98%	99%	95%	93%	94%
South Africa	85%	91%	93%	79%	84%
Thailand	93%	100%	99%	93%	99%
Tunisia	84%	100%	98%	82%	98%
Turkey	99%	100%	99%	98%	99%
United States	83%	90%	94%	78%	85%

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

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.

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 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, such as retired school teachers, 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 own roles and responsibilities. In all, 71 quality control monitors participated in this training.

The quality control monitors interviewed the NRCs about data collection plans and procedures. They also visited a sample of 15 schools where they observed testing sessions and interviewed school coordinators.[8] Quality control monitors interviewed school coordinators in all 38 countries, and observed a total of 550 testing sessions.

The results of the interviews indicate that, in general, NRCs had prepared well for data collection and, despite the heavy demands 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.

8 Steps taken to ensure high-quality data collection in TIMSS are described in detail in O'Connor, K., and Stemler, S. (2000), "Quality Control in the TIMSS Data Collection" in M.O. Martin, K.D. Gregory and S.E. Stemler (eds.), *TIMSS 1999 Technical Report*, Chestnut Hill, MA: Boston College.

Scoring the Free-Response Items

Because about one-third of the written test time was devoted to free-response items, TIMSS needed to develop procedures for reliably evaluating student responses within and across countries. Scoring 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. Because of the burden of maintaining scoring consistency across time, no free-response items were used to measure trends from 1995 to 1999. However, samples of student responses from each country to selected items in 1999 have been scanned using advanced imaging technology in preparation for studying trends to 2003 and beyond.

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 free-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 subsamples of at least 100 students' responses to each item coded independently by two readers. Exhibit A.9 shows the average and range of the within-country exact percent of agreement between scorers on the free-response items in the mathematics test for 37 of the 38 countries. A high percentage of exact agreement was observed, with an overall average of 99 percent across the 37 countries. 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.

A.9

Exhibit A.9 TIMSS 1999 Within-Country Free-Response Scoring Reliability Data for Mathematics Items

TIMSS1999 8th grade Mathematics

	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	94	100	95	80	100
Belgium (Flemish)	99	92	100	98	91	100
Bulgaria	99	94	100	96	73	100
Canada	98	88	100	94	80	99
Chile	99	94	100	97	88	100
Chinese Taipei	100	98	100	99	93	100
Cyprus	–	–	–	–	–	–
Czech Republic	97	81	100	92	63	99
England	99	96	100	97	87	100
Finland	99	97	100	97	90	100
Hong Kong, SAR	98	84	100	95	80	100
Hungary	98	87	100	96	76	100
Indonesia	99	92	100	94	79	100
Iran, Islamic Rep.	99	93	100	94	74	100
Israel	98	92	100	95	81	100
Italy	99	95	100	97	89	100
Japan	99	90	100	96	88	100
Jordan	99	96	100	96	89	100
Korea, Rep. of	98	88	100	96	73	100
Latvia (LSS)	99	96	100	96	79	100
Lithuania	99	90	100	98	88	100
Macedonia, Rep. of	99	97	100	98	95	100
Malaysia	100	98	100	99	97	100
Moldova	97	92	100	94	86	99
Morocco	97	84	100	88	65	99
Netherlands	99	85	100	94	79	100
New Zealand	99	95	100	95	88	100
Philippines	99	97	100	95	84	100
Romania	99	96	100	97	92	100
Russian Federation	100	98	100	98	92	100
Singapore	99	94	100	97	87	100
Slovak Republic	99	97	100	99	96	100
Slovenia	100	99	100	96	83	100
South Africa	99	93	100	96	85	99
Thailand	100	100	100	100	100	100
Tunisia	98	92	100	96	88	100
Turkey	100	97	100	99	97	100
United States	99	96	100	97	89	100
International Avg.	99	93	100	96	85	100

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

A dash (–) indicates data are not available.

Test Reliability

A.10 Exhibit A.10 displays the mathematics test reliability coefficient for each country. This coefficient is the median KR-20 reliability across the eight test booklets. Median reliabilities ranged from 0.76 in the Philippines to 0.94 in Chinese Taipei. The international median, 0.89, is the median of the reliability coefficients for all countries.

Data Processing

To ensure the availability of comparable, high-quality data for analysis, TIMSS took rigorous quality control steps to create the international database.[9] 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 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 mathematics test, one item was deleted for all countries. In addition, 14 countries had one or more items deleted (in most cases, one). Usually the poor statistics (negative point-biserials for the key, large item-by-country interactions, and statistics indicating lack of fit with the model) were a result of translation, adaptation, or printing deviations.

9 These steps are detailed in Hastedt, D., and Gonzalez, E. (2000), "Data Management and Database Construction" in M.O. Martin, K.D. Gregory and S.E. Stemler (eds.), *TIMSS 1999 Technical Report*, Chestnut Hill, MA: Boston College.

Exhibit A.10 Cronbach's Alpha Reliability Coefficient – TIMSS 1999 Mathematics Test

TIMSS 1999 8th grade Mathematics

	Reliability Coefficient[1]
Australia	0.90
Belgium (Flemish)	0.89
Bulgaria	0.90
Canada	0.88
Chile	0.83
Chinese Taipei	0.94
Cyprus	0.87
Czech Republic	0.90
England	0.90
Finland	0.86
Hong Kong, SAR	0.89
Hungary	0.91
Indonesia	0.87
Iran, Islamic Rep.	0.83
Israel	0.90
Italy	0.89
Japan	0.91
Jordan	0.89
Korea, Rep. of	0.91
Latvia (LSS)	0.89
Lithuania	0.89
Macedonia, Rep. of	0.88
Malaysia	0.90
Moldova	0.88
Morocco	0.69
Netherlands	0.89
New Zealand	0.91
Philippines	0.76
Romania	0.90
Russian Federation	0.91
Singapore	0.90
Slovak Republic	0.89
Slovenia	0.90
South Africa	0.77
Thailand	0.87
Tunisia	0.79
Turkey	0.86
United States	0.90
International Median	0.89

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

1 The reliability coefficient for each country is the median KR-20 reliability across the eight test booklets.

IRT Scaling and Data Analysis

The general approach to reporting the TIMSS achievement data was based primarily on item response theory (IRT) scaling methods.[10] 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 (fractions and number sense, measurement, data representation, analysis, and probability, geometry, and algebra), 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 eight test booklets they received. The IRT analysis provides a common scale on which performance can be compared across countries. In addition to providing a basis for estimating mean achievement, scale scores permit estimates of how students within countries vary and provide information on percentiles of performance. To provide a reliable measure of student achievement in both 1999 and 1995, the overall mathematics scale was calibrated using students from the countries that participated in both years. 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. 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. When the metric of the scale had been established, students from the countries that tested in 1999 but not 1995 were assigned scores on the basis of the new scale.

IRT scales were also created for each of the five mathematics content areas for the 1999 data. However, insufficient items were used both in 1995 and in 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.

10 For a detailed description of the TIMSS scaling, see Yamamoto, K., and Kulick, E. (2000), "Scaling Methods and Procedures for the TIMSS Mathematics and Science Scales" in M.O. Martin, K.D. Gregory and S.E. Stemler (eds.), *TIMSS 1999 Technical Report*, Chestnut Hill, MA: Boston College.

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.

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.[11] The jackknife standard errors also include an error component due to variation between 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.

Making Multiple Comparisons

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. However, in exhibits where statistical significance tests are reported, the results of many tests are reported simultaneously, usually at least one for each country in the exhibit. The significance tests in these exhibits are based on a Bonferroni procedure for multiple comparisons that hold to 0.05 the probability of erroneously declaring a statistic (mean or percentage)

11 Procedures for computing jackknifed standard errors are presented in Gonzalez, E. and Foy, P. (2000), "Estimation of Sampling Variance" in M.O. Martin, K.D. Gregory and S.E. Stemler (eds.), *TIMSS 1999 Technical Report*, Chestnut Hill, MA: Boston College.

for one country to be different from that for another country. In the multiple comparison charts (Exhibit 1.2 and those in Appendix B), the Bonferroni procedure adjusts for the number of countries in the chart, minus one. In exhibits where a country statistic is compared to the international average, the adjustment is for the number of countries.[12]

Setting International Benchmarks of Student Achievement

International benchmarks of student achievement were computed at each grade level for both mathematics and science. The benchmarks are points in the weighted international distribution of achievement scores that separate the 10 percent of students located on top of the distribution, the top 25 percent of students, the top 50 percent, and the bottom 25 percent. The percentage of students in each country meeting or exceeding the international benchmarks is reported. The benchmarks correspond to the 90th, 75th, 50th, and 25th percentiles of the international distribution of achievement. When computing these percentiles, each country contributed as many students to the distribution as there were students in the target population in the country. That is, each country's contribution to setting the international benchmarks was proportional to the estimated population enrolled at the eighth grade.

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.[13]

12 The application of the Bonferroni procedures is described in Gonzalez, E., and Gregory, K. (2000), "Reporting Student Achievement in Mathematics and Science" in M.O. Martin, K.D. Gregory and S.E. Stemler (eds.), *TIMSS 1999 Technical Report*, Chestnut Hill, MA: Boston College.

13 The scale-anchoring procedure is described fully in Gregory, K., and Mullis, I. (2000), "Describing International Benchmarks of Student Achievement" in M.O. Martin, K.D. Gregory and S.E. Stemler (eds.), *TIMSS 1999 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.

Mathematics Curriculum Questionnaire

In an effort to collect information about the content of the intended curriculum in mathematics, TIMSS asked National Research Coordinators to complete a questionnaire about the structure, organization, and content coverage of their national curricula. NRCs reviewed 56 mathematics topics and reported the percentage of their eighth-grade students for which each topic was intended in their curriculum. Although most topic descriptions were used without modification, there were occasions when NRCs found it necessary to expand on or qualify the topic description to describe their situation accurately. These country-specific adaptations to the mathematics curriculum questionnaire are presented in Exhibit A.11. A.11

Exhibit A.11 Country-Specific Variations in Mathematics Topics in the Curriculum Questionnaire

	Topic	Response	Comments
Bulgaria	Geometry: Congruence and similarity	All or almost all of the students (at least 90%)	Similarity not included in curriculum through grade 8.
Czech Republic	Measurement: Volume of other solids (e.g., pyramids, cylinders, cones, spheres)	All or almost all of the students (at least 90%)	Volume of pyramids, cones, & spheres not included in curriculum through grade 8.
	Geometry: Congruence and similarity	All or almost all of the students (at least 90%)	Similarity not included in curriculum through grade 8.
Finland	Fractions and Number Sense: Concepts of ratio and proportion; ratio and proportion problems	Not included in curriculum through grade 8	Concepts of ratio and proportion included in curriculum through grade 8.
	Geometry: Symmetry and transformations (reflection and rotation)	Not included in curriculum through grade 8	Symmetry included in curriculum through grade 8.
	Algebra: Representing situations algebraically; formulas	All or almost all of the students (at least 90%)	Formulas not included in curriculum through grade 8.
Israel	Fractions and Number Sense: Whole numbers - including place values, factorization and operations (+, -, x, ÷)	All or almost all of the students (at least 90%)	Factorization not included in curriculum through grade 8.
	Fractions and Number Sense: Computations with common fractions	All or almost all of the students (at least 90%)	Division with common fractions not included in curriculum through grade 8.
	Fractions and Number Sense: Computations with decimal fractions	All or almost all of the students (at least 90%)	Division with decimal fractions is not included in curriculum through grade 8.
	Measurement: Estimates of measurement; accuracy of measurement	Only the most advanced students (10% or less)	Accuracy of measurement is not included in curriculum through grade 8.
	Geometry: Simple two dimensional geometry - angles on a straight line, parallel lines, triangles and quadrilaterals	About half of the students	Quadrilaterals not included in curriculum through grade 8.
	Geometry: Congruence and similarity	All or almost all of the students (at least 90%)	Similarity not included in curriculum through grade 8.
Japan	Fractions and Number Sense: Prime factors, highest common factor, lowest common multiple, rules for divisibility	Not included in curriculum through grade 8	Highest common factor and lowest common multiple included in curriculum through grade 8.
Korea, Rep. of	Fractions and Number Sense: Number lines	All or almost all of the students (at least 90%)	Whole number and integer number lines included in curriculum through grade 8. The real number line is taught in grade 9.
	Geometry: Cartesian coordinates of points in a plane	Not included in curriculum through grade 8	Linear function and its graph is included in curriculum through grade 8.
Morocco	Geometry: Symmetry and transformations (reflection and rotation)	All or almost all of the students (at least 90%)	Transformations (reflection & rotation) not included in curriculum through grade 8.
Netherlands	Geometry: Congruence and similarity	Not included in curriculum through grade 8	Symmetry taught to all or almost all of the students.
New Zealand	Fractions and Number Sense: Computations with common fractions	All or almost all of the students (at least 90%)	Division with common fractions is not included in curriculum through grade 8.
	Fractions and Number Sense: Square roots (of perfect squares less than 144), small integer exponents	All or almost all of the students (at least 90%)	Small integer exponents taught to about half of the students.
	Algebra: Representing situations algebraically; formulas	About half of the students	Formulas not included in curriculum through grade 8.
	Algebra: Using the graph of a relationship to interpolate/extrapolate	All or almost all of the students (at least 90%)	Using the graph of a relationship to extrapolate not included in curriculum through grade 8.
Russian Federation	Measurement: Perimeter and area of simple shapes - triangles, rectangles, and circles	About half of the students	Perimeter and area of rectangles and circles included in curriculum through grade 8.
	Geometry: Congruence and similarity	About half of the students	Congruence included in curriculum through grade 8.
South Africa	Measurement: Volume of other solids (e.g., pyramids, cylinders, cones, spheres)	All or almost all of the students (at least 90%)	Volume of pyramids, cones, & spheres not included in curriculum through grade 8.
Tunisia	Geometry: Symmetry and transformations (reflection and rotation)	All or almost all of the students (at least 90%)	Rotation not included in curriculum through grade 8.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

APPENDIX B

B

Multiple Comparisons of Average Achievement in Mathematics Content Areas

Exhibit B.1 Multiple Comparisons of Average Achievement in Fractions and Number Sense

TIMSS 1999 8th grade Mathematics

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.

	Singapore	Hong Kong, SAR	Chinese Taipei	Korea, Rep. of	Japan	Belgium (Flemish)	Netherlands	Canada	Malaysia	Finland	Slovenia	Hungary	Slovak Republic	Australia	Russian Federation	United States	Czech Republic	Bulgaria	England	Latvia (LSS)	New Zealand	Cyprus	Lithuania	Israel	Thailand	Italy	Moldova	Romania	Tunisia	Iran, Islamic Rep.	Macedonia, Rep. of	Jordan	Turkey	Indonesia	Chile	Philippines	Morocco	South Africa
Singapore		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong, SAR	▼		●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei	▼	●		●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Korea, Rep. of	▼	●	●		●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan	▼	●	●	●		●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Belgium (Flemish)	▼	▼	▼	●	●		●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Netherlands	▼	▼	▼	▼	▼	●		●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Canada	▼	▼	▼	▼	▼	▼	●		●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Malaysia	▼	▼	▼	▼	▼	▼	●	●		●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Finland	▼	▼	▼	▼	▼	▼	●	●	●		●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovenia	▼	▼	▼	▼	▼	▼	●	●	●	●		●	●	●	●	●	▲	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hungary	▼	▼	▼	▼	▼	▼	●	●	●	●	●		●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovak Republic	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●		●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Australia	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●		●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Russian Federation	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●		●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
United States	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●		●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Czech Republic	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●		●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Bulgaria	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●		●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
England	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●		●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Latvia (LSS)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●		●	▲	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
New Zealand	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●		●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	▼	▼	●		●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Lithuania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	▼	●	●	●		●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Israel	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●		●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Thailand	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●		●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Italy	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●		●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Moldova	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●		●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Romania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●		●	●	●	▲	▲	▲	▲	▲	▲	▲
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●		●	●	●	●	▲	▲	▲	▲	▲
Iran, Islamic Rep.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●		●	●	●	▲	▲	▲	▲	▲
Macedonia, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●		●	●	▲	▲	▲	▲	▲
Jordan	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●		●	▲	▲	▲	▲	▲
Turkey	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●		▲	▲	▲	▲	▲
Indonesia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		●	▲	▲	▲
Chile	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●		●	▲	▲
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●		▲	▲
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲
South Africa	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ Average achievement significantly higher than comparison country

● No statistically significant difference from comparison country

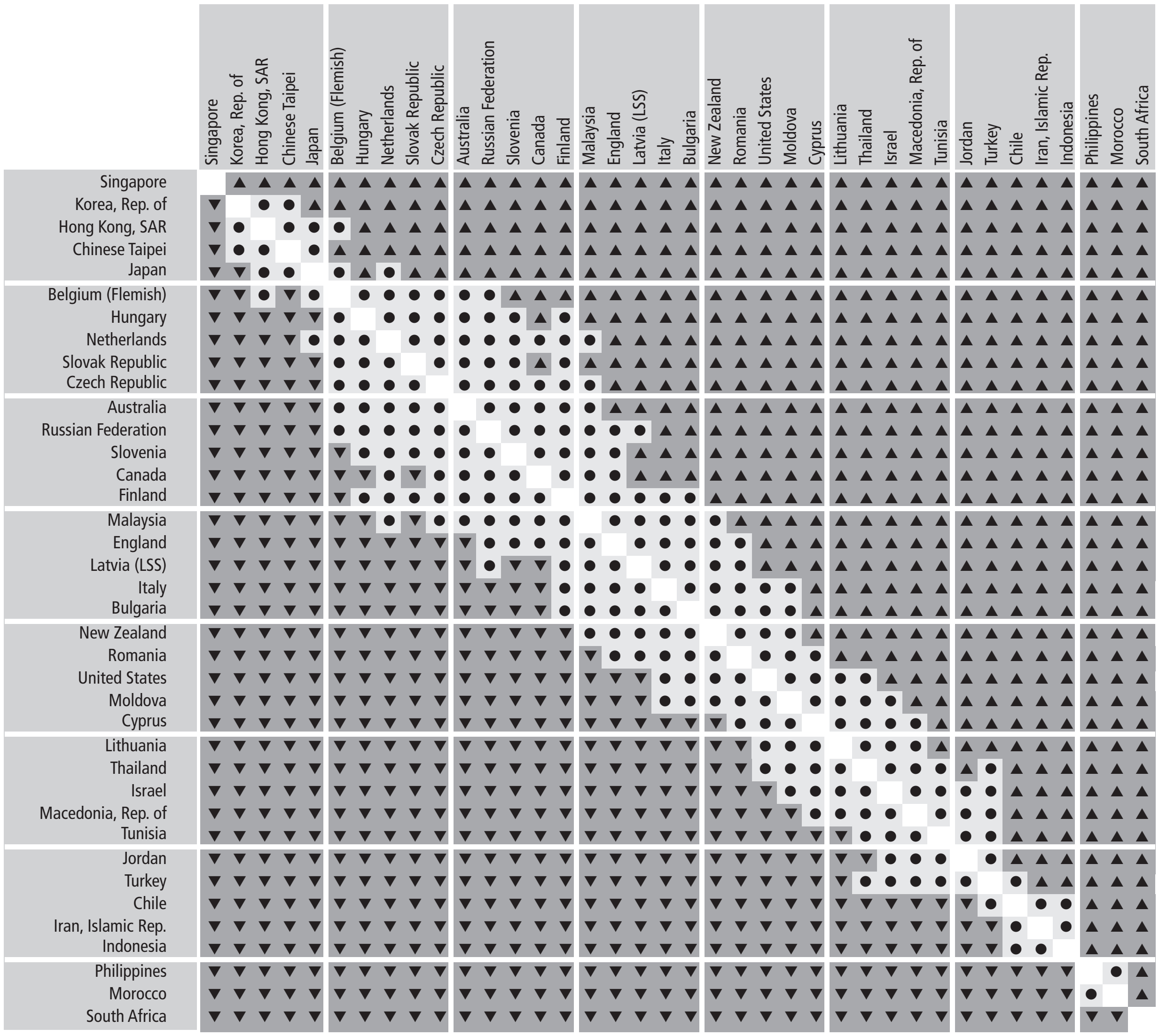
▼ Average achievement significantly lower than comparison country

Significance tests adjusted for multiple comparisons

Exhibit B.2 Multiple Comparisons of Average Achievement in Measurement

TIMSS 1999 8th grade Mathematics

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.



SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ Average achievement significantly higher than comparison country

● No statistically significant difference from comparison country

▼ Average achievement significantly lower than comparison country

Significance tests adjusted for multiple comparisons

Exhibit B.3 Multiple Comparisons of Average Achievement in Data Representation, Analysis, and Probability

TIMSS 1999 8th grade Mathematics

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.

	Korea, Rep. of	Singapore	Chinese Taipei	Japan	Hong Kong, SAR	Belgium (Flemish)	Netherlands	Slovenia	Finland	Australia	Slovak Republic	Canada	Hungary	Czech Republic	England	United States	Russian Federation	New Zealand	Latvia (LSS)	Lithuania	Bulgaria	Malaysia	Italy	Thailand	Cyprus	Israel	Romania	Moldova	Tunisia	Turkey	Macedonia, Rep. of	Jordan	Iran, Islamic Rep.	Chile	Indonesia	Philippines	Morocco	South Africa
Korea, Rep. of		●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Singapore	●		●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei	●	●		●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan	▼	●	●		●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong, SAR	▼	●	●	●		●	●	●	▲	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Belgium (Flemish)	▼	●	●	●	●		●	●	▲	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Netherlands	▼	●	●	●	●	●		●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovenia	▼	▼	▼	▼	●	●	●		●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Finland	▼	▼	▼	▼	▼	▼	●	●		●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Australia	▼	▼	▼	▼	●	●	●	●	●		●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovak Republic	▼	▼	▼	▼	▼	▼	●	●	●	●		●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Canada	▼	▼	▼	▼	▼	▼	●	●	●	●	●		●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hungary	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●		●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Czech Republic	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
England	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
United States	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●		●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Russian Federation	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●		●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
New Zealand	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	▼	▼	●	●	●	●	●		●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Latvia (LSS)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●		●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Lithuania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●		●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Bulgaria	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●		●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Malaysia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●		●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Italy	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●		●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Thailand	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●		●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●		●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Israel	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	▼	●	●	●		●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲
Romania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●		●	●	●	●	●	●	▲	▲	▲	▲	▲
Moldova	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●		●	●	●	●	●	●	▲	▲	▲	▲
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●		●	●	●	●	●	▲	▲	▲	▲
Turkey	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●		●	●	●	▲	▲	▲	▲	▲
Macedonia, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●		●	●	●	●	▲	▲	▲
Jordan	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●		●	●	●	▲	▲	▲
Iran, Islamic Rep.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●		●	●	▲	▲	▲
Chile	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	▼	●	●	●		●	▲	▲	▲
Indonesia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●		●	▲	▲
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●		▲	▲
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲
South Africa	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ Average achievement significantly higher than comparison country

● No statistically significant difference from comparison country

▼ Average achievement significantly lower than comparison country

Significance tests adjusted for multiple comparisons

Exhibit B.4 Multiple Comparisons of Average Achievement in Geometry

TIMSS1999 8th grade Mathematics

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.

	Japan	Korea, Rep. of	Singapore	Chinese Taipei	Hong Kong, SAR	Belgium (Flemish)	Slovak Republic	Bulgaria	Latvia (LSS)	Russian Federation	Netherlands	Czech Republic	Canada	Slovenia	Australia	Malaysia	Lithuania	Finland	Hungary	Romania	Thailand	Cyprus	Tunisia	Italy	Moldova	New Zealand	United States	England	Israel	Macedonia, Rep. of	Jordan	Iran, Islamic Rep.	Indonesia	Turkey	Chile	Morocco	Philippines	South Africa
Japan		●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Korea, Rep. of	●		●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Singapore	●	●		●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Chinese Taipei	●	●	●		●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong, SAR	●	●	●	●		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Belgium (Flemish)	▼	▼	▼	▼	▼		●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovak Republic	▼	▼	▼	▼	▼	●		●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Bulgaria	▼	▼	▼	▼	▼	●	●		●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Latvia (LSS)	▼	▼	▼	▼	▼	●	●	●		●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Russian Federation	▼	▼	▼	▼	▼	●	●	●	●		●	●	●	●	●	▲	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Netherlands	▼	▼	▼	▼	▼	●	●	●	●	●		●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Czech Republic	▼	▼	▼	▼	▼	●	●	●	●	●	●		●	●	●	●	●	●	▲	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Canada	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●		●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovenia	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Australia	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Malaysia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Lithuania	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Finland	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hungary	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Romania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲
Thailand	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●		●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●	●		●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Italy	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲
Moldova	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲
New Zealand	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲
United States	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●	●	●		●	●	●	●	▲	▲	▲	▲	▲	▲	▲
England	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●	●	●		●	●	●	▲	▲	▲	▲	▲	▲	▲
Israel	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	▼	●	▼	●	●	●	●	●		●	●	●	●	▲	▲	▲	▲	▲
Macedonia, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	▼	●	▼	●	●	●	●	●	●		●	●	●	▲	▲	▲	▲	▲
Jordan	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●		●	●	●	▲	▲	▲	▲
Iran, Islamic Rep.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●		●	●	▲	▲	▲	▲
Indonesia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●		●	▲	▲	▲	▲
Turkey	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●		●	▲	▲	▲
Chile	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●		●	▲	▲
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●		▲	▲
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲
South Africa	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ Average achievement significantly higher than comparison country

● No statistically significant difference from comparison country

▼ Average achievement significantly lower than comparison country

Significance tests adjusted for multiple comparisons

Exhibit B.5 Multiple Comparisons of Average Achievement in Algebra

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.

	Chinese Taipei	Korea, Rep. of	Singapore	Japan	Hong Kong, SAR	Belgium (Flemish)	Hungary	Russian Federation	Slovak Republic	Slovenia	Canada	Netherlands	Australia	Czech Republic	Bulgaria	United States	Malaysia	Latvia (LSS)	England	Finland	New Zealand	Lithuania	Italy	Romania	Israel	Cyprus	Moldova	Macedonia, Rep. of	Thailand	Tunisia	Jordan	Iran, Islamic Rep.	Turkey	Indonesia	Chile	Morocco	Philippines	South Africa
Chinese Taipei		●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Korea, Rep. of	●		●	▲	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Singapore	●	●		●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Japan	●	▼	●		●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hong Kong, SAR	●	●	●	●		▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Belgium (Flemish)	▼	▼	▼	▼	▼		●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Hungary	▼	▼	▼	▼	▼	●		●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Russian Federation	▼	▼	▼	▼	▼	●	●		●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovak Republic	▼	▼	▼	▼	▼	●	●	●		●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Slovenia	▼	▼	▼	▼	▼	●	●	●	●		●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Canada	▼	▼	▼	▼	▼	●	●	●	●	●		●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Netherlands	▼	▼	▼	▼	▼	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Australia	▼	▼	▼	▼	▼	●	●	●	●	●	●	●		●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Czech Republic	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●		●	●	●	●	●	▲	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Bulgaria	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●		●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
United States	▼	▼	▼	▼	▼	▼	▼	▼	●	▼	▼	●	●	●	●		●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Malaysia	▼	▼	▼	▼	▼	▼	▼	▼	●	▼	▼	●	●	●	●	●		●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Latvia (LSS)	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●		●	●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
England	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●	●		●	●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Finland	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	▼	▼	●	●	●	●	●		●	●	▲	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
New Zealand	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	▼	●	●	●	●	●	●	●		●	●	●	●	▲	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Lithuania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●		●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Italy	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	▼	●	●		●	●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Romania	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●		●	●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Israel	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	▼	●	●	●	●		●	●	●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Cyprus	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●		●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Moldova	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	●	●	●		●	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Macedonia, Rep. of	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●	▼	●		●	●	▲	▲	▲	▲	▲	▲	▲	▲
Thailand	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●		●	●	▲	▲	▲	▲	▲	▲	▲
Tunisia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●		●	▲	▲	▲	▲	▲	▲	▲
Jordan	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●		●	●	●	▲	▲	▲	▲
Iran, Islamic Rep.	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●		●	●	▲	▲	▲	▲
Turkey	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●		●	▲	▲	▲	▲
Indonesia	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●	●	●		▲	▲	▲	▲
Chile	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▲	▲	▲
Morocco	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		●	▲
Philippines	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	●		▲
South Africa	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

▲ Average achievement significantly higher than comparison country

● No statistically significant difference from comparison country

▼ Average achievement significantly lower than comparison country

Significance tests adjusted for multiple comparisons

APPENDIX C

C

The Test-Curriculum Matching Analysis: Mathematics

c

When comparing student achievement across countries, it is important that the comparisons be as fair as possible. LSS has worked toward this goal in a number of ways, including providing detailed procedures for standardizing the population definitions, sampling, test translations, test administration, scoring, and database formation. Similar to the procedures used for developing the original TIMSS instruments, developing the TIMSS 1999 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 1999 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 a set of agreed-upon mathematics content, differences among the curricula of participating countries result in various topics being taught at different grades. To restrict test items to topics included in the curricula of all participating countries and covered in the same sequence would severely limit test coverage and restrict the research questions that the study is designed to address. The tests, therefore, inevitably have some items measuring topics unfamiliar to some students in some countries.

The Test-Curriculum Matching Analysis (TCMA) was conducted to investigate the appropriateness of the TIMSS 1999 mathematics test for the eighth-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 1999 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. The NRC was asked to choose a person or persons who were very familiar with the curriculum at the grade tested to make this determination. Since an item might be in the curriculum for some but not all students in a country, an item was 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 participating countries returned the information for analysis.

Exhibits C.1 and C.2 present the TCMA results for the TIMSS 1999 tests. Exhibit C.1 shows the average percent correct for each country on items selected as appropriate and on the test as a whole. Exhibit C.2 shows the standard errors corresponding to the percentages presented in Exhibit C.1.

C1–C2

1 See Appendix A for more information on test development.

2 Because there may also be curriculum areas covered in some countries that are not covered by the TIMSS 1999 tests, the TCMA does not provide complete information about how well the tests cover the curricula of the countries.

In Exhibit C.1, the last row of the exhibit indicates that the countries varied substantially in the number of items (score points) identified as appropriate.[3] The percentages ranged from 100 percent (169 score points) in Chinese Taipei, the Slovak Republic, Latvia (LSS), the United States, Lithuania, Moldova, and Indonesia to 58 percent (98 score points) in Chile. Thirty-four of the 38 countries indicated that the items representing three-quarters or more of the score points (127 out of a possible 169) were appropriate.

Since most countries indicated that some items were not included in their intended curriculum at the grade tested, the data were analyzed to determine whether the inclusion of these items had any effect on the international performance comparisons.[4]

The first column in Exhibit C.1 shows the average percent correct on all test items for each country. The countries are presented in order of their overall performance based on overall percent correct, 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, Singapore, where the average percent correct was 77 percent on its own set of items, also had 78 percent correct for the items selected by Korea, 77 percent for the items selected by Hong Kong, and so forth. The column for a country listed across the top shows how each of the other countries performed on the subset of items selected as appropriate for its own students. Using the set of items selected by Finland as an example, on average 77 percent of these items were answered correctly by students in Singapore, 73 percent by students in Korea, 72 percent by those in Hong Kong, 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 own curriculum. Thus, Finnish students averaged 56 percent correct on the set of items identified by Finland for the analysis.

The international averages of each country's selected items are presented across the second to the last row of the exhibit. They show that the selection of items for the participating countries varied somewhat in average difficulty, ranging from 48 to 54 percent. Despite these differences, the overall picture presented by Exhibit C.1 reveals 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]

3 Of the 162 items in the test, 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 total number of score points available for analysis was 169. The TCMA uses score points in order to give the same weight to items given them in test scoring.

4 It should be noted that the performance levels presented in Exhibit C.1 are based on average percents, which are different from the average scale scores that are presented in Chapter 1.

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.

Comparing the diagonal element for a country with the overall average percent correct shows the difference between performance on the subset of items chosen as appropriate and performance on the test as a whole. In general, there were only small increases in each country's performance on its own subset of items. To illustrate, the average percent correct for Singapore was 77 percent. The diagonal element shows that Singaporean students had the same percent correct (77 percent) based on the smaller set of items selected as they did overall. All countries had a difference of less than five percentage points between the two performance measures, with the largest difference four percent for the Netherlands (65 percent compared with 61 percent).

It is clear that the selection of items does not have a major effect on the general relationship among countries. Countries that had substantially higher or lower relative performance on all items also had higher or lower relative performance on the different sets of items selected for the TCMA. For example, Singapore had the highest average percent correct on the test as a whole and on most of the different item selections, with Korea, Hong Kong, and Chinese Taipei among the four highest-performing countries in all cases. 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 149 score points selected by Jordan. The Jordanian students did better on these items than on the test as a whole, with 41 percent correct on these items, on average, compared with 38 percent correct on all items. However, most other countries also did better on these particular items, with an international average of 54 percent correct on the items selected by Jordan. All 30 countries that performed better than Jordan on the overall test also performed better on the items selected by Jordan.

The TCMA results provide evidence that the TIMSS 1999 mathematics test provides a reasonable basis for comparing achievement of the participating countries. 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.

Exhibit C.1 Average Percent Correct for Test-Curriculum Matching Analysis – Mathematics

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

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)	Hungary	Slovak Republic	Netherlands	Slovenia	Canada	Russian Federation	Australia	Malaysia	Czech Republic	Finland	Bulgaria	Latvia (LSS)	United States	England	New Zealand	Lithuania	Italy	Cyprus	Romania	Moldova	Israel	Thailand	Macedonia, Rep. of	Tunisia	Jordan	Turkey	Iran, Islamic Rep.	Indonesia	Chile	Philippines	Morocco	South Africa
Singapore	77 (1.3)	77	78	77	77	77	77	78	77	78	77	77	78	77	78	77	77	78	77	77	78	77	77	77	77	77	77	78	78	77	77	78	77	77	77	80	79	77	77
Korea, Rep. of	73 (0.4)	72	73	72	73	72	73	73	73	75	72	73	73	73	73	72	73	73	73	73	73	73	73	73	70	73	73	73	73	74	72	76	74	72	73	73	73	72	72
Hong Kong, SAR	72 (1.1)	72	73	72	72	72	73	73	72	75	72	72	73	73	73	72	72	73	72	72	73	73	72	72	71	73	72	73	73	74	72	74	73	72	72	73	73	73	72
Chinese Taipei	72 (0.9)	72	73	72	72	72	72	72	72	74	72	72	72	72	72	72	72	73	72	72	73	72	72	72	70	72	72	73	72	73	72	74	73	72	72	73	72	72	72
Japan	72 (0.4)	71	71	71	72	72	72	72	72	74	72	72	71	72	72	72	72	71	72	72	73	72	72	72	68	72	72	71	72	72	71	74	72	71	72	72	71	71	71
Belgium (Flemish)	66 (0.8)	65	66	65	66	66	66	67	66	68	66	66	66	67	66	66	66	67	66	66	68	67	66	66	63	66	66	66	67	66	66	69	67	66	66	66	67	66	65
Hungary	61 (0.9)	61	62	61	61	61	61	62	61	63	61	61	63	62	62	61	62	62	61	61	62	62	61	61	59	61	61	62	62	62	61	65	62	62	61	60	63	61	60
Slovak Republic	61 (1.1)	61	61	61	61	61	61	62	61	64	61	61	62	62	62	61	61	62	61	61	62	61	61	61	59	61	61	61	62	62	61	64	61	62	61	61	63	61	61
Netherlands	61 (1.8)	60	60	60	61	60	61	60	61	65	60	61	60	62	60	60	61	60	61	61	63	62	61	61	55	60	61	60	60	61	60	64	61	60	61	61	61	60	59
Slovenia	60 (0.7)	59	60	59	60	59	60	60	60	62	59	60	60	60	60	59	60	60	60	60	61	60	60	60	57	60	60	60	60	60	59	63	60	60	60	60	62	60	59
Canada	59 (0.5)	58	59	58	59	59	59	59	59	62	58	59	58	60	59	58	59	59	59	59	61	60	59	59	54	58	59	59	59	59	58	62	59	59	59	59	60	59	58
Russian Federation	58 (1.3)	58	59	58	58	58	58	59	58	59	58	58	60	58	59	58	58	60	58	58	58	58	58	58	57	58	58	59	60	59	58	62	59	59	58	57	60	58	57
Australia	58 (1.2)	57	58	57	58	57	58	57	58	61	57	58	57	59	57	57	58	57	58	58	60	59	58	58	52	57	58	58	57	57	57	61	58	57	58	57	58	57	56
Malaysia	57 (1.1)	57	58	57	57	57	57	58	57	59	57	57	58	58	58	57	57	58	57	57	59	58	57	57	55	57	57	58	58	58	57	60	58	58	57	60	59	57	57
Czech Republic	57 (1.1)	57	57	57	57	57	57	58	57	60	57	57	58	58	57	57	57	57	57	57	58	58	57	58	54	57	57	57	58	58	57	60	58	57	57	56	59	57	56
Finland	56 (0.7)	55	56	55	56	55	56	56	56	59	55	56	55	57	56	55	56	55	56	56	59	58	56	56	50	55	56	56	56	55	55	60	56	56	56	56	57	56	54
Bulgaria	54 (1.4)	54	55	54	54	54	54	55	54	56	54	54	55	55	55	54	54	55	54	54	54	54	54	55	53	54	54	55	55	55	54	57	55	55	54	54	55	54	54
Latvia (LSS)	53 (0.8)	52	53	52	53	53	53	54	53	55	53	53	54	53	54	53	53	54	53	53	53	53	53	53	50	53	53	53	54	53	53	56	53	53	53	52	54	53	52
United States	52 (0.9)	52	53	52	52	52	52	52	52	55	52	53	53	53	52	52	53	52	52	52	54	54	52	52	48	52	52	53	53	53	51	56	53	52	52	52	54	52	51
England	50 (1.1)	49	50	49	50	50	50	49	50	54	50	51	49	51	49	50	50	49	50	50	53	52	50	50	43	49	50	50	50	50	49	53	51	49	50	50	50	50	48
New Zealand	50 (1.2)	49	50	49	50	49	50	49	50	53	49	50	49	51	49	49	50	49	50	50	52	51	50	50	44	49	50	50	49	49	49	53	50	49	50	49	50	49	48
Lithuania	49 (1.0)	49	50	49	49	49	49	50	49	52	49	49	51	50	50	49	50	50	49	49	50	50	49	50	47	49	49	50	51	50	49	53	50	50	49	49	51	49	48
Italy	49 (0.8)	48	49	48	49	49	49	49	49	51	48	49	48	50	49	48	49	49	49	49	50	49	49	49	46	49	49	49	49	49	48	51	50	49	49	50	50	49	48
Cyprus	47 (0.4)	46	49	46	47	47	47	48	47	49	46	47	47	48	48	46	46	47	47	47	49	48	47	47	45	47	47	49	48	47	47	50	48	47	47	48	49	47	46
Romania	47 (1.2)	47	48	47	47	47	47	48	47	48	47	47	48	47	48	47	47	49	47	47	47	47	47	47	47	47	47	48	48	48	47	49	48	48	47	47	48	47	47
Moldova	46 (0.9)	46	46	46	46	46	46	47	46	47	46	45	47	46	47	46	46	46	46	46	46	46	46	46	45	46	46	45	47	47	46	48	46	46	46	46	47	46	46
Israel	45 (0.8)	44	46	44	45	45	45	45	45	47	45	45	45	46	45	45	45	45	45	45	46	46	45	45	42	45	45	46	45	45	45	48	46	45	45	44	46	45	44
Thailand	45 (1.1)	45	45	45	45	45	45	45	45	47	45	45	46	46	46	45	45	45	45	45	46	46	45	45	41	45	45	45	46	46	44	48	45	46	45	45	46	45	44
Macedonia, Rep. of	40 (0.8)	40	40	39	40	40	40	41	40	42	40	40	40	40	40	40	39	41	40	40	40	41	40	40	38	40	40	40	41	41	40	43	41	40	40	39	40	40	39
Tunisia	39 (0.5)	40	40	39	39	39	40	41	39	42	39	40	41	40	41	39	39	41	39	39	40	40	39	40	39	40	39	40	41	41	40	42	40	40	39	41	41	40	40
Jordan	38 (0.6)	38	38	38	38	38	38	38	38	39	38	38	39	38	39	38	38	39	38	38	39	38	38	38	35	38	38	38	39	39	38	41	39	39	38	39	39	38	37
Turkey	37 (0.9)	36	38	36	37	36	37	37	37	38	36	37	38	37	37	36	36	38	37	37	38	37	37	37	35	37	37	38	38	37	37	40	38	37	37	37	38	37	36
Iran, Islamic Rep.	36 (0.6)	36	37	35	36	36	36	37	36	37	36	36	36	36	37	36	35	37	36	36	37	36	36	36	34	36	36	37	37	36	36	39	36	36	36	37	37	35	36
Indonesia	35 (0.8)	34	35	34	35	35	35	35	35	36	35	35	35	35	35	35	34	35	35	35	35	35	35	35	32	35	35	35	35	35	34	37	35	35	35	34	35	35	34
Chile	31 (0.8)	31	31	30	31	31	31	31	31	33	31	31	31	32	31	31	31	31	31	31	32	32	31	31	28	31	31	31	31	31	31	34	32	31	31	32	32	31	30
Philippines	26 (0.7)	26	27	26	26	26	26	27	26	28	26	27	26	27	27	26	26	27	26	26	27	27	26	27	24	26	26	27	27	27	26	29	27	27	26	27	27	26	26
Morocco	24 (0.2)	23	23	23	24	23	24	23	24	25	23	24	24	24	24	23	23	24	24	24	24	24	24	24	22	23	24	23	24	24	23	26	24	24	24	24	24	23	23
South Africa	21 (0.6)	20	21	20	21	20	21	21	21	21	20	21	21	21	21	20	20	21	21	21	21	21	21	21	20	20	21	21	21	21	20	23	21	21	21	21	21	20	20
International Avg.	**51 (0.2)**	**50**	**51**	**50**	**51**	**51**	**51**	**51**	**51**	**53**	**51**	**51**	**51**	**51**	**51**	**51**	**51**	**51**	**51**	**51**	**52**	**52**	**51**	**51**	**48**	**51**	**51**	**51**	**51**	**51**	**50**	**54**	**51**	**51**	**51**	**51**	**52**	**51**	**50**
Number of Items (Score Points) Identified*	169	159	127	152	169	160	166	142	169	120	162	165	126	159	141	162	140	135	169	169	136	156	169	161	99	153	169	128	147	134	145	149	165	150	169	98	126	150	141

*Of the 162 items in the mathematics test, some items had two parts and some extended–response items were scored on a two–point scale, resulting in 169 total score points.

( ) Standard errors for the average percent of correct responses on all items appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Because population coverage falls below 65% Latvia is annotated LSS for Latvian Speaking Schools only.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

Exhibit C.2 Standard Errors for the Test-Curriculum Matching Analysis – Mathematics

Country	Average Percent Correct on All Items	Singapore	Korea, Rep. of	Hong Kong, SAR	Chinese Taipei	Japan	Belgium (Flemish)	Hungary	Slovak Republic	Netherlands	Slovenia	Canada	Russian Federation	Australia	Malaysia	Czech Republic	Finland	Bulgaria	Latvia (LSS)	United States	England	New Zealand	Lithuania	Italy	Cyprus	Romania	Moldova	Israel	Thailand	Macedonia, Rep. of	Tunisia	Jordan	Turkey	Iran, Islamic Rep.	Indonesia	Chile	Philippines	Morocco	South Africa
Singapore	77 (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	1.4	1.4	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
Korea, Rep. of	73 (0.4)	0.5	0.5	0.5	0.4	0.5	0.4	0.5	0.4	0.4	0.5	0.4	0.5	0.4	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.4	0.5	0.5	0.5	0.5	0.4	0.4	0.5	0.4	0.5	0.5	0.5	0.5
Hong Kong, SAR	72 (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	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Chinese Taipei	72 (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	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	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
Japan	72 (0.4)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	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	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Belgium (Flemish)	66 (0.8)	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	0.7	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.7	0.7	0.8	0.8
Hungary	61 (0.9)	0.9	0.9	0.9	0.9	0.8	0.8	0.9	0.9	0.9	0.9	0.8	0.9	0.8	0.9	0.9	0.8	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	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.8
Slovak Republic	61 (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	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.1	1.0	1.1	1.1	1.1	1.1	1.1	1.0	1.1	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1
Netherlands	61 (1.8)	1.8	1.8	1.8	1.8	1.8	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.9	1.8	1.8	1.8	1.9	1.9	1.8	1.8	1.9	1.9	1.8	1.8	1.8	1.9	1.8	1.8	1.9	1.8	1.8	1.8	1.9	1.9	1.9
Slovenia	60 (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	0.8	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	0.8	0.7	0.7	0.7
Canada	59 (0.5)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Russian Federation	58 (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	1.4	1.3	1.3	1.3	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
Australia	58 (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	1.2	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	1.2	1.2	1.2
Malaysia	57 (1.1)	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.1	1.1	1.1
Czech Republic	57 (1.1)	1.1	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.1	1.0	1.1	1.1	1.1	1.1	1.1
Finland	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	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Bulgaria	54 (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	1.4	1.4	1.5	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	1.4	1.5	1.4	1.4	1.4
Latvia (LSS)	53 (0.8)	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	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.8
United States	52 (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	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
England	50 (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	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.1	1.1
New Zealand	50 (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	1.2	1.2	1.2	1.3	1.2	1.2	1.3	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
Lithuania	49 (1.0)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Italy	49 (0.8)	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.9	0.8	0.8	0.8	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.9	0.8	0.8	0.8	0.9	0.9	0.8	0.8	0.9	0.9	0.8	0.8
Cyprus	47 (0.4)	0.3	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.4	0.3	0.4	0.3	0.4	0.4	0.3	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	0.4	0.4	0.4	0.4
Romania	47 (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	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.2	1.2
Moldova	46 (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	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
Israel	45 (0.8)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	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
Thailand	45 (1.1)	1.1	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.1	1.1	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
Macedonia, Rep. of	40 (0.8)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Tunisia	39 (0.5)	0.5	0.5	0.5	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Jordan	38 (0.6)	0.7	0.6	0.7	0.6	0.7	0.6	0.7	0.6	0.7	0.7	0.6	0.7	0.6	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.6	0.6	0.7	0.7	0.7	0.6	0.6	0.7	0.6	0.7	0.7	0.7	0.7
Turkey	37 (0.9)	0.9	0.9	0.9	0.9	0.8	0.9	0.9	0.9	0.9	0.9	0.8	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	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Iran, Islamic Rep.	36 (0.6)	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.7	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.6	0.7	0.6	0.6	0.7	0.7	0.7	0.6	0.6	0.7	0.7	0.6	0.6
Indonesia	35 (0.8)	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	0.7	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
Chile	31 (0.8)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Philippines	26 (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	0.6	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
Morocco	24 (0.2)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.3	0.2	0.2	0.2	0.3	0.2	0.2	0.2
South Africa	21 (0.6)	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.7	0.6	0.6	0.7	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6
International Avg.	**51 (0.2)**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**
Number of Items (Score Points) Identified*	169	159	127	152	169	160	166	142	169	120	162	165	126	159	141	162	140	135	169	169	136	156	169	161	99	153	169	128	147	134	145	149	165	150	169	98	126	150	141

*Of the 162 items in the mathematics test, some items had two parts and some extended-response items were scored on a two–point scale, resulting in 169 total score points.

( ) Standard errors for the average percent of correct responses on all items appear in parentheses. The matrix contains standard errors corresponding to the average percent of correct responses based on TCMA subsets of items, as displayed in Exhibit C.1. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Because population coverage falls below 65% Latvia is annotated LSS for Latvian Speaking Schools only.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

APPENDIX D

D

Percentiles and Standard Deviations of Mathematics Achievement

Exhibit D.1 Percentiles of Achievement in Mathematics

	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Australia	387 (6.5)	472 (5.6)	529 (6.2)	581 (4.5)	648 (7.3)
Belgium (Flemish)	423 (14.1)	511 (4.0)	563 (3.6)	611 (3.2)	675 (5.5)
Bulgaria	367 (6.3)	454 (5.8)	512 (7.0)	567 (10.8)	649 (11.9)
Canada	406 (4.6)	484 (3.8)	533 (2.6)	581 (2.1)	646 (6.0)
Chile	253 (7.5)	336 (4.3)	391 (2.9)	448 (5.7)	533 (13.1)
Chinese Taipei	396 (6.4)	524 (6.1)	595 (4.4)	656 (3.5)	739 (5.1)
Cyprus	335 (6.9)	422 (4.0)	481 (2.0)	534 (2.4)	603 (4.0)
Czech Republic	392 (9.9)	467 (5.0)	517 (5.7)	573 (6.0)	653 (9.9)
England	360 (6.4)	442 (4.8)	496 (5.1)	551 (3.5)	632 (6.4)
Finland	408 (4.0)	479 (3.9)	523 (2.4)	565 (3.1)	623 (4.6)
Hong Kong, SAR	456 (11.0)	538 (5.8)	587 (3.7)	632 (3.8)	693 (4.1)
Hungary	386 (6.4)	476 (3.4)	536 (3.7)	590 (4.1)	667 (5.1)
Indonesia	239 (8.4)	337 (7.8)	401 (4.8)	469 (4.3)	574 (8.8)
Iran, Islamic Rep.	284 (4.7)	367 (2.9)	423 (4.0)	478 (4.9)	556 (7.9)
Israel	300 (6.9)	402 (6.6)	473 (7.2)	534 (2.6)	614 (3.7)
Italy	331 (8.8)	423 (5.3)	482 (3.3)	540 (4.8)	615 (5.8)
Japan	441 (2.8)	529 (2.4)	583 (1.8)	633 (1.9)	702 (4.1)
Jordan	258 (4.3)	357 (3.8)	429 (3.6)	498 (4.3)	596 (4.2)
Korea, Rep. of	448 (5.8)	538 (3.6)	592 (2.3)	640 (2.0)	710 (3.2)
Latvia (LSS)	377 (5.1)	453 (4.0)	505 (4.6)	557 (3.7)	631 (4.3)
Lithuania	354 (9.1)	429 (3.9)	482 (4.2)	534 (3.4)	608 (7.5)
Macedonia, Rep. of	287 (7.2)	386 (5.1)	451 (5.0)	510 (3.5)	594 (5.5)
Malaysia	387 (6.0)	464 (5.0)	519 (5.3)	577 (6.8)	648 (4.3)
Moldova	331 (6.4)	412 (4.6)	468 (4.8)	528 (4.4)	607 (4.8)
Morocco	181 (7.1)	277 (3.9)	340 (2.8)	401 (2.6)	477 (4.8)
Netherlands	410 (9.1)	495 (9.0)	545 (6.1)	590 (5.6)	653 (9.7)
New Zealand	341 (5.5)	430 (5.9)	493 (7.0)	554 (6.5)	632 (7.4)
Philippines	185 (7.3)	278 (5.7)	345 (6.4)	414 (7.5)	504 (10.2)
Romania	312 (11.7)	412 (5.6)	477 (4.7)	537 (7.2)	616 (7.4)
Russian Federation	385 (12.0)	471 (8.0)	526 (6.9)	584 (6.1)	666 (13.4)
Singapore	464 (7.5)	555 (5.7)	608 (6.6)	658 (8.9)	728 (6.5)
Slovak Republic	407 (7.4)	485 (4.2)	534 (6.0)	585 (4.8)	656 (4.9)
Slovenia	392 (4.4)	476 (3.6)	531 (3.1)	587 (4.8)	663 (5.7)
South Africa	113 (9.6)	200 (5.5)	263 (6.6)	337 (9.9)	485 (11.1)
Thailand	328 (9.1)	412 (4.7)	465 (4.5)	524 (7.6)	609 (7.0)
Tunisia	341 (7.1)	406 (2.5)	449 (2.9)	491 (2.9)	551 (2.9)
Turkey	290 (5.9)	371 (3.8)	428 (3.5)	486 (6.7)	572 (7.1)
United States	356 (4.3)	442 (4.7)	504 (4.3)	562 (3.7)	642 (6.6)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

( ) Standard errors appear in parentheses.

Exhibit D.2 Standard Deviations of Achievement in Mathematics

TIMSS 1999 8th grade Mathematics

	Overall		Girls		Boys	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Australia	525 (4.8)	80 (2.9)	524 (5.7)	77 (3.8)	526 (5.7)	83 (3.3)
Belgium (Flemish)	558 (3.3)	77 (2.8)	560 (7.2)	74 (4.8)	556 (8.3)	79 (5.6)
Bulgaria	511 (5.8)	86 (3.8)	510 (5.9)	84 (3.5)	511 (6.9)	88 (4.7)
Canada	531 (2.5)	73 (1.7)	529 (2.5)	72 (1.9)	533 (3.2)	74 (1.7)
Chile	392 (4.4)	85 (3.5)	388 (4.3)	82 (2.9)	397 (5.8)	89 (4.2)
Chinese Taipei	585 (4.0)	104 (1.8)	583 (3.9)	98 (2.4)	587 (5.3)	110 (2.1)
Cyprus	476 (1.8)	82 (1.7)	479 (2.1)	77 (2.2)	474 (2.7)	85 (1.9)
Czech Republic	520 (4.2)	79 (2.4)	512 (4.0)	78 (2.6)	528 (5.8)	80 (2.9)
England	496 (4.1)	83 (2.2)	487 (5.4)	79 (3.5)	505 (5.0)	86 (2.8)
Finland	520 (2.7)	65 (1.3)	519 (3.0)	63 (1.7)	522 (3.5)	68 (1.7)
Hong Kong, SAR	582 (4.3)	73 (3.0)	583 (4.7)	69 (2.8)	581 (5.9)	77 (4.4)
Hungary	532 (3.7)	85 (2.0)	529 (4.0)	82 (2.3)	535 (4.3)	88 (2.6)
Indonesia	403 (4.9)	101 (2.9)	401 (5.4)	102 (3.4)	405 (5.0)	101 (3.1)
Iran, Islamic Rep.	422 (3.4)	83 (2.3)	408 (4.2)	81 (2.5)	432 (4.8)	83 (2.5)
Israel	466 (3.9)	96 (2.6)	459 (4.2)	90 (2.4)	474 (4.8)	100 (3.8)
Italy	479 (3.8)	87 (2.3)	475 (4.5)	85 (2.8)	484 (4.3)	88 (2.8)
Japan	579 (1.7)	80 (1.1)	575 (2.4)	76 (2.1)	582 (2.3)	82 (1.3)
Jordan	428 (3.6)	103 (1.6)	431 (4.7)	96 (2.3)	425 (5.9)	109 (2.2)
Korea, Rep. of	587 (2.0)	79 (1.0)	585 (3.1)	79 (1.3)	590 (2.2)	80 (1.6)
Latvia (LSS)	505 (3.4)	78 (2.0)	502 (3.8)	75 (2.6)	508 (4.4)	81 (2.4)
Lithuania	482 (4.3)	78 (2.6)	480 (4.7)	76 (3.2)	483 (4.8)	80 (3.2)
Macedonia, Rep. of	447 (4.2)	93 (2.5)	446 (5.3)	92 (3.0)	447 (4.3)	94 (2.8)
Malaysia	519 (4.4)	81 (2.0)	521 (4.7)	79 (2.2)	517 (6.0)	83 (2.6)
Moldova	469 (3.9)	85 (2.1)	468 (4.1)	83 (2.6)	471 (4.7)	87 (2.6)
Morocco	337 (2.6)	91 (2.0)	326 (5.3)	90 (3.5)	344 (4.1)	91 (2.0)
Netherlands	540 (7.1)	73 (4.2)	538 (7.6)	73 (4.4)	542 (7.0)	74 (4.3)
New Zealand	491 (5.2)	89 (2.3)	495 (5.5)	87 (2.9)	487 (7.6)	91 (3.0)
Philippines	345 (6.0)	97 (2.8)	352 (6.9)	96 (4.1)	337 (6.5)	98 (2.8)
Romania	472 (5.8)	93 (3.5)	475 (6.3)	90 (3.8)	470 (6.2)	96 (3.8)
Russian Federation	526 (5.9)	86 (3.0)	526 (6.0)	83 (3.0)	526 (6.4)	90 (3.8)
Singapore	604 (6.3)	79 (2.9)	603 (6.1)	76 (3.0)	606 (7.5)	82 (3.3)
Slovak Republic	534 (4.0)	75 (1.6)	532 (4.2)	72 (1.9)	536 (4.5)	79 (2.3)
Slovenia	530 (2.8)	83 (2.0)	529 (3.0)	79 (1.9)	531 (3.6)	86 (2.8)
South Africa	275 (6.8)	109 (4.7)	267 (7.5)	110 (5.1)	283 (7.3)	108 (4.7)
Thailand	467 (5.1)	85 (2.5)	469 (5.7)	84 (2.8)	465 (5.5)	86 (2.9)
Tunisia	448 (2.4)	64 (0.9)	436 (2.4)	64 (1.2)	460 (2.9)	61 (1.3)
Turkey	429 (4.3)	86 (2.0)	428 (4.7)	83 (2.1)	429 (4.4)	87 (2.4)
United States	502 (4.0)	88 (2.4)	498 (3.9)	84 (2.1)	505 (4.8)	91 (3.0)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

( ) Standard errors appear in parentheses.

APPENDIX E

Acknowledgments

TIMSS 1999 was truly a collaborative effort among hundreds of individuals around the world. Staff from the national research centers in each participating country, the International Association for the Evaluation for Educational Achievement (IEA), the International Study Center (ISC) at Boston College, advisors, and funding agencies worked closely to develop and implement TIMSS 1999. The project would not have been possible without the tireless efforts of all involved. Inside, the individuals and organizations are acknowledged for their contributions. Given that implementing TIMSS 1999 has spanned approximately four years and involved so many people and organizations, this list may not pay heed to all who contributed throughout the life of the project. Any omission is inadvertent. TIMSS 1999 also acknowledges the students, teachers, and school principals who contributed their time and effort to the study. This report would not be possible without them.

Funding Agencies

Funding for the international coordination of TIMSS 1999 was provided by the National Center for Education Statistics of the U.S. Department of Education, the U.S. National Science Foundation, the World Bank, and participating countries. Valena Plisko, Eugene Owen, and Patrick Gonzales of the National Center for Education Statistics; Larry Suter, Elizabeth VanderPutten, and Janice Earle of the National Science Foundation; and Marlaine Lockheed of the World Bank each played a crucial role in making TIMSS 1999 possible and for ensuring the quality of the study. Each participating country was responsible for funding national project costs and implementing TIMSS 1999 in accordance with the international procedures.

Management and Operations

TIMSS 1999 was conducted under the auspices of the IEA. The study was co-directed by Michael O. Martin and Ina V.S. Mullis, and managed centrally by the staff of the 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 1999, 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 coordinated translation verification and recruiting of quality control monitors. The data were processed centrally by the IEA Data Processing Center in Hamburg. 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 conducted the scaling of the achievement data.

IEA Secretariat

Hans Wagemaker, Executive Director
Barbara Malak, Manager Membership Relations
Leendert Dijkhuizen, Fiscal Officer

International Study Center at Boston College Responsible for TIMSS and PIRLS

Michael O. Martin, Co-Director
Ina V.S. Mullis, Co-Director
Eugenio J. Gonzalez, Director of Operations and Data Analysis
Kelvin D. Gregory, TIMSS Project Coordinator
Teresa A. Smith, TIMSS Science Coordinator
Robert Garden, TIMSS Mathematics Coordinator
Kathleen O'Connor, TIMSS Benchmarking Coordinator
Dana L. Kelly, PIRLS Project Coordinator
Steven Chrostowski, Research Associate
Ce Shen, Research Associate
Julie Miles, Research Associate
Steven Stemler, Research Associate
Ann Kennedy, Research Associate
Joseph Galia, Statistician/Programmer
Lana Seliger, Statistician/Programmer
Andrea Pastelis, Database Manager
Kieran Brosnan, Technology Support Specialist
Christine Conley, Publications Design Manager
Jose Nieto, Publications Manager
Mario Pita, Data Graphics Specialist
Christina Lopez, Data Graphics Specialist
Betty Hugh, Data Graphics Specialist
Isaac Li, Data Graphics Assistant
Kathleen Packard, Manager, Finance
Susan Comeau, Manager, Office Administration
Ann Tan, Manager, Conference Administration
Monica Guidi, Administrative Coordinator
Laura Misas, Administrative Coordinator

Statistics Canada

Pierre Foy, Senior Methodologist
Marc Joncas, Senior Methodologist
Andrea Farkas, Junior Methodologist
Salina Park, Cooperative Exchange Student

IEA Data Processing Center

Dirk Hastedt, Senior Researcher
Heiko Sibberns, Senior Researcher
Knut Schwippert, Senior Researcher
Caroline Dupeyrat, Researcher
Oliver Neuschmidt, Researcher
Stephan Petzchen, Research Assistant
Anneke Niemeyer, Research Assistant
Juliane Pickel, Research Assistant

Educational Testing Service

Kentaro Yamamoto, Principal Research Scientist
Ed Kulick, Manager, Research Data Analysis

Project Management Team

Michael Martin, International Study Center
Ina Mullis, International Study Center
Eugenio Gonzalez, International Study Center
Hans Wagemaker, IEA Secretariat
Dirk Hastedt, IEA Data Processing Center
Pierre Foy, Statistics Canada
Kentaro Yamamoto, Educational Testing Service
Eugene Johnson, American Institutes for Research

Sampling Referee

Keith Rust, Westat, Inc.

National Research Coordinators

The TIMSS 1999 National Research Coordinators and their staff had the enormous task of implementing the TIMSS 1999 design. This required 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 1999 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. Of course, across the life of the project, some NRCs have changed. This list attempts to include all past NRCs who served for a significant period of time as well as all the present NRCs. All of the TIMSS 1999 National Research Coordinators and their staff members are to be commended for their professionalism and their dedication in conducting all aspects of TIMSS.

Australia

Susan Zammit
Australian Council for Educ. Res.(ACER)
19 Prospect Hill Rd.
Private Bag 55
Camberwell, Victoria 3124

Belgium (Flemish)

Jan Van Damme
Afd.Didactiek
Vesaliusstraat 2
B-3000 Leuven

Christiane Brusselmans-Dehairs
Jean-Pierre Verhaeghe
Vakgroep Onderwijskunde Universiteit Gent
Henri Dunantlaan 2
B 9000 Gent

Ann Van Den Broeck
Dekenstraat 2
AFD.Didaktiek
3000 Leuven

Bulgaria

Kiril Bankov
Faculty of Mathematics and Informatics
University of Sofia
1164 Sophia

Canada

Alan Taylor
Applied Research and Evaluation Services (ARES)
University of British Columbia
6058 Pearl Avenue,
Burnaby, BC V5H 3P9

Richard Jones
Education Quality & Accountability Office(EQAO)
2 Carlton St., Suite 1200
Toronto, ON M5B2M9

Jean-Louis Lebel
Direction de la sanction des etudes
1035 rue De La Chevrotiere
26 etage
Quebec GIR 5A5

Michael Marshall
University of British Columbia
Faculty of Education, Rm 6
2125 Main Mall
Vancouver, BC V6T1Z4

Chile

Maria Ines Alvarez
Unidad de Curriculum y Evaluacion
Ministerio de Educacion
Alameda 1146
Sector B, Piso 8

Chinese Tapei

Jau-D Chen
Dean of General Affairs
National Taiwan Normal University
162, E. Hoping Rd. Sec. 1
Taipei, Taiwan 117

Cyprus

Constantinos Papanastasiou
Department of Education
University of Cyprus
P.O. Box 20537
Nicosia CY-1678

Czech Republic

Jana Paleckova
Institute for Information of Education (UIV)
Senovazne nam.26
111 21 Praha 1

England

Graham Ruddock
National Foundation for Educational Research (NFER)
The Mere, Upton Park
Slough, Berkshire
SL1 2DQ

Finland

Pekka Kupari
University of Jyvaskyla
Institute for the Educational Research
P. O. Box 35
SF – 40351 Jyvaskyla
40351

Hong Kong, SAR

Frederick Leung
The University of Hong Kong –
Department of Curriculum
Faculty of Education, Rm. 219
Pokfulam Road
Hong Kong, SAR

Hungary

Péter Vari
National Institute of Public Education
Centre for Evaluation Studies
Dorottya u.8, Pf 701/420
1051 Budapest

Indonesia

Jahja Umar
Examiniation Development Center
Jalan Gunung Sahari Raya – 4
Jakarta Pusat
Jakarta

Iran, Islamic Republic

Ali Reza Kiamanesh
Ministry of Education
196, Institute for Education Research
Keshavaraz Blvd.
Tehran, 14166

Israel

Ruth Zuzovsky
Tel Aviv University
School of Education
Center for Science and Technology Education
Ramat Aviv 69978

Italy

Anna Maria Caputo
Ministerio della Pubblica Istruzione
Centro Europeo Dell 'Educazione (CEDE)
5- Villa Falconieri
Frascati (Roma)
00044

Japan

Yuji Saruta
Hanako Senuma
National Institute for Educational Research (NIER)
6-5-22 Shimomeguro
Meguro-ku, Tokyo
153-8681

Jordan

Tayseer Al-Nhar
National Center for Human Resources Development
P. O. Box 560
Amman, Jordan 11941

Korea, Republic of

Sungsook Kim
Chung Park
Korea Institute of Curriculum & Evaluation (KICE)
KICE
25-1 Samchung-dong
GhongRo-Gu, Seoul
110-230

Latvia

Andrejs Geske
University of Latvia
IEA National Research Center
Jurmalas Gatve 74/76, Rm. 204A
Riga
LV-1083

Lithuania

Algirdas Zabulionis
National Examinations Center
Ministry of Education and Science
M. Katkaus 44
Vilnius
LT2051

Malaysia

Azmi Zakaria
Ministry of Education
Level 2,3 & 5 Block J South
Pusat Bandar Damansara, Kuala Lumpur
50604

Macedonia, Republic of

Anica Aleksova
Ministry of Education and Science
Bureau for Development of Education
Ruder Boskovic St. bb.
1 000 Skopje

Moldova, Republic of

Ilie Nasu
Ministry of Education and Science
University "A. Russo"
Str. Puschin 38
Balti 3100

Lidia Costiuc
1 Piata Mazzi Adunazi Nationale
Chisinau

Morocco

Mohamed Fatihi
Direction de l'Evaluation du Systeme Educatif
INNOVATIONS PEDAGOGIQUES
32 Boulevard Ibn Toumert
Place Bob Rouah, Rabat

Netherlands

Klaas Bos
University of Twente
Centre for Applied Research in Education (OCTO)
P.O. Box 217
7500 AE Enschede

New Zealand

Megan Chamberlain
Ministry of Education
CER Unit-Research Division
45-47 Pipitea Street
Thorndon, Wellington

Philippines

Ester Ogena
DOST-Science Education Institute
3F PTRI Blg
Bicutan, Taguig
Metro Manila 1604

Vivien Talisayon
Institute Of Science & Mathematics Education Development
University of the Philippines UPISMED
Diliman, Quezon City

Romania

Gabriela Noveanu
Institute for Educational Sciences
Evaluation and Forecasting Division
Str. Stirbei Voda 37
Bucharest Ro-70732

Russian Federation

Galina Kovalyova
Center for Evaluating the Quality of Education
Institute of General Secondary Education
ul. Pogodinskaya 8
Moscow
119905

Singapore

Cheow Cher Wong
Research and Evaluation Branch
Ministry of Education
1 North Buona Vista Dr /MOE Building
Singapore, Singapore
138675

Slovak Republic

Olga Zelmanova
Maria Berova
SPU-National Institute for Education
Pluhova 8, P. O. Box 26
Brastislava
830 00

Slovenia

Barbara Japelj
Educational Research Institute Ljubljana
Gerbiceva 62
Ljubljana
1000

South Africa

Sarah Howie
Human Sciences Research Council
134 Pretorius Street
Private Bag X41
Pretoria
0001

Thailand

Precharn Dechsri
Institute For the Promotion of Teaching Science & Technology (IPST)
924 Sukhumvit Rd. Ekamai
Bangkok
10100

Tunisia

Ktari Mohsen
Ministere de l'Education
Boulevard Bab-Bnet
Tunis

Turkey

Yurdanur Atlioglu
Educational Research and Development Directorate
Gazi Mustafa Kemal Bulvani
No 109/5-6-7
Maltepe, Ankara
06570

USA

Patrick Gonzales
National Center for Education Statistics
U.S. Department of Education
1990 K St., NW Rm 9071
Washington, DC 20006

TIMSS 1999 ADVISORY COMMITTEES

The International Study Center at Boston College was supported in its work by advisory committees. The Subject Matter Item Replacement Committee was instrumental in developing the TIMSS 1999 tests, and the Questionnaire Item Review Committee revised the TIMSS questionnaires. The Scale Anchoring Panel developed the descriptions of the international benchmarks in mathematics and science.

Subject Matter Item Replacement Committee

Mathematics

Antoine Bodin, France
Anna-Maria Caputo, Italy
Nobert Delagrange, Belgium (Flemish)
Jan de Lange, Netherlands
Hee-Chan Lew, Republic of Korea
Mary Lindquist, United States
David Robitaille, Canada

Science

Hans Ernst Fischer, Germany
Galina Kovalyova, Russian Federation
Svein Lie, Norway
Masao Miyake, Japan
Graham Orpwood, Canada
Jana Strakova, Czech Republic
Carolyn Swain, England

Special Consultants

Chancey Jones, Mathematics
Christine O'Sullivan, Science

Questionnaire Item Review Committee

Im Hyung, Republic of Korea
Barbara Japelj, Slovenia
Trevor Williams, United States
Graham Ruddock, England
Klaas Bos, Netherlands

Scale Anchoring Committees

Mathematics

Anica Aleksova, Republic of Macedonia
Lillie Albert, United States
Kiril Bankov, Bulgaria
Jau-D Chen, Chinese Taipei
John Dossey, United States
Barbara Japelj, Slovenia
Mary Lindquist, United States
David Robitaille, Canada
Graham Ruddock, United Kingdom
Hanako Senuma, Japan
Pauline Vos, The Netherlands

Science

Audrey Champagne, United States
Galina Kovalyova, Russian Federation
Jan Lokan, Australia
Jana Paleckova, Czech Republic
Senta Raizen, United States
Vivien Talisayon, Philippines
Hong Kim Tan, Singapore

Typography
This book was set in ITC New Baskerville, designed by George W. Jones, and Frutiger, designed by Adrian Frutiger for Linotype-Hell, released by Adobe.

Cover Design
Christine Conley

Book Design and Illustrations
José R. Nieto

Layout and Production
Mario Pita

Production Assistants
Christina López
Betty Hugh
Nathan Pyritz
Sarah Enderlin