CHAPTER 4

4

Students' Backgrounds and Attitudes Towards Mathematics

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

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

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

What Educational Resources Do Students Have in Their Homes?

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

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

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

between high performance and home resources, there are clearly other influences at work also. For example, Singapore had about the same percentage of students (five percent) at the high level of the index as Romania and Malaysia, but the average mathematics achievement of its students was considerably higher than that of most participating countries, including Romania and Malaysia.

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

R1.1

R1.2

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

R1.3

R1.4

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

R1.5

R1.6

text continued page 120

Index of Home Educational Resources

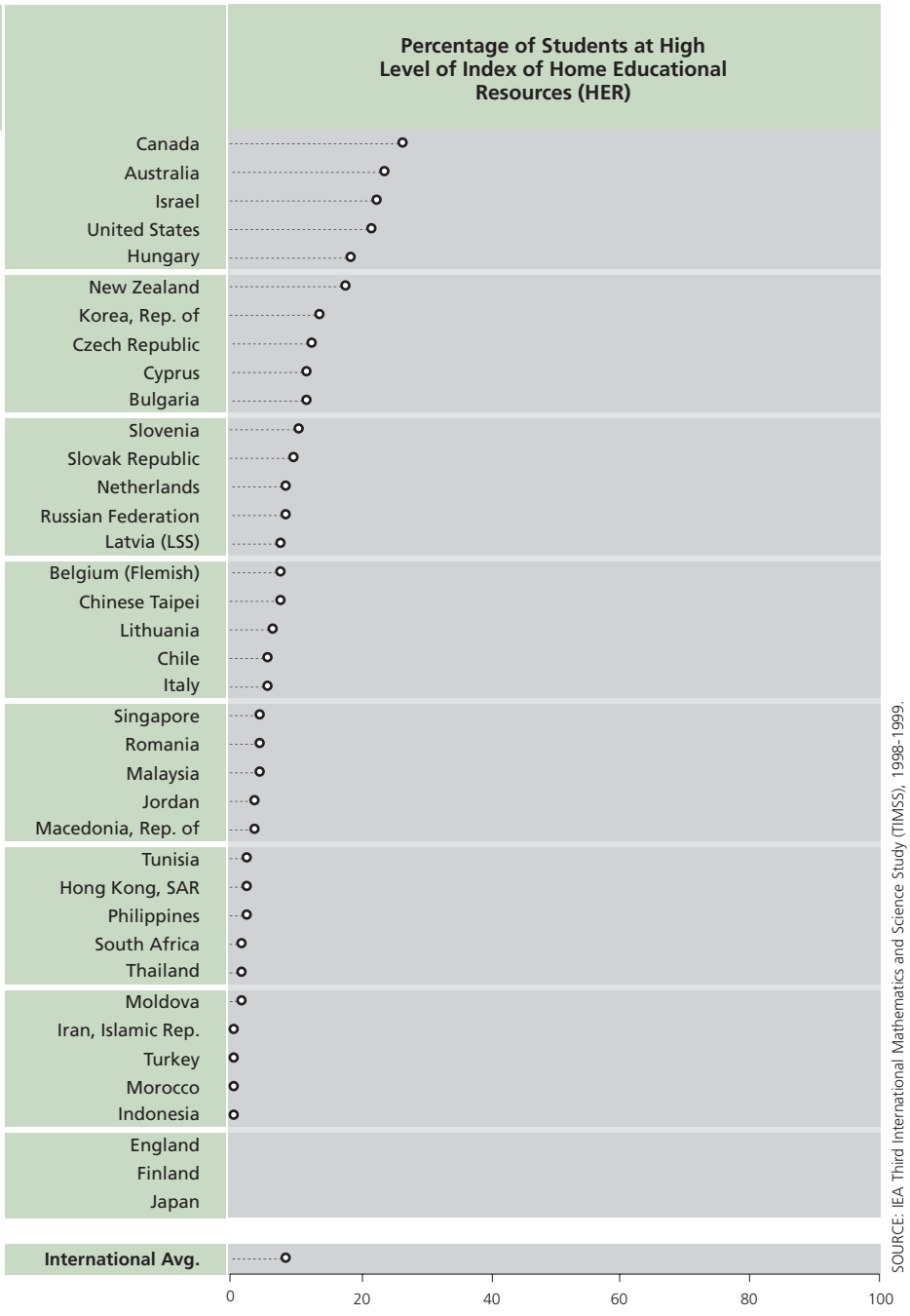
Index based on students' responses to three questions about home educational resources: number of books in the home; educational aids in the home (computer, study desk/table for own use, dictionary); parents' education (see reference exhibits R1.1, R1.3, R1.5). High level indicates more than 100 books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

	High HER		**Medium** HER		**Low** HER	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Canada	27 (1.0)	552 (4.1)	71 (1.0)	525 (2.2)	2 (0.2)	~ ~
Australia	24 (1.5)	557 (5.1)	72 (1.4)	517 (4.9)	3 (0.4)	466 (12.5)
Israel	23 (1.2)	514 (4.8)	72 (1.1)	461 (3.5)	5 (0.6)	387 (10.0)
United States	22 (1.5)	555 (5.1)	73 (1.4)	492 (3.1)	4 (0.5)	427 (6.4)
Hungary	19 (1.2)	588 (5.3)	75 (1.2)	525 (3.1)	5 (0.7)	427 (7.9)
New Zealand	18 (1.2)	546 (6.5)	76 (1.1)	484 (4.8)	6 (0.5)	418 (9.3)
Korea, Rep. of	14 (0.8)	637 (2.8)	80 (0.8)	583 (1.9)	5 (0.3)	513 (5.0)
Czech Republic	13 (0.8)	560 (6.8)	83 (0.8)	517 (3.9)	4 (0.5)	460 (11.3)
Cyprus	12 (0.7)	526 (4.5)	81 (0.8)	476 (1.6)	8 (0.5)	415 (7.1)
Bulgaria	12 (1.7)	571 (12.9)	82 (1.5)	507 (4.7)	7 (0.8)	455 (9.8)
Slovenia	11 (0.8)	588 (5.8)	84 (0.8)	527 (2.6)	5 (0.5)	470 (8.8)
Slovak Republic	10 (0.9)	586 (6.8)	86 (0.9)	531 (3.7)	4 (0.5)	463 (8.0)
Netherlands	9 (1.1)	575 (10.4)	89 (1.1)	538 (7.1)	2 (0.8)	~ ~
Russian Federation	9 (0.8)	560 (8.3)	86 (0.7)	527 (5.9)	6 (0.5)	474 (12.6)
Latvia (LSS)	8 (0.7)	552 (7.2)	88 (0.8)	504 (3.4)	4 (0.5)	428 (7.9)
Belgium (Flemish)	8 (0.7)	599 (6.5)	86 (1.3)	559 (3.9)	6 (1.3)	490 (11.7)
Chinese Taipei						

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

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

A dash (–) indicates data are not available. A tilde (~) indicates insufficient data to achievement.



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

continued from page 117

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

4.2

4.3

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

4.4

R1.7 – R1.9

Exhibits R1.7 to R1.9 in the reference section present eighth-grade students' reports about how they themselves, their mothers, and their friends feel about the importance of doing well in various academic and non-academic activities. On average, more than 90 percent of the students reported that they and their mothers agreed that it was important to do well in mathematics, science, and language. Somewhat fewer reported that their

friends agreed it was important to do well in these three subjects (77 to 86 percent). As might be anticipated, slightly more students reported that they and their friends felt it was important to have fun (92 percent) than reported that their mothers found this important (85 percent). More moderate agreement was reported for the importance of doing well in sports (from 81 to 87 percent). Students also were asked why they needed to do well in mathematics (see Exhibit R1.10). Although a motivating factor for 71 percent of the students on average internationally, pleasing their parents was secondary to getting into their desired secondary school or university (87 percent) or getting their desired job (81 percent).

R1.10

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

						Average Achievement
					.3)	~ ~
					(0.9)	522 (13.5)
					1 (0.3)	~ ~
					2 (0.2)	~ ~
					1 (0.1)	~ ~
					2 (0.2)	~ ~
					2 (0.3)	~ ~
					1 (0.2)	~ ~
				12.1)	0 (0.1)	~ ~
				(15.6)	1 (0.2)	~ ~
				600 (8.5)	3 (0.5)	609 (12.2)
				~ ~	1 (0.1)	~ ~
				397 (5.0)	9 (0.8)	428 (10.6)
				405 (4.2)	15 (1.6)	408 (5.0)
Israel	85 (1.2)			455 (10.0)	2 (0.3)	~ ~
Italy	77 (1.1)	493 (3.5)	20 (1		4 (0.5)	442 (11.8)
Japan	97 (0.3)	581 (1.8)	3			
Jordan	85 (0.9)	433 (3.9)				
Korea, Rep. of	96 (0.3)	589 (2.0)				
Latvia (LSS)	92 (1.2)	506 (3.6)				
Lithuania ‡	99 (0.3)	482 (4.5)				
Macedonia, Rep. of s	93 (1.5)	470 (4.6)				
Malaysia	61 (2.3)	503 (4.4				
Moldova	89 (1.2)	473 (				
Morocco	20 (1.0)	32				
Netherlands	86 (2.4)					
New Zealand	90 (0.9)					
Philippines	11 (1.6)					
Romania	92 (2.4)					
Russian Federation	94 (2.3)					
Singapore	27 (1					
Slovak Republic	87					
Slovenia						
South Africa						
Thailand						
Tunisia						
Turkey						
United Stat						
Internationa						

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

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

TIMSS 1999 8th grade Mathematics

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

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

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

Background data provided by students.

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

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

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

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

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

A dash (–) indicates data are not available.

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

	Finish University[1]		Some Vocational/ Technical Education or University Only[2]		Finish Secondary School Only[3]		Some Secondary School Only		Do Not Know	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Australia	55 (1.8)	554 (5.0)	14 (0.7)	524 (5.0)	17 (1.0)	479 (7.1)	5 (0.5)	460 (7.0)	9 (0.7)	501 (7.5)
Belgium (Flemish)	26 (1.1)	605 (6.4)	30 (0.9)	563 (3.8)	16 (0.9)	509 (4.5)	0 (0.0)	~ ~	29 (1.0)	544 (2.9)
Bulgaria	60 (2.9)	538 (7.2)	8 (0.6)	473 (6.8)	22 (2.2)	467 (6.1)	1 (0.2)	~ ~	9 (0.9)	477 (8.9)
Canada	76 (0.9)	539 (2.6)	13 (0.6)	522 (4.7)	4 (0.3)	482 (7.7)	1 (0.1)	~ ~	7 (0.6)	497 (6.0)
Chile r	54 (1.6)	428 (6.0)	18 (0.8)	367 (5.4)	19 (1.0)	347 (5.2)	2 (0.2)	~ ~	7 (0.5)	359 (6.7)
Chinese Taipei	62 (1.4)	624 (3.7)	24 (1.0)	527 (3.0)	2 (0.3)	~ ~	0 (0.1)	~ ~	11 (0.6)	534 (7.2)
Cyprus	51 (1.0)	515 (2.3)	14 (0.7)	455 (3.9)	13 (0.6)	431 (4.8)	6 (0.5)	372 (8.4)	16 (0.9)	460 (5.2)
Czech Republic	38 (1.8)	564 (4.1)	5 (0.6)	542 (7.1)	39 (1.5)	496 (3.3)	8 (1.0)	452 (7.1)	10 (0.8)	493 (7.6)
England	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –
Finland	10 (0.8)	564 (5.8)	22 (1.0)	541 (3.2)	41 (1.2)	503 (3.4)	3 (0.4)	481 (7.9)	24 (0.8)	519 (4.8)
Hong Kong, SAR	63 (1.7)	601 (3.8)	20 (0.9)	562 (4.9)	10 (0.8)	529 (7.7)	1 (0.2)	~ ~	6 (0.4)	562 (6.8)
Hungary	56 (1.8)	575 (3.7)	0 (0.0)	~ ~	39 (1.7)	482 (4.0)	1 (0.2)	~ ~	4 (0.4)	511 (9.5)
Indonesia	39 (1.8)	435 (5.7)	30 (1.1)	401 (5.3)	12 (0.9)	381 (6.1)	5 (0.5)	336 (9.2)	13 (1.0)	373 (8.4)
Iran, Islamic Rep.	48 (1.7)	444 (4.6)	6 (0.4)	415 (9.6)	6 (0.5)	377 (8.8)	4 (0.5)	378 (8.7)	36 (1.2)	411 (4.0)
Israel	59 (1.0)	492 (4.2)	16 (0.6)	457 (7.0)	11 (0.7)	419 (6.2)	1 (0.2)	~ ~	13 (0.7)	438 (7.5)
Italy	33 (1.3)	517 (4.1)	19 (0.9)	487 (4.4)	31 (1.1)	463 (4.0)	7 (0.6)	396 (10.4)	9 (0.7)	461 (8.7)
Japan	38 (0.9)	614 (2.7)	18 (0.6)	564 (2.6)	18 (0.7)	532 (3.0)	1 (0.1)	~ ~	25 (0.7)	572 (3.1)
Jordan	60 (1.1)	461 (3.9)	11 (0.6)	376 (6.1)	5 (0.5)	365 (7.8)	3 (0.3)	372 (12.6)	21 (0.8)	407 (4.8)
Korea, Rep. of	77 (0.7)	605 (1.9)	8 (0.4)	521 (4.2)	4 (0.3)	500 (6.3)	0 (0.1)	~ ~	11 (0.5)	551 (4.3)
Latvia (LSS)										

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

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

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

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

4.5

On average internationally, and in most of the countries, students at the low level of the index also had lower mathematics achievement, on average, than their classmates who reported more out-of-school study time. However, spending a lot of time studying was not usually associated with higher achievement. On average internationally and in many countries, students at the medium level of the study index had average achievement that was as high as or higher than that of students at the

high level. This pattern suggests that, compared with their higher-achieving counterparts, the lower-performing students may do less homework, either because they simply do not do it or because their teachers do not assign it, or more homework, perhaps in an effort to keep up academically.

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

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

Further detail on the student data that underlie the index of out-of-school study time is provided in Exhibit R1.11 in the reference section. On average, in comparison with the 1.1 hours each day students spent on mathematics homework, they reported 12(11)TJ/F2 1 Tf1.3976 0 TD0.026 T[illegible]

Index of Out-of-School Study Time

Index based on students' responses to three questions about out-of-school study time: time spent after school studying mathematics or doing mathematics homework; time spent after school studying science or doing science homework; time spent after school studying or doing homework in school subjects other than mathematics and science (see reference exhibit R1.11). Number of hours based on: no time = 0, less than 1

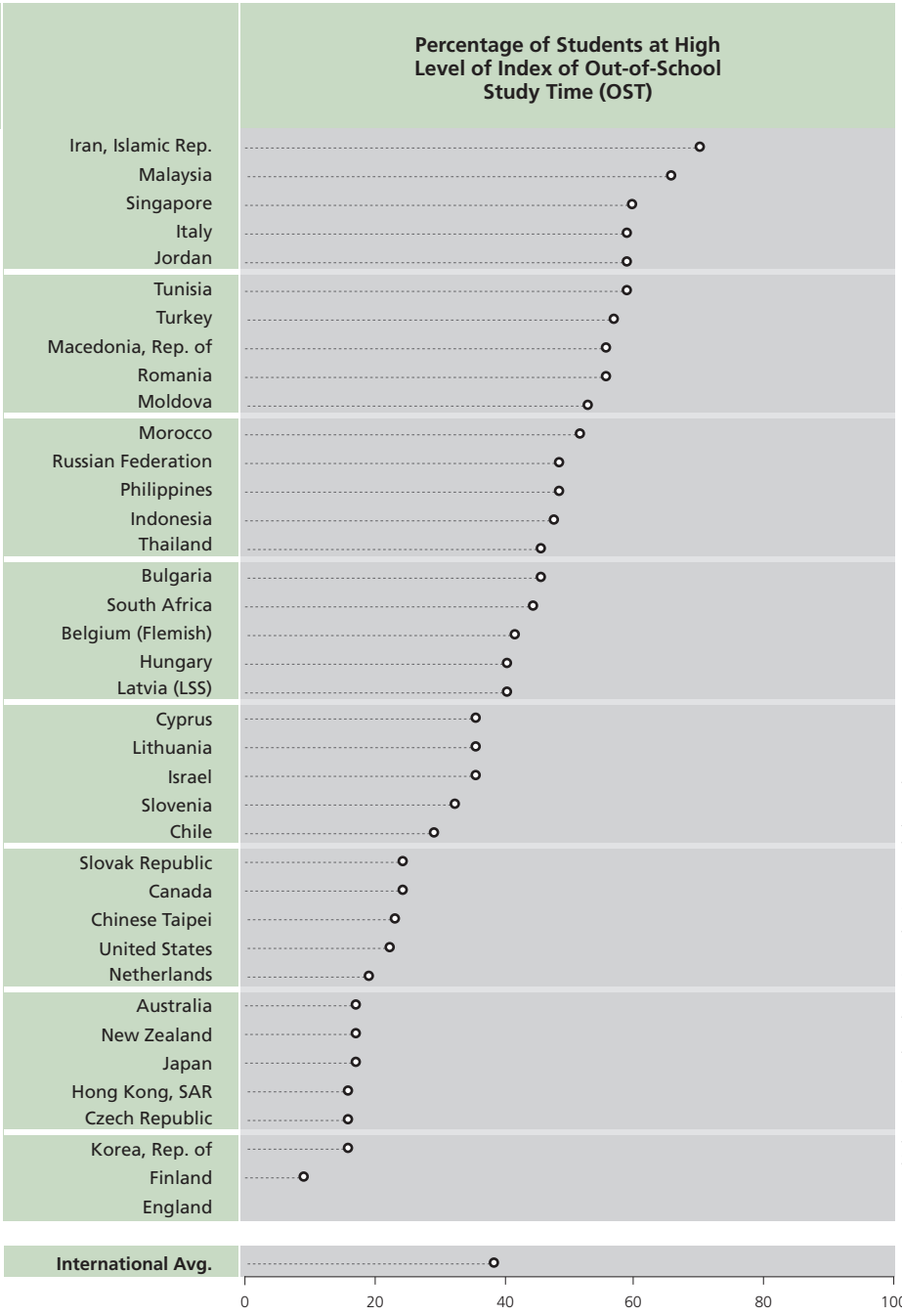
			Medium OST		**Low** OST	

‡ 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.



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

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

TIMSS 1999 8th grade Mathematics

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

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

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

Background data provided by students.

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

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

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

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

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

A dash (–) indicates data are not available.

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

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

How Do Students Perceive Their Ability in Mathematics?

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

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

Students who disagreed or strongly disagreed with all five statements were assigned to the high level of the index, while students who agreed or strongly agreed with all five were assigned to the low level. The medium level includes all other possible combinations of responses. (As an example of one of the components of the index, Exhibit R1.14 in the refer-

ematics curricula pose a greater challenge to students. Internationally on average, about 15 percent of the eighth-grade students seem to be convinced that they just cannot do mathematics. They may think they can be good with numbers or with words, but not both. Mathematics to them may seem dry and unimportant to daily life.

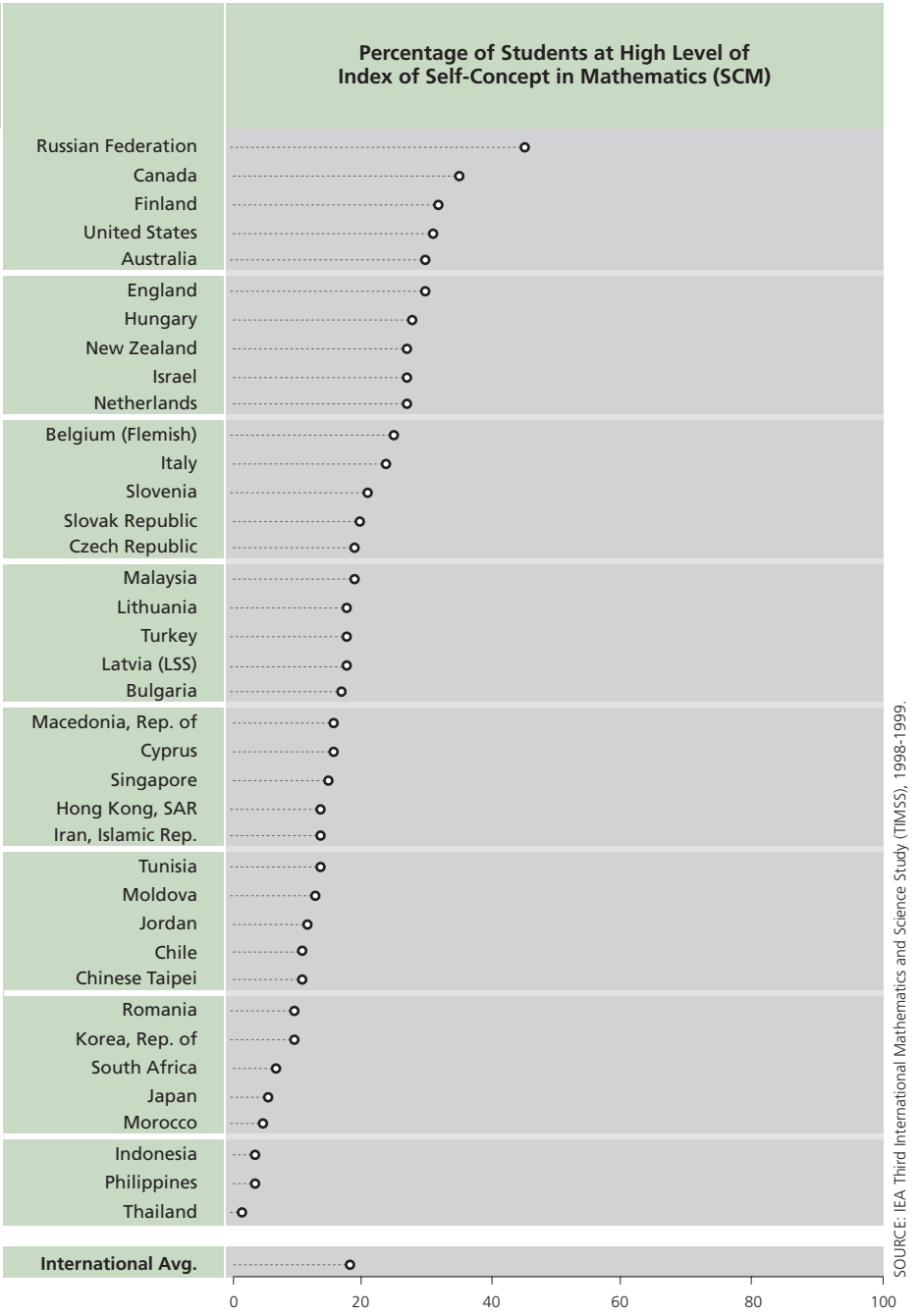
Exhibit 4.9 presents the percentages of girls and of boys in each country at the high, medium, and low levels of the mathematics self-concept index. Even though the gender differences in TIMSS mathematics achievement were negligible at the eighth grade in both 1995 and 1999, there was a modest but statistically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

4.9

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

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

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



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

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

TIMSS 1999 8th grade Mathematics

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

▲ Significantly higher than other gender

Significance tests adjusted for multiple comparisons

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

Background data provided by students.

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

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

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

What Are Students' Attitudes Towards Mathematics?

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

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

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

4.10

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

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

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

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

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

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

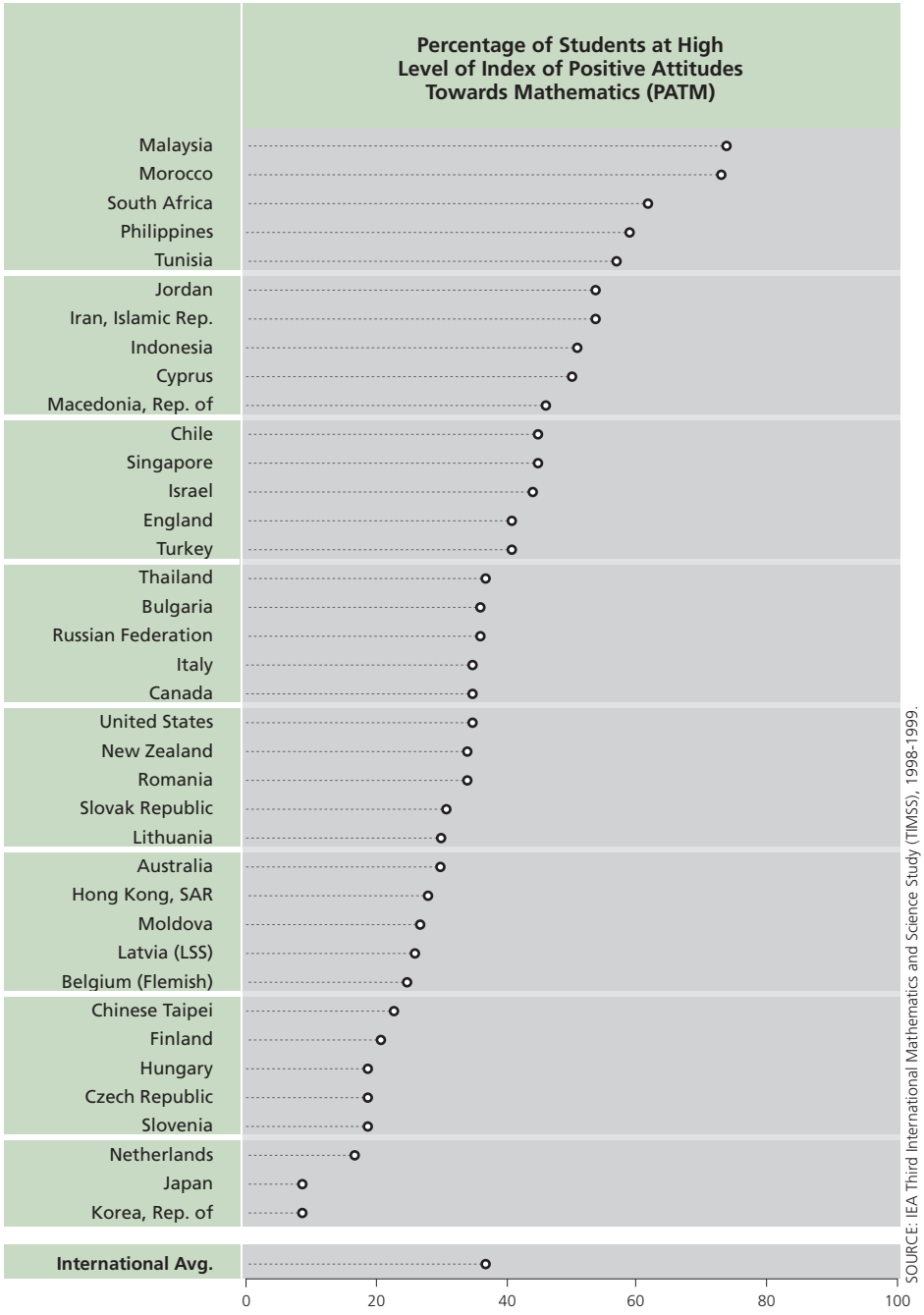
Exhibit 4.12 provides information on trends in the index of positive attitudes towards mathematics from 1995 to 1999. There was little change overall or among the countries. Australia and Lithuania had increased

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

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

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

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



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

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

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

▲ Significantly higher than other gender

Significance tests adjusted for multiple comparisons

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

Background data provided by students.

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

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

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

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

TIMSS 1999 8th grade Mathematics

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

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

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

Background data provided by students.

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

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

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

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

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

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

TIMSS 1999 8th grade Mathematics

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

▲ Significantly higher than other gender

Significance tests adjusted for multiple comparisons

Increased ⬈
Decreased ⬊
No change ⇔

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

Background data provided by students.

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

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

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

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

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

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