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

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

text continued page 190

Exhibit 6.1 Age and Gender of Teachers

	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.

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.

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.

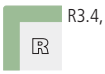


Exhibit 6.3 Index of Teachers' Confidence in Preparation to Teach Mathematics (CPTM)

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.

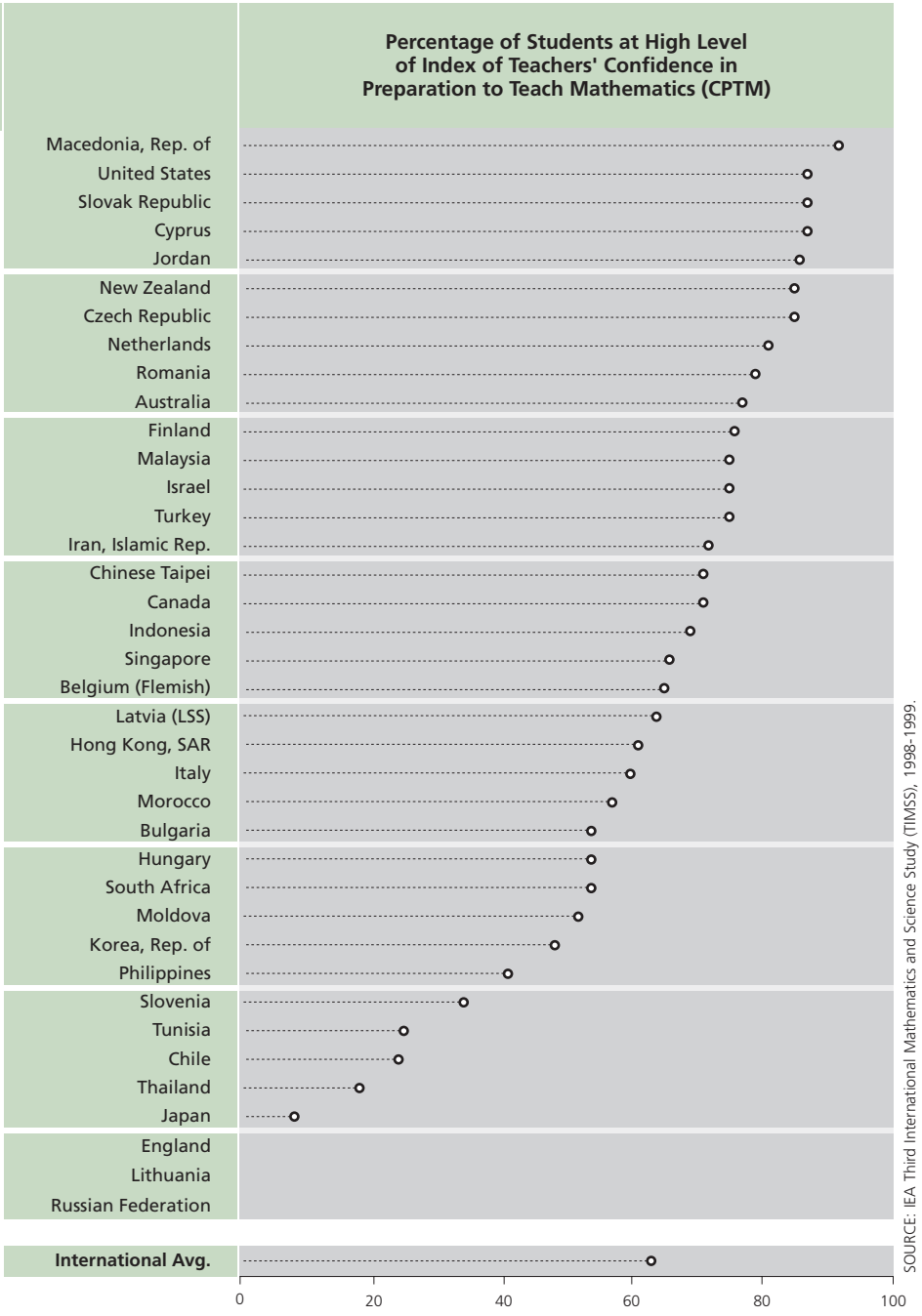
	High CPTM		Medium CPTM		Low CPTM	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Macedonia, Rep. of	92 (2.2)	447 (4.7)	8 (2.1)	435 (16.2)	1 (0.6)	~ ~
United States	87 (2.4)	505 (4.2)	11 (2.3)	489 (7.0)	2 (1.0)	~ ~
Slovak Republic	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 instruc-

enc1 Tf6.31545 0 TD-0.006.92277)Tj/F2 1 Tf0.5503 0 TD(.)Tj/

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

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

	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

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	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.

	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)

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?

6.8

Because it can affect pedagogical strategies, class size data are shown in Exhibit 6.8. Teachers' reports about the size of their eighth-grade mathematics class reveal that across countries the average class size was 31 students, 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 achievement is difficult to disentangle, given the variety of policies and practices and the fact that smaller classes can be used for both advanced and remedial 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.

Exhibit 6.10 presents a profile of the activities most commonly encountered in mathematics classes around the world, as reported by mathematics teachers. The two predominant activities, accounting for nearly half of class time on average, were teacher lecture (23 percent of class time) and teacher-guided student practice (22 percent). As shown in Exhibit 6.11, most students (86 percent on average internationally) agreed with teachers' reports, saying that their teachers frequently showed them how to do mathematics problems. According to 55 to 59 percent of the students, discussing homework and working independently on worksheets or textbooks were also frequent activities in class. Students also reported that use of the board was an extremely common presentational mode (see Exhibit 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 projector 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 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.

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.

R3.9

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-

6.14

R3.10

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 participted 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

TIMSS 1999 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

TIMSS 1999 8th grade Mathematics

	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.


Percentage of Students at High Level of Index of Teachers' Emphasis on Mathematics Reasoning and Problem-Solving (EMRPS)
Japan
Italy
Turkey
Malaysia
Romania
Macedonia, Rep. of
Philippines
Slovenia
Bulgaria
Czech Republic
Korea, Rep. of
Israel
United States
Slovak Republic
South Africa
Iran, Islamic Rep.
Hungary
Moldova
Chile
Jordan
Cyprus
Chinese Taipei
Canada
Netherlands
Russian Federation
Indonesia
Lithuania
Tunisia
Australia
Singapore
Morocco
Thailand
Hong Kong, SAR
Latvia (LSS)
New Zealand
Finland
England
Belgium (Flemish)
International Avg.
0
20
40
60
80
100
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)

TIMSS 1999 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

R3.13

Exhibit 6.15 Calculator Use in Mathematics Class*

TIMSS 1999 8th grade Mathematics

	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.

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) ●

▲ 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.

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.

	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			23 (2.3)	535 (6.0)	71 (3.0)	524 (5.7)
Belgium (Flemish)			5 (1.2)	536 (17.4)	93 (1.3)	562 (3.1)
Bulgaria			4 (0.5)	486 (12.3)	93 (0.8)	517 (5.9)
Canada			25 (1.5)	534 (3.8)	67 (1.6)	534 (2.5)
Chile			11 (0.9)	388 (7.7)	81 (1.6)	399 (4.5)
Chinese Taipei			21 (0.6)	564 (5.2)	66 (0.9)	601 (3.8)
Cyprus			13 (0.7)	459 (5.3)	81 (0.8)	485 (2.2)
Czech Republic			14 (2.4)	526 (8.4)	84 (2.6)	520 (3.8)
England			43 (2.2)	512 (5.1)	46 (2.7)	492 (5.2)
Finland			21 (2.2)	524 (4.4)	76 (2.7)	521 (3.1)
Hong Kong, SAR			18 (0.8)	577 (6.2)	75 (1.1)	587 (4.1)
Hungary			6 (1.0)	501 (11.3)	92 (1.2)	536 (3.6)
Indonesia			4 (0.4)	389 (16.2)	95 (0.5)	407 (4.6)
Iran, Islamic Rep.			4 (0.4)	413 (10.7)	96 (0.4)	426 (3.3)
Israel			19 (1.5)	470 (8.2)	67 (2.2)	479 (4.2)
Italy			17 (1.6)	489 (5.5)	72 (2.3)	482 (4.0)
Japan			21 (2.3)	576 (3.7)	76 (2.7)	581 (2.0)
Jordan r			12 (0.8)	406 (7.3)	75 (1.6)	454 (4.2)
Korea, Rep. of			13 (0.7)	596 (3.9)	83 (0.8)	587 (2.2)
Latvia (LSS)			3 (0.6)	475 (15.3)	95 (0.6)	507 (3.4)
Lithuania ‡			– –	– –	– –	– –
Macedonia, Rep. of			8 (0.5)	420 (8.8)	88 (0.8)	462 (3.7)
Malaysia			6 (0.4)	524 (8.2)	93 (0.4)	520 (4.3)
Moldova			16 (1.2)	461 (5.9)	73 (1.7)	480 (4.4)
Morocco s			10 (0.8)	336 (11.9)	84 (1.2)	350 (4.0)
Netherlands			19 (3.2)	543 (9.6)	80 (3.2)	541 (8.2)
New Zealand			21 (2.2)	517 (8.8)	73 (2.4)	491 (5.5)
Philippines			12 (0.7)	319 (11.3)	80 (1.3)	362 (5.8)
Romania			5 (0.4)	447 (13.0)	93 (0.5)	481 (5.4)
Russian Federation			3 (0.4)	513 (11.1)	97 (0.4)	530 (5.7)
Singapore				625 (6.8)	46 (2.7)	589 (6.1)
Slovak Republic				536 (10.2)	95 (1.0)	535 (3.9)
Slovenia				516 (6.5)	81 (1.4)	537 (2.5)
South Africa				– –	– –	– –
Thailand				471 (7.4)	85 (1.0)	470 (5.0)
Tunisia				440 (5.3)	90 (0.6)	451 (2.4)
Turkey				415 (11.2)	93 (0.6)	436 (4.3)
United States				520 (5.2)	61 (2.7)	506 (4.0)
International Avg.				488 (1.5)	80 (0.3)	498 (0.7)

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

	Almost Always or 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
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

	Percentage of Students				
	Have Access to the Internet			Use the Internet for Mathematics Projects at Least Once a Month	
	At Home		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.

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

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).

R3.17

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.

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.

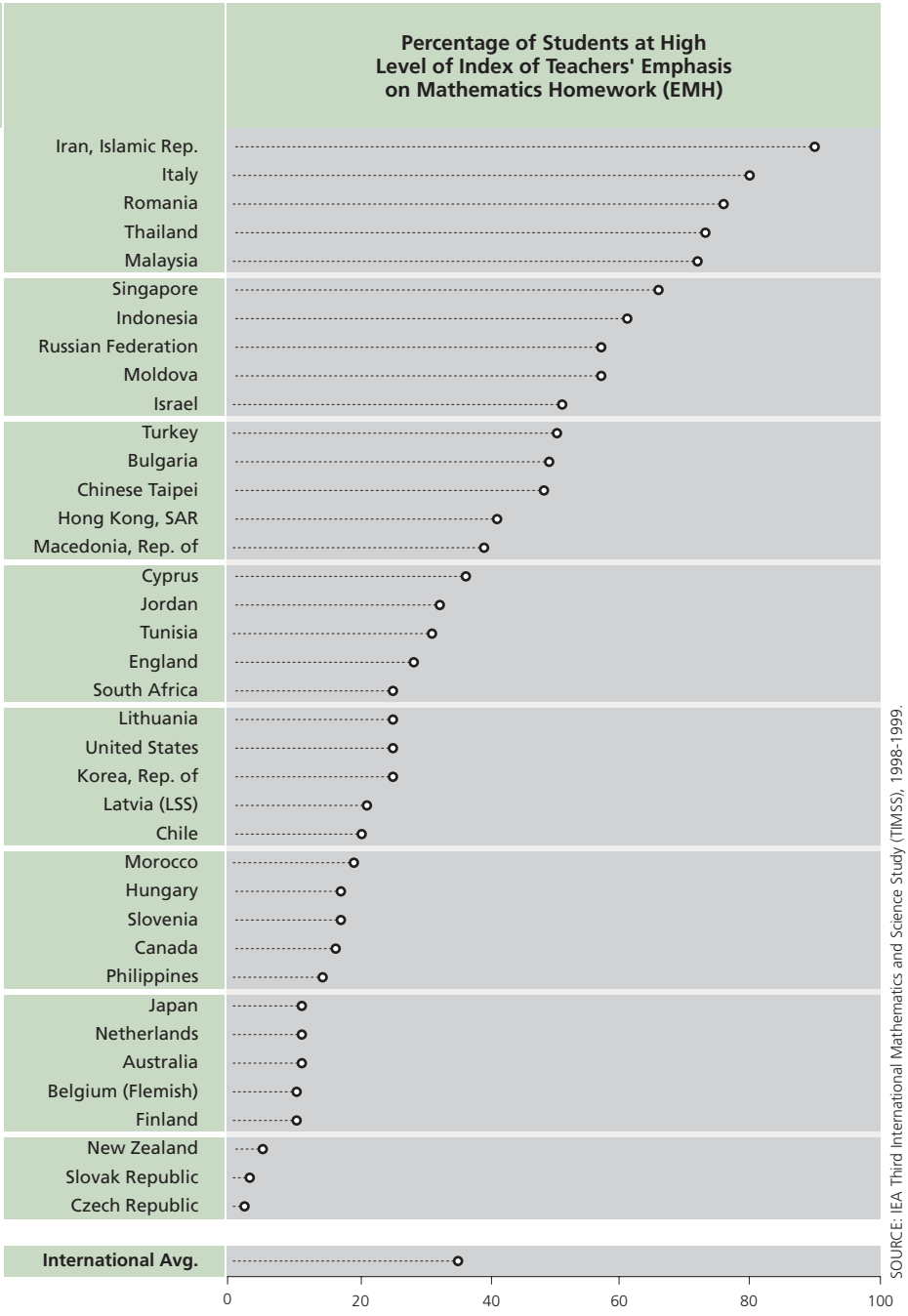
	High EMH		Medium EMH		Low EMH	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Iran, Islamic Rep.	90 (2.7)	421 (3.5)	10 (2.6)	435 (14.9)	1 (0.0)	~ ~
Italy	80 (3.0)	479 (4.9)	20 (2.9)	479 (7.9)	0 (0.0)	~ ~
Romania	76 (3.9)	471 (6.7)	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.