

CHAPTER 4

4

Students' Backgrounds and Attitudes Towards Science

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 science, and their attitudes towards science. Also provided is information on changes in results between 1995 and 1999.





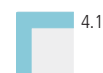
To provide an educational context for interpreting the science achievement results, TIMSS collected detailed information from students about their home backgrounds, how they spend their time out of school, and their attitudes towards science. This chapter presents eighth-grade students' responses to 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 science and their feelings towards science.

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 science 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 science 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 data² 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 science 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).

Exhibit 4.1 summarizes the home educational resources index in a two-page display. The index is described on the first page. Students assigned to the high level of this index reported coming from homes with more than 100 books, with all three study aids (a computer, a study desk or table for the student's own use, and a dictionary), and where at least one



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



parent finished university. Students assigned to the low level had 25 or fewer books in the home, not all three study aids, and parents that had not completed secondary education. The remaining students were assigned to the medium level.

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

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

The educational significance of this wide divergence becomes apparent when achievement differences between the levels of the index are considered. There was a substantial difference in the average science achievement of students at the three index levels in every country for which data were available. This is reflected in the international average, where the achievement difference between students at the high level (558) and the low level (431) amounted to 127 score points.

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

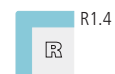
More detailed information on the student responses that were combined in the home educational resources index is presented in Exhibits R1.1



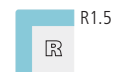
through R1.5 in the reference section. Exhibit R1.1 shows the percentage of eighth-grade students in each country that had a dictionary, study desk or table, or computer, and shows that students reporting having all three had higher average science achievement than those without all three. The changes 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).



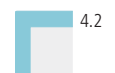
Exhibit R1.3 shows for each country the percentage of students at each of five ranges of numbers of books in the home in relation to average science achievement; changes in these results are shown in Exhibit R1.4. In most countries, the more books students reported in the home, the higher their science 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.



The percentages of students in each of five categories of parents' educational level are shown in Exhibit R1.5, together with their average science 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' science achievement. The pattern across countries was that eighth-grade students whose parents had more education were also those who had higher achievement in science.



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 science 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



text continued
page 122



Exhibit 4.1 Index of Home Educational Resources (HER)

Index of Home Educational Resources

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

	High HER		Medium HER		Low HER	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Canada	27 (1.0)	559 (3.8)	71 (1.0)	526 (2.1)	2 (0.2)	~ ~
Australia	24 (1.5)	577 (4.7)	72 (1.4)	532 (4.4)	3 (0.4)	472 (12.9)
Israel	23 (1.2)	521 (5.4)	72 (1.1)	462 (4.4)	5 (0.6)	380 (12.4)
United States	22 (1.5)	573 (3.8)	73 (1.4)	506 (4.2)	4 (0.5)	420 (7.3)
Hungary	19 (1.2)	600 (4.9)	75 (1.2)	547 (3.6)	5 (0.7)	463 (10.7)
New Zealand	18 (1.2)	567 (5.9)	76 (1.1)	503 (4.5)	6 (0.5)	422 (11.2)
Korea, Rep. of	14 (0.8)	600 (4.0)	80 (0.8)	544 (2.6)	5 (0.3)	475 (6.4)
Czech Republic	13 (0.8)	587 (5.6)	83 (0.8)	535 (4.2)	4 (0.5)	479 (10.5)
Cyprus	12 (0.7)	506 (4.5)	81 (0.8)	460 (2.7)	8 (0.5)	399 (6.0)
Bulgaria	12 (1.7)	570 (10.6)	82 (1.5)	516 (4.4)	7 (0.8)	450 (8.8)
Slovenia	11 (0.8)	585 (7.9)	84 (0.8)	531 (3.1)	5 (0.5)	482 (8.0)
Slovak Republic	10 (0.9)	579 (8.3)	86 (0.9)	533 (3.0)	4 (0.5)	464 (11.1)
Netherlands	9 (1.1)	581 (8.7)	89 (1.1)	543 (6.7)	2 (0.8)	~ ~
Russian Federation	9 (0.8)	564 (8.4)	86 (0.7)	530 (6.3)	6 (0.5)	475 (14.8)
Latvia (LSS)	8 (0.7)	545 (8.0)	88 (0.8)	501 (4.8)	4 (0.5)	444 (12.8)
Belgium (Flemish)	8 (0.7)	571 (7.0)	86 (1.3)	536 (3.3)	6 (1.3)	483 (9.1)
Chinese Taipei	8 (0.7)	639 (5.8)	84 (0.7)	569 (4.2)	8 (0.6)	505 (7.1)
Lithuania [†]	7 (0.8)	555 (12.0)	83 (1.1)	488 (3.7)	10 (1.0)	437 (9.3)
Chile	6 (0.9)	502 (10.3)	56 (1.3)	438 (3.6)	38 (1.6)	382 (3.5)
Italy	6 (0.6)	546 (9.4)	81 (0.8)	498 (3.7)	14 (0.8)	446 (6.4)
Singapore	5 (0.7)	650 (10.2)	87 (0.6)	569 (7.6)	8 (0.7)	494 (10.5)
Romania	5 (0.7)	541 (7.2)	73 (1.6)	481 (5.4)	22 (1.7)	435 (7.9)
Malaysia	5 (0.6)	573 (9.0)	71 (0.9)	499 (4.6)	25 (1.1)	458 (4.6)
Jordan	4 (0.4)	526 (10.0)	71 (1.0)	462 (3.6)	25 (1.1)	416 (5.3)
Macedonia, Rep. of	4 (0.5)	531 (8.3)	73 (1.4)	477 (4.7)	23 (1.6)	397 (8.7)
Tunisia	3 (0.5)	464 (10.7)	59 (1.3)	434 (3.8)	38 (1.5)	420 (3.5)
Hong Kong, SAR	3 (0.3)	558 (9.6)	78 (0.8)	533 (3.7)	19 (0.9)	515 (4.5)
Philippines	3 (0.5)	446 (28.0)	67 (1.1)	356 (8.0)	30 (1.2)	314 (8.4)
South Africa	2 (0.4)	~ ~	54 (1.7)	269 (9.6)	44 (1.8)	203 (5.1)
Thailand	2 (0.3)	~ ~	47 (1.4)	496 (4.5)	51 (1.4)	468 (4.2)
Moldova	2 (0.4)	~ ~	80 (1.3)	466 (4.1)	18 (1.3)	432 (7.7)
Iran, Islamic Rep.	1 (0.4)	~ ~	45 (1.7)	468 (3.8)	54 (1.9)	431 (3.9)
Turkey	1 (0.2)	~ ~	51 (1.5)	447 (4.6)	48 (1.5)	417 (4.6)
Morocco	1 (0.2)	~ ~	36 (1.5)	339 (6.2)	63 (1.6)	319 (3.6)
Indonesia	1 (0.2)	~ ~	56 (1.6)	446 (4.4)	44 (1.7)	422 (5.2)
England	--	--	--	--	--	--
Finland	--	--	--	--	--	--
Japan	--	--	--	--	--	--
International Avg.	9 (0.1)	558 (2.0)	72 (0.2)	487 (0.8)	19 (0.2)	431 (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.

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

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





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.

4.3

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.

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 science 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 science, mathematics, 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 science (see Exhibit R1.10). In general, getting into their desired secondary school or university was a stronger motivating factor than was pleasing their parents or getting their desired job.

R1.10

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

	Always or Almost Always		Sometimes		Never	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Australia	89 (1.2)	547 (4.6)	10 (1.1)	506 (10.1)	1 (0.3)	~ ~
Belgium (Flemish)	86 (1.3)	542 (2.8)	8 (0.7)	504 (10.7)	6 (0.9)	496 (18.1)
Bulgaria	88 (1.9)	526 (5.6)	11 (1.7)	468 (13.1)	1 (0.3)	~ ~
Canada	91 (0.6)	537 (2.3)	8 (0.5)	494 (7.4)	2 (0.2)	~ ~
Chile ^r	94 (0.5)	423 (4.5)	6 (0.5)	368 (9.3)	1 (0.1)	~ ~
Chinese Taipei	67 (1.4)	587 (4.8)	31 (1.3)	535 (5.5)	2 (0.2)	~ ~
Cyprus	89 (1.1)	465 (3.2)	9 (1.0)	450 (8.2)	2 (0.3)	~ ~
Czech Republic	98 (0.5)	541 (4.4)	1 (0.3)	~ ~	1 (0.2)	~ ~
England	95 (0.9)	544 (4.8)	5 (0.8)	487 (13.6)	0 (0.1)	~ ~
Finland	97 (0.7)	540 (3.3)	3 (0.7)	483 (24.5)	1 (0.2)	~ ~
Hong Kong, SAR ^r	80 (2.4)	523 (4.2)	17 (1.9)	536 (8.8)	3 (0.5)	551 (11.5)
Hungary ^r	99 (0.2)	557 (4.1)	0 (0.2)	~ ~	1 (0.1)	~ ~
Indonesia	28 (2.5)	438 (8.1)	63 (2.3)	432 (4.6)	9 (0.8)	456 (9.8)
Iran, Islamic Rep.	59 (3.4)	462 (3.7)	26 (2.1)	426 (7.0)	15 (1.6)	430 (8.2)
Israel	85 (1.2)	474 (4.4)	13 (1.1)	453 (10.4)	2 (0.3)	~ ~
Italy	77 (1.1)	506 (3.9)	20 (1.0)	448 (6.1)	4 (0.5)	468 (12.9)
Japan	97 (0.3)	552 (2.2)	3 (0.3)	511 (13.5)	0 (0.1)	~ ~
Jordan	85 (0.9)	457 (3.7)	13 (0.8)	436 (6.2)	2 (0.3)	~ ~
Korea, Rep. of	96 (0.3)	551 (2.6)	4 (0.3)	504 (8.6)	0 (0.0)	~ ~
Latvia (LSS)	92 (1.2)	503 (4.9)	6 (0.8)	489 (13.2)	2 (0.6)	~ ~
Lithuania [†]	99 (0.3)	490 (4.3)	1 (0.3)	~ ~	0 (0.1)	~ ~
Macedonia, Rep. of ^s	93 (1.5)	482 (5.3)	5 (0.9)	451 (13.1)	2 (0.8)	~ ~
Malaysia	61 (2.3)	483 (4.5)	30 (1.7)	504 (6.9)	10 (1.0)	515 (9.2)
Moldova	89 (1.2)	462 (4.6)	10 (1.1)	441 (12.9)	1 (0.3)	~ ~
Morocco	20 (1.0)	305 (8.5)	51 (1.6)	334 (6.1)	30 (1.6)	322 (7.6)
Netherlands	86 (2.4)	550 (6.9)	8 (1.2)	509 (14.8)	6 (1.8)	536 (11.7)
New Zealand	90 (0.9)	517 (4.6)	9 (0.7)	456 (9.9)	1 (0.3)	~ ~
Philippines	11 (1.6)	322 (8.9)	70 (1.5)	357 (8.6)	19 (0.9)	327 (11.3)
Romania	92 (2.4)	475 (5.9)	5 (1.5)	460 (18.6)	3 (0.9)	475 (21.4)
Russian Federation	94 (2.3)	530 (6.2)	5 (2.3)	541 (47.0)	1 (0.2)	~ ~
Singapore	27 (1.8)	612 (8.4)	63 (1.6)	553 (8.2)	10 (0.5)	548 (11.2)
Slovak Republic	87 (1.9)	540 (3.3)	9 (1.4)	504 (7.5)	3 (0.7)	493 (17.2)
Slovenia	91 (1.0)	540 (3.3)	7 (0.7)	489 (8.8)	2 (0.4)	~ ~
South Africa	23 (2.2)	368 (14.9)	53 (1.6)	222 (5.8)	24 (1.8)	177 (5.4)
Thailand	72 (2.4)	489 (4.4)	25 (2.1)	466 (5.5)	3 (0.4)	446 (10.1)
Tunisia	88 (1.5)	431 (3.6)	8 (1.0)	418 (6.1)	4 (0.7)	436 (15.1)
Turkey	92 (1.4)	438 (3.9)	7 (1.3)	394 (10.4)	1 (0.2)	~ ~
United States	90 (1.0)	524 (4.3)	9 (1.0)	456 (7.4)	1 (0.1)	~ ~
International Avg.	79 (0.3)	496 (0.8)	17 (0.2)	459 (3.0)	5 (0.1)	445 (3.8)

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

Background data provided by students.

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

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

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

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

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

	Always or Almost Always		Sometimes		Never	
	Percent of Students 1999	1995-1999 Difference	Percent of Students 1999	1995-1999 Difference	Percent of Students 1999	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 (0.3) ●	3 (0.1)	0 (0.2) ●

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

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

Background data provided by students.

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

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

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

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

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

A dash (–) indicates data are not available.

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

Exhibit 4.4

Students' Expectations for Finishing School*

	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)	568 (4.6)	14 (0.7)	539 (5.5)	17 (1.0)	497 (6.9)	5 (0.5)	483 (11.2)	9 (0.7)	516 (9.3)
Belgium (Flemish)	26 (1.1)	569 (4.1)	30 (0.9)	542 (4.1)	16 (0.9)	501 (4.5)	0 (0.0)	~ ~	29 (1.0)	520 (3.5)
Bulgaria	60 (2.9)	544 (6.3)	8 (0.6)	493 (8.6)	22 (2.2)	477 (5.8)	1 (0.2)	~ ~	9 (0.9)	480 (9.2)
Canada	76 (0.9)	541 (2.0)	13 (0.6)	521 (5.7)	4 (0.3)	493 (10.8)	1 (0.1)	~ ~	7 (0.6)	498 (7.1)
Chile	54 (1.6)	454 (4.9)	18 (0.8)	399 (4.3)	19 (1.0)	372 (4.9)	2 (0.2)	~ ~	7 (0.5)	390 (11.8)
Chinese Taipei	62 (1.4)	601 (3.9)	24 (1.0)	523 (4.2)	2 (0.3)	~ ~	0 (0.1)	~ ~	11 (0.6)	528 (6.8)
Cyprus	51 (1.0)	498 (2.6)	14 (0.7)	444 (4.7)	13 (0.6)	417 (6.2)	6 (0.5)	366 (12.0)	16 (0.9)	433 (7.4)
Czech Republic	38 (1.8)	580 (4.2)	5 (0.6)	557 (10.0)	39 (1.5)	517 (4.8)	8 (1.0)	475 (9.0)	10 (0.8)	518 (6.7)
England	--	--	--	--	--	--	--	--	--	--
Finland	10 (0.8)	587 (8.3)	22 (1.0)	558 (6.4)	41 (1.2)	518 (3.8)	3 (0.4)	491 (9.9)	24 (0.8)	530 (4.9)
Hong Kong, SAR	63 (1.7)	547 (3.3)	20 (0.9)	512 (6.1)	10 (0.8)	479 (8.1)	1 (0.2)	~ ~	6 (0.4)	511 (9.3)
Hungary	56 (1.8)	590 (3.3)	0 (0.0)	~ ~	39 (1.7)	508 (5.0)	1 (0.2)	~ ~	4 (0.4)	536 (11.2)
Indonesia	39 (1.8)	460 (4.3)	30 (1.1)	436 (5.2)	12 (0.9)	420 (8.3)	5 (0.5)	378 (9.8)	13 (1.0)	408 (9.6)
Iran, Islamic Rep.	48 (1.7)	469 (5.5)	6 (0.4)	437 (11.1)	6 (0.5)	421 (10.8)	4 (0.5)	421 (10.1)	36 (1.2)	434 (5.2)
Israel	59 (1.0)	497 (5.0)	16 (0.6)	456 (6.3)	11 (0.7)	421 (9.6)	1 (0.2)	~ ~	13 (0.7)	435 (10.1)
Italy	33 (1.3)	531 (6.1)	19 (0.9)	504 (8.0)	31 (1.1)	477 (4.5)	7 (0.6)	403 (8.6)	9 (0.7)	472 (9.5)
Japan	38 (0.9)	579 (3.6)	18 (0.6)	540 (2.8)	18 (0.7)	512 (5.2)	1 (0.1)	~ ~	25 (0.7)	544 (3.6)
Jordan	60 (1.1)	483 (3.3)	11 (0.6)	403 (9.1)	5 (0.5)	394 (10.6)	3 (0.3)	369 (13.3)	21 (0.8)	434 (7.8)
Korea, Rep. of	77 (0.7)	565 (2.7)	8 (0.4)	486 (4.1)	4 (0.3)	472 (9.2)	0 (0.1)	~ ~	11 (0.5)	510 (6.6)
Latvia (LSS)	65 (1.5)	521 (5.4)	13 (0.9)	476 (5.7)	8 (0.7)	475 (7.9)	1 (0.1)	~ ~	13 (1.0)	463 (7.5)
Lithuania †	45 (2.1)	527 (4.6)	25 (1.2)	468 (6.7)	6 (0.6)	441 (9.7)	2 (0.3)	~ ~	23 (1.2)	454 (8.5)
Macedonia, Rep. of	53 (1.8)	502 (4.3)	11 (0.7)	462 (9.6)	17 (1.1)	429 (5.6)	8 (0.6)	390 (9.2)	11 (0.9)	397 (10.4)
Malaysia	65 (1.4)	505 (4.7)	18 (0.9)	472 (6.1)	4 (0.4)	452 (11.8)	2 (0.2)	~ ~	11 (0.8)	480 (8.1)
Moldova	45 (1.7)	481 (4.6)	20 (1.1)	458 (5.3)	9 (0.8)	442 (8.5)	4 (0.6)	427 (13.4)	22 (1.2)	435 (7.8)
Morocco	43 (0.9)	349 (6.3)	22 (0.9)	308 (6.9)	6 (0.4)	314 (13.2)	6 (0.7)	285 (16.5)	23 (0.7)	322 (7.4)
Netherlands	22 (2.8)	583 (9.2)	30 (1.8)	557 (5.3)	29 (2.6)	511 (9.3)	1 (0.2)	~ ~	18 (0.9)	537 (7.6)
New Zealand	52 (1.5)	536 (5.7)	16 (0.7)	507 (4.6)	16 (0.8)	473 (6.9)	3 (0.3)	450 (14.5)	13 (0.7)	473 (8.5)
Philippines	64 (2.0)	382 (7.9)	10 (0.6)	294 (9.9)	9 (0.6)	271 (11.1)	8 (0.8)	273 (10.3)	8 (0.7)	309 (8.8)
Romania	43 (2.0)	515 (6.0)	10 (0.6)	447 (8.4)	25 (1.3)	456 (7.2)	4 (0.8)	461 (18.7)	19 (1.3)	422 (7.1)
Russian Federation	61 (1.5)	547 (6.0)	19 (1.0)	518 (6.7)	7 (0.5)	493 (11.3)	2 (0.5)	~ ~	11 (0.7)	496 (9.2)
Singapore	57 (2.1)	597 (7.3)	26 (1.6)	529 (7.7)	2 (0.3)	~ ~	0 (0.0)	~ ~	15 (0.7)	544 (11.1)
Slovak Republic	46 (2.3)	568 (3.6)	11 (0.8)	539 (7.0)	33 (1.6)	500 (4.2)	2 (0.3)	~ ~	8 (0.7)	507 (7.9)
Slovenia	40 (1.0)	576 (3.6)	32 (0.9)	514 (4.0)	18 (0.7)	501 (6.5)	4 (0.4)	454 (7.3)	6 (0.5)	510 (8.4)
South Africa	55 (1.4)	268 (10.3)	18 (0.9)	226 (11.6)	10 (0.6)	215 (12.3)	9 (0.7)	194 (11.8)	8 (0.6)	215 (9.7)
Thailand	55 (1.6)	502 (4.5)	4 (0.3)	486 (13.0)	23 (1.2)	461 (5.3)	5 (0.5)	440 (10.6)	13 (0.9)	455 (9.4)
Tunisia	59 (1.0)	434 (3.5)	23 (0.7)	423 (9.4)	6 (0.4)	414 (7.9)	2 (0.2)	~ ~	10 (0.5)	431 (8.4)
Turkey	62 (1.3)	452 (4.3)	15 (0.8)	410 (8.2)	8 (0.5)	398 (8.4)	4 (0.4)	380 (16.9)	12 (0.5)	409 (4.4)
United States	78 (1.2)	530 (4.2)	9 (0.6)	484 (6.5)	5 (0.4)	447 (7.3)	1 (0.1)	~ ~	7 (0.5)	484 (7.1)
International Avg.	52 (0.3)	515 (0.9)	17 (0.1)	470 (1.2)	15 (0.2)	445 (1.4)	3 (0.1)	397 (3.8)	14 (0.1)	461 (1.2)

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

Background data provided by students.

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

¹ In most countries, finish university is defined as completion of at least a 4-year degree program at a university or an equivalent institute of higher education.² In some countries, may include higher post-secondary education levels.³ In most countries, finish secondary school corresponds to completion of an upper-secondary track terminating after 11 to 13 years of schooling (ISCED level 3 vocational, apprenticeship or academic tracks).

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

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

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

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

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

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

To summarize the amount of time typically devoted to homework in each country, TIMSS constructed an index of out-of-school study time (OST) that assigns students to a high, medium, or low level on the basis of the amount of time they reported studying science, mathematics, 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.

4.5



Exhibit 4.5 presents the percentages of students at the various levels of this index across countries, and their average science 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.

On average internationally, and in all countries, students at the low level of the index also had lower average science achievement 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-per-

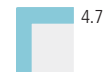


forming students may do less homework, either because they simply do not do it or because their teachers do not assign it, or more homework, perhaps in an effort to keep up academically.



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 science homework is presented in Exhibit 4.7. The results reveal that students spend one hour per day doing science 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 science or doing science homework on a normal school day, together with their average science achievement. Almost 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. On average, 36 percent of students reported spending more than one hour per day doing science homework. Countries where more than half of the students reported spending an hour or more included Iran, Jordan, Macedonia, Malaysia, Moldova, Morocco, the Philippines, the Russian Federation, Singapore, and Turkey. The countries where students reported the least science homework included Australia, Canada, Chinese Taipei, Hong Kong, Japan, Korea, and the United States. In these countries, one-fifth or more (20 to 45 percent) of students reported spending no time on science homework, and the average amount of time was about half an hour each 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 one hour each day spent on science homework, they reported 2.8 hours of homework in total. Exhibit R1.12 shows essentially no change on average internationally in the amount of homework reported by students from 1995 to 1999. To provide a fuller picture of how students spend their out-of-school time on a school day, Exhibit R1.13, also in the reference section, gives students' reports on how they spend their daily leisure time. The two most popular activities are watching television or videos and playing or talking with friends (each about two hours per day).



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

Index of Out-of-School Study Time

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

		High OST		Medium OST		Low OST	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Iran, Islamic Rep.	r	69 (1.1)	457 (4.6)	27 (0.9)	448 (5.5)	4 (0.4)	426 (13.5)
Malaysia		65 (1.2)	495 (4.6)	31 (1.0)	495 (6.0)	3 (0.3)	465 (11.8)
Singapore		59 (1.2)	573 (7.2)	35 (0.9)	571 (9.8)	7 (0.6)	514 (13.3)
Italy		58 (1.3)	504 (4.4)	36 (1.2)	497 (5.0)	6 (0.6)	419 (8.6)
Jordan	s	58 (1.2)	475 (4.4)	33 (0.9)	465 (6.2)	8 (0.7)	396 (12.6)
Tunisia	r	58 (0.9)	432 (3.2)	34 (0.8)	439 (5.5)	8 (0.6)	432 (7.5)
Turkey	r	56 (1.3)	444 (4.1)	39 (1.0)	433 (4.5)	6 (0.5)	408 (13.0)
Macedonia, Rep. of	r	55 (1.3)	475 (5.5)	39 (1.1)	471 (5.0)	6 (0.5)	445 (9.7)
Romania	r	55 (1.6)	488 (5.3)	33 (1.1)	467 (7.2)	12 (1.0)	444 (9.2)
Moldova	r	52 (1.3)	469 (4.3)	38 (1.1)	468 (5.8)	10 (0.8)	441 (8.5)
Morocco	s	51 (1.5)	338 (4.5)	34 (1.1)	330 (4.4)	15 (0.8)	327 (11.1)
Russian Federation		48 (1.3)	541 (6.3)	46 (1.2)	536 (7.0)	6 (0.6)	493 (9.7)
Philippines	s	48 (0.9)	364 (8.2)	45 (0.9)	375 (8.7)	7 (0.5)	329 (11.0)
Indonesia		47 (1.4)	441 (5.3)	43 (1.0)	442 (4.5)	11 (0.8)	428 (8.4)
Thailand		45 (1.2)	494 (4.7)	47 (1.0)	479 (4.7)	8 (0.5)	448 (5.6)
Bulgaria		45 (1.5)	533 (6.1)	40 (1.0)	525 (5.7)	15 (1.2)	494 (8.7)
South Africa	s	44 (1.3)	260 (9.8)	41 (0.7)	273 (11.3)	15 (1.1)	217 (13.7)
Belgium (Flemish)		41 (1.3)	529 (3.0)	52 (1.1)	545 (3.6)	7 (1.0)	514 (14.4)
Hungary		40 (1.3)	554 (3.8)	52 (1.1)	560 (3.9)	8 (0.6)	516 (9.2)
Latvia (LSS)		40 (1.2)	498 (5.3)	54 (1.2)	512 (5.3)	6 (0.5)	484 (11.2)
Cyprus		35 (1.1)	465 (4.6)	51 (1.1)	475 (3.4)	14 (0.7)	413 (8.3)
Lithuania [†]		35 (1.2)	495 (4.8)	57 (1.2)	493 (4.7)	8 (0.8)	451 (8.2)
Israel		35 (1.5)	462 (5.5)	53 (1.2)	489 (4.2)	12 (0.8)	465 (8.7)
Slovenia		32 (1.0)	522 (4.5)	55 (0.9)	544 (3.5)	13 (0.8)	532 (7.0)
Chile		29 (0.9)	424 (4.6)	51 (0.7)	432 (4.5)	20 (0.8)	416 (4.9)
Slovak Republic		24 (0.9)	526 (4.6)	65 (1.1)	541 (3.5)	10 (0.7)	536 (6.9)
Canada		24 (0.8)	519 (3.3)	59 (1.0)	542 (2.3)	18 (0.8)	531 (4.6)
Chinese Taipei		23 (1.0)	604 (4.0)	42 (0.8)	581 (4.5)	35 (1.3)	533 (5.7)
United States		22 (0.8)	520 (5.1)	56 (0.9)	531 (4.2)	23 (1.3)	492 (6.5)
Netherlands		19 (1.4)	519 (12.8)	74 (1.3)	553 (6.9)	7 (1.0)	543 (11.4)
Australia		17 (0.9)	539 (5.9)	61 (1.4)	554 (4.2)	22 (1.4)	511 (5.9)
New Zealand		17 (1.0)	501 (7.3)	63 (1.3)	531 (4.7)	20 (1.2)	470 (6.4)
Japan		17 (0.9)	558 (5.9)	49 (0.9)	558 (2.7)	35 (1.3)	535 (3.7)
Hong Kong, SAR		16 (0.8)	545 (6.0)	42 (0.9)	541 (3.5)	42 (1.4)	513 (4.5)
Czech Republic		16 (1.1)	522 (5.3)	62 (1.4)	547 (4.6)	22 (1.3)	537 (6.3)
Korea, Rep. of		16 (0.7)	574 (4.6)	43 (0.7)	561 (3.7)	41 (1.0)	527 (2.9)
Finland		9 (0.7)	516 (8.3)	82 (1.0)	541 (3.5)	9 (0.8)	520 (9.2)
England		--	--	--	--	--	--
International Avg.		38 (0.2)	491 (1.0)	48 (0.2)	496 (0.9)	14 (0.1)	464 (1.3)

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.

A dash (–) indicates data are not available.

() 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. An "s" indicates a 50-69% student response rate.

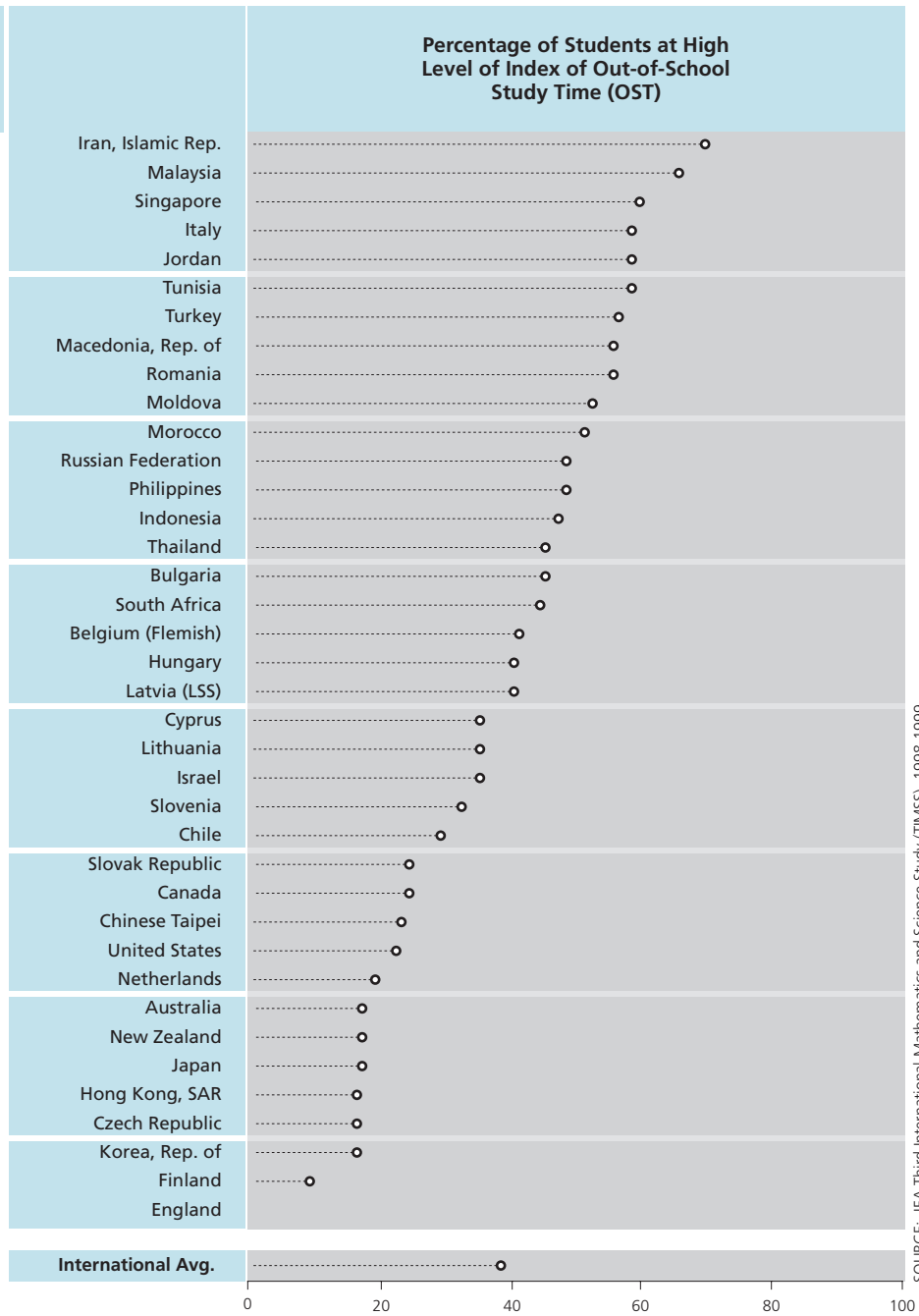


Exhibit 4.6 Trends in Index of Out-of-School Study Time (OST)

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

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

▲	1999 significantly higher than 1995
●	No significant difference between 1995 and 1999
▼	1999 significantly lower than 1995
Significance tests adjusted for multiple comparisons	

Background data provided by students.

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

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

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

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

A dash (–) indicates data are not available.

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

Exhibit 4.7

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

TIMSS¹⁹⁹⁹
8th grade
Science

	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	14 (0.8)	533 (6.9)	65 (1.4)	553 (4.4)	21 (1.4)	510 (6.6)	0.6 (0.02)
Belgium (Flemish)	31 (1.4)	520 (3.7)	55 (1.2)	543 (3.9)	14 (1.1)	538 (8.8)	0.8 (0.03)
Bulgaria	45 (1.5)	528 (7.0)	38 (1.2)	523 (6.7)	17 (1.6)	505 (8.7)	1.1 (0.03)
Canada	18 (0.7)	515 (4.4)	62 (0.9)	541 (2.3)	20 (1.0)	525 (4.1)	0.6 (0.01)
Chile	30 (1.0)	417 (5.4)	53 (0.8)	431 (4.7)	17 (0.7)	415 (4.9)	0.9 (0.02)
Chinese Taipei	20 (0.9)	607 (4.7)	42 (0.9)	588 (4.4)	38 (1.3)	530 (5.7)	0.6 (0.02)
Cyprus	25 (1.0)	461 (5.0)	57 (0.9)	474 (3.1)	18 (0.7)	425 (6.6)	0.7 (0.02)
Czech Republic	20 (1.1)	530 (5.0)	62 (1.2)	546 (4.5)	18 (1.1)	529 (7.0)	0.6 (0.02)
England	--	--	--	--	--	--	--
Finland	8 (0.6)	511 (10.8)	84 (0.9)	541 (3.5)	8 (0.8)	514 (9.7)	0.5 (0.01)
Hong Kong, SAR	13 (0.6)	539 (6.6)	48 (1.0)	543 (4.0)	39 (1.3)	513 (4.2)	0.5 (0.01)
Hungary	45 (1.3)	554 (4.0)	49 (1.2)	558 (4.0)	6 (0.6)	505 (8.6)	1.1 (0.02)
Indonesia	47 (1.1)	435 (5.9)	40 (0.9)	442 (4.9)	13 (0.8)	432 (6.7)	1.1 (0.02)
Iran, Islamic Rep.	68 (1.1)	451 (4.6)	29 (1.0)	453 (4.1)	3 (0.3)	432 (16.0)	1.6 (0.03)
Israel	23 (1.1)	450 (6.5)	60 (1.1)	487 (4.6)	17 (0.8)	449 (7.8)	0.8 (0.02)
Italy	45 (1.4)	498 (4.3)	48 (1.4)	501 (4.3)	7 (0.7)	435 (8.6)	1.0 (0.02)
Japan	12 (0.7)	555 (7.5)	50 (1.2)	560 (2.3)	39 (1.4)	535 (3.2)	0.4 (0.01)
Jordan	56 (1.1)	465 (3.7)	37 (1.0)	466 (5.0)	7 (0.5)	396 (9.2)	1.5 (0.03)
Korea, Rep. of	13 (0.6)	578 (4.6)	42 (0.7)	564 (3.1)	45 (0.8)	527 (2.9)	0.4 (0.01)
Latvia (LSS)	25 (1.0)	496 (6.3)	66 (1.0)	509 (5.4)	9 (0.6)	480 (9.9)	0.8 (0.02)
Lithuania [‡]	25 (1.2)	494 (4.9)	66 (1.2)	493 (4.8)	10 (0.9)	456 (8.2)	0.8 (0.02)
Macedonia, Rep. of	72 (1.2)	470 (5.3)	25 (1.0)	453 (5.9)	3 (0.3)	428 (15.3)	2.0 (0.05)
Malaysia	60 (1.2)	495 (4.9)	36 (1.1)	493 (5.1)	4 (0.3)	460 (10.6)	1.3 (0.02)
Moldova	63 (1.2)	467 (4.2)	29 (1.0)	460 (5.8)	7 (0.6)	439 (10.8)	1.7 (0.04)
Morocco ^r	51 (1.7)	335 (6.4)	35 (1.2)	330 (4.9)	14 (0.8)	323 (12.4)	1.5 (0.06)
Netherlands	15 (1.3)	507 (12.9)	80 (1.5)	555 (6.4)	6 (0.8)	530 (11.6)	0.6 (0.02)
New Zealand	15 (1.0)	491 (7.7)	66 (1.2)	528 (4.8)	18 (1.1)	472 (6.8)	0.6 (0.02)
Philippines	54 (0.9)	348 (7.7)	41 (0.8)	365 (9.7)	5 (0.4)	294 (14.4)	1.7 (0.04)
Romania	48 (1.3)	484 (5.6)	36 (1.0)	479 (7.8)	16 (0.9)	451 (8.4)	1.2 (0.03)
Russian Federation	61 (1.3)	536 (6.4)	34 (1.3)	534 (7.1)	5 (0.4)	494 (8.4)	1.5 (0.03)
Singapore	55 (1.2)	573 (7.1)	38 (1.1)	573 (9.9)	7 (0.6)	507 (13.2)	1.2 (0.02)
Slovak Republic	25 (1.2)	532 (4.8)	67 (1.2)	539 (3.7)	8 (0.7)	521 (7.5)	0.8 (0.02)
Slovenia	38 (1.1)	521 (4.2)	52 (1.1)	546 (3.7)	10 (0.8)	526 (6.7)	0.9 (0.02)
South Africa	47 (1.3)	237 (8.7)	39 (1.1)	269 (11.1)	15 (1.8)	211 (14.0)	1.5 (0.05)
Thailand	42 (1.2)	493 (5.2)	50 (1.1)	480 (4.8)	8 (0.5)	455 (4.8)	1.0 (0.02)
Tunisia	48 (1.0)	425 (2.8)	39 (0.9)	434 (5.3)	13 (0.8)	438 (8.2)	1.2 (0.03)
Turkey	51 (1.2)	444 (4.4)	44 (0.9)	433 (4.0)	6 (0.5)	409 (12.9)	1.2 (0.02)
United States	16 (0.8)	502 (5.9)	60 (1.3)	532 (4.6)	24 (1.4)	495 (6.4)	0.6 (0.01)
International Avg.	36 (0.2)	486 (1.0)	49 (0.2)	495 (1.0)	14 (0.2)	462 (1.2)	1.0 (0.00)

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

Background data provided by students.

¹ Average hours based on: No time=0; less than 1 hour=5; 1-2 hours=1.5; 3-5 hours=4; more than 5 hours=7.[‡] Lithuania tested the same cohort of students as other countries, but later in 1999, at the beginning of the next school year.

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

A dash (–) indicates data are not available.

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

How Do Students Perceive Their Ability in the Sciences?

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

- I would like science much more if it were not so difficult
- Although I do my best, science 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 science
- Science is not one of my strengths.

In countries where the sciences are taught as separate subjects, students were asked about each subject separately.

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

R1.14



4.8



The percentages of eighth-grade students at each level of this index, and their average science achievement, are presented in Exhibit 4.8. This four-page display summarizes the data in one panel for the countries that teach science as a single subject, and in separate panels for earth science, biology, physics, and chemistry for countries that teach the sciences separately. On average internationally, 26 percent of students in the single-science countries had a high self-concept in the sciences. The percentages ranged from a high of 45 percent in the United States to a low of eight percent in Indonesia and the Philippines. Although there was a clear positive association between self-concept and science achievement internationally and in every country, at the country level the relationship was more complex. Several countries with high average science achievement, including Singapore, Japan, Hong Kong, Chinese Taipei, and Korea, had relatively low percentages (21 percent or less) of students in the high self-concept category. Since all of these are Asian Pacific countries, they may share cultural traditions that encourage a modest self-concept.

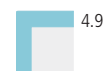
In countries teaching the sciences as separate subjects, the percentage of students at the high level of the science self-concept index was greatest for biology and earth science, with more than 40 percent of students in the high category on average for these subjects. The percentage was lower for



physics (32 percent on average) and chemistry (28 percent). Generally, countries with high percentages of students in the high category for one subject had high percentages in the other subjects also. The largest percentages of students in the high category were in the Russian Federation and the Netherlands in all subjects.³ The smallest percentages were in Romania and Morocco for earth science and biology, and in Romania and Lithuania for physics and chemistry. The positive association between science self-concept and science achievement that was found for science as a single subject was also evident in each of the science subject areas.

Results of analyses of the 1995 TIMSS data by gender⁴ reveal not only that boys outperformed girls in science at the eighth grade in many countries, but that they attached more importance to doing well in science and mathematics compared with language, and to doing well in science in order to get a good job. It is not surprising, therefore, to find differences in science self-concept between boys and girls in many countries.

Exhibit 4.9 presents the percentages of girls and of boys in each country at the high, medium, and low levels of the science self-concept index. Among countries teaching science as a single subject, there was a slightly greater percentage of boys at the high level and girls at the low level on average across countries. This overall difference was largely the result of relatively large gender differences in fewer than half of the single-science countries, including Australia, Chinese Taipei, England, Hong Kong, Japan, Korea, New Zealand, Singapore, and the United States.



Gender differences in science self-concept were both more pronounced and more differentiated for the separate science subjects. In biology, a greater percentage of girls than boys, on average, was found at the high level of the index. Countries with significantly greater percentages of girls reporting a high level of self-concept in biology included the Czech Republic, Hungary, Latvia (LSS), Macedonia, Romania, the Russian Federation, and Slovenia. In contrast, greater percentages of boys reported high levels of self-concept in physics, and to a lesser extent in earth science and chemistry. In all of the separate-subject countries except Belgium (Flemish), Bulgaria, Macedonia, Moldova, Morocco, and the Russian Federation, the percentages of boys with high self-concept in physics were significantly greater than the percentages of girls, often substantially so. In earth science, significantly greater percentages of boys with high self-concept were found in Finland and the Netherlands, and significantly greater percentages of girls in Macedonia and Romania. Significantly greater percentages of boys with high self-concept in chemistry were found in Finland, Hungary, and Latvia (LSS).

³ Physics and chemistry are taught as one subject in the Netherlands. Student responses are reported in the physics panel of Exhibit 4.8.

⁴ Mullis, I.V.S., Martin, M.O., Fierros, E.G., Goldberg, A.L., and Stemler, S.E. (2000). *Gender Differences in Achievement: IEA's Third International Mathematics and Science Study*, Chestnut Hill, MA: Boston College.

Exhibit 4.8 Index of Students' Self-Concept in the Sciences (SCS)

Index of Students' Self-Concept in the Sciences

Index based on students' responses to four statements about their science ability:

1) I would like science much more if it were not so difficult; 2) although I do my best, science is more difficult for me than for many of my classmates; 3) nobody can be good in every subject, and I am just not talented in science; 4) science is not one of my strengths. In countries where science is taught as separate subjects, students were asked about each subject area separately.

High level indicates student disagrees or strongly disagrees with all four statements. Low level indicates student agrees or strongly agrees with all four statements. Medium level includes all other possible combinations of responses.

G

	High SCS		Medium SCS		Low SCS	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
General/Integrated Science (SCS-G)						
United States	45 (1.2)	550 (4.5)	40 (0.8)	505 (4.4)	15 (0.7)	459 (6.2)
England	42 (1.3)	573 (5.8)	45 (1.2)	528 (4.6)	13 (0.8)	486 (8.6)
Israel	40 (1.1)	515 (3.5)	47 (0.9)	457 (5.5)	13 (0.8)	399 (10.5)
Italy	38 (1.3)	523 (3.6)	49 (1.1)	487 (4.4)	12 (0.7)	441 (6.3)
Canada	38 (0.8)	562 (2.5)	45 (0.7)	526 (2.9)	17 (0.6)	490 (4.7)
Australia	37 (1.2)	581 (4.4)	45 (1.0)	531 (4.8)	19 (1.0)	486 (5.3)
Tunisia	36 (0.9)	445 (4.5)	55 (0.8)	424 (3.2)	9 (0.5)	408 (5.0)
Iran, Islamic Rep.	35 (1.1)	478 (3.6)	53 (1.0)	443 (4.0)	12 (0.7)	398 (6.3)
Turkey	33 (1.0)	461 (5.4)	48 (0.7)	431 (4.2)	19 (0.7)	410 (5.7)
New Zealand	32 (1.2)	553 (5.4)	49 (1.1)	502 (4.4)	19 (0.8)	467 (6.5)
Chile	27 (1.0)	461 (5.3)	51 (0.9)	420 (4.0)	22 (0.9)	381 (6.0)
Jordan	25 (1.0)	513 (3.7)	53 (0.9)	451 (3.7)	21 (0.8)	413 (5.3)
Cyprus	23 (1.0)	511 (3.5)	55 (1.1)	460 (3.5)	22 (0.9)	412 (4.0)
Malaysia	23 (1.0)	524 (5.7)	69 (1.0)	486 (4.4)	8 (0.6)	461 (6.9)
Singapore	21 (1.1)	616 (8.9)	59 (0.8)	562 (7.8)	19 (0.9)	533 (8.7)
Japan	21 (0.6)	592 (4.1)	63 (0.6)	543 (2.3)	16 (0.6)	521 (4.4)
Hong Kong, SAR	20 (0.8)	556 (4.2)	58 (0.7)	532 (3.4)	22 (0.8)	504 (5.9)
Chinese Taipei ^a	14 (0.6)	617 (5.1)	61 (0.8)	572 (4.9)	25 (0.8)	538 (4.0)
South Africa	12 (1.1)	358 (19.2)	58 (0.9)	243 (7.5)	30 (1.1)	202 (6.2)
Thailand	12 (0.6)	512 (6.0)	53 (0.9)	488 (4.5)	35 (1.0)	466 (4.7)
Korea, Rep. of	12 (0.5)	601 (5.0)	80 (0.6)	547 (2.6)	8 (0.4)	490 (4.5)
Indonesia ^b	8 (0.6)	465 (6.3)	73 (0.7)	438 (4.5)	19 (0.8)	416 (5.2)
Philippines	8 (0.6)	424 (11.5)	67 (0.9)	354 (7.6)	25 (0.9)	319 (8.5)
International Avg.	26 (0.2)	521 (1.4)	56 (0.2)	475 (1.0)	18 (0.2)	439 (1.3)
Earth Science (SCS-E)						
Russian Federation	68 (1.2)	545 (6.4)	22 (0.9)	519 (7.2)	10 (0.6)	488 (8.1)
Netherlands	50 (1.7)	555 (7.3)	43 (1.4)	538 (8.3)	7 (0.6)	527 (9.8)
Slovak Republic	49 (1.7)	551 (4.9)	39 (1.2)	531 (3.9)	12 (0.9)	495 (8.3)
Czech Republic	48 (1.5)	552 (4.8)	43 (1.2)	533 (4.6)	9 (0.7)	506 (8.2)
Macedonia, Rep. of	48 (1.5)	501 (4.4)	39 (1.2)	444 (5.3)	13 (0.9)	390 (10.0)
Finland	47 (1.4)	555 (3.9)	36 (1.0)	530 (3.9)	16 (1.1)	495 (7.6)
Hungary	47 (1.4)	566 (3.8)	41 (1.2)	551 (4.3)	13 (0.8)	516 (7.4)
Moldova	40 (1.6)	486 (4.4)	47 (1.3)	452 (4.8)	13 (0.8)	427 (7.9)
Bulgaria	38 (1.7)	539 (4.8)	42 (1.4)	521 (7.6)	20 (1.0)	491 (6.5)
Belgium (Flemish)	36 (1.1)	555 (4.5)	49 (1.3)	535 (3.5)	15 (0.9)	511 (5.3)
Romania	23 (1.3)	511 (6.3)	52 (1.1)	479 (6.3)	25 (1.1)	436 (6.8)
Morocco ^r	14 (0.8)	351 (7.4)	57 (1.2)	324 (5.7)	29 (1.0)	317 (6.3)
Latvia (LSS)	--	--	--	--	--	--
Lithuania [†]	--	--	--	--	--	--
Slovenia	--	--	--	--	--	--
International Avg.	42 (0.4)	522 (1.5)	43 (0.3)	496 (1.5)	15 (0.3)	467 (2.0)

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

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

^a Chinese Taipei: Students were asked about 'natural science'; data pertain to grade 8 physics/chemistry course.

^b Indonesia: Students were asked about 'IPA science'; data pertain to the composite course taught by biology and physics teachers.

^c Netherlands: Data in physics panel pertain to physics/chemistry course.

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

A dash (–) indicates data are not available.

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

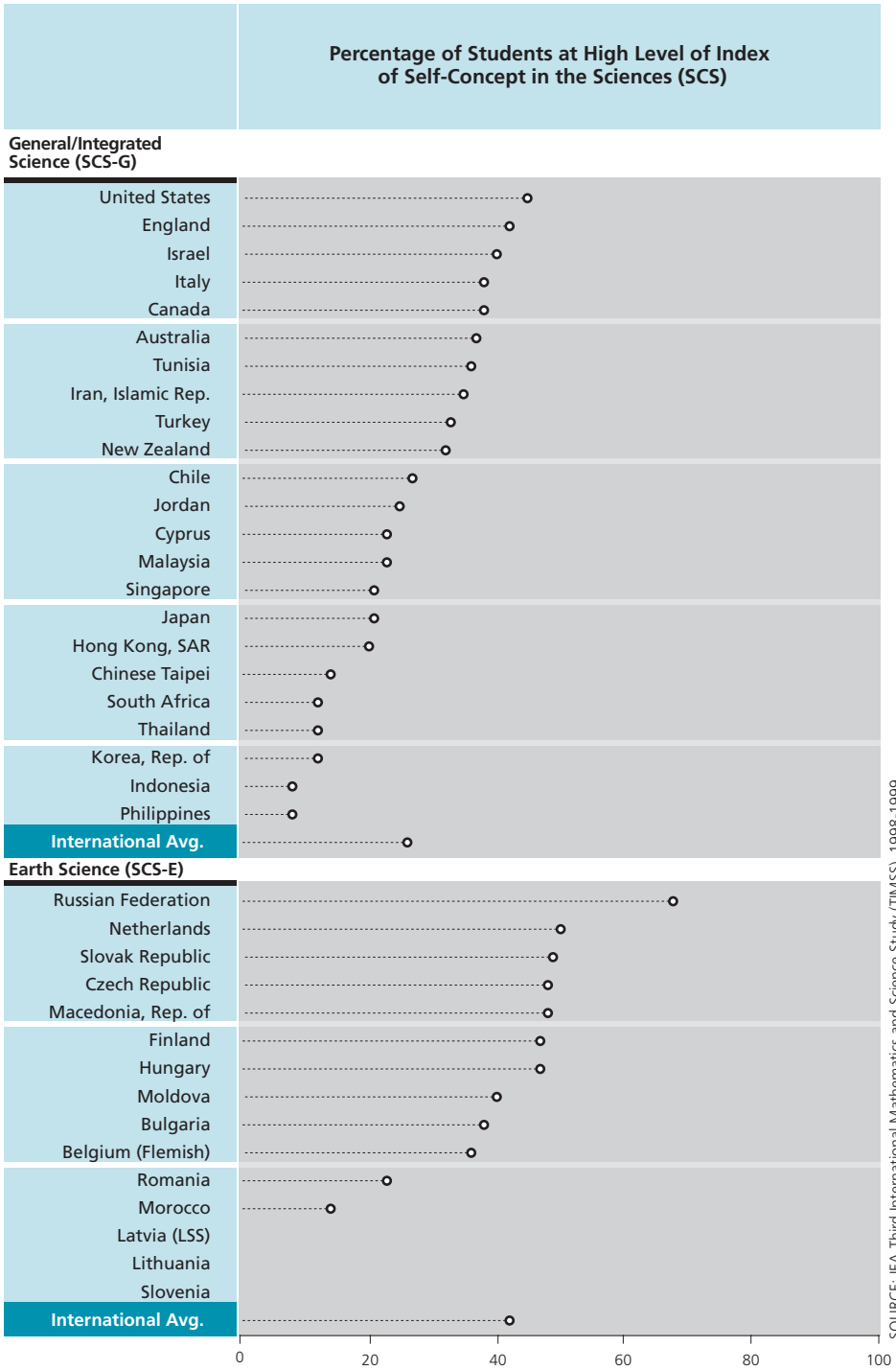



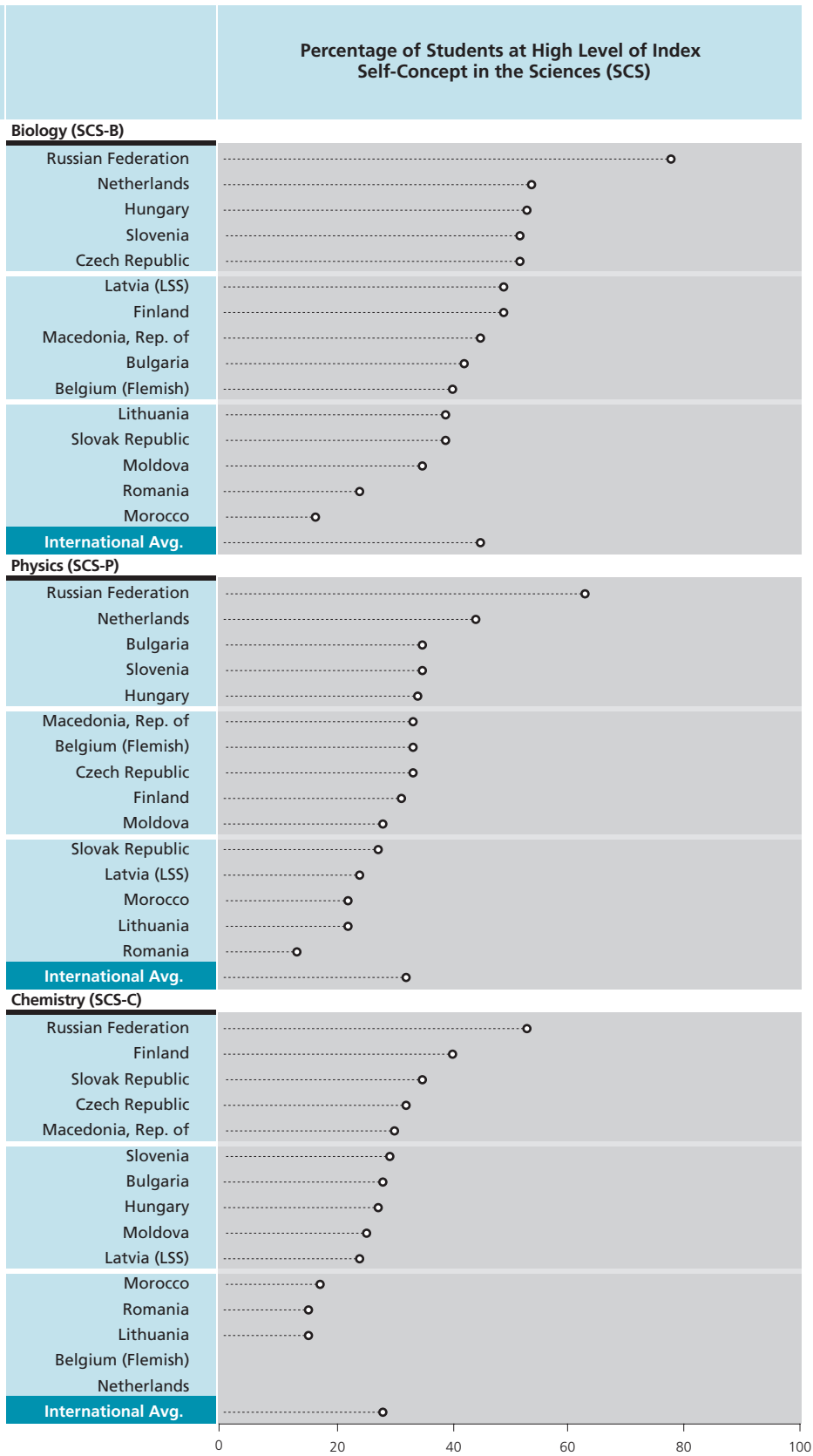


Exhibit 4.8: Index of Students' Self-Concept in the Sciences (SCS) (Continued 2)

	High SCS		Medium SCS		Low SCS	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Biology (SCS-B)						
 Russian Federation	78 (1.2)	542 (6.3)	17 (0.9)	510 (7.6)	5 (0.5)	481 (11.7)
Netherlands	54 (1.4)	556 (8.1)	39 (1.3)	535 (7.3)	7 (0.6)	514 (9.8)
Hungary	53 (1.5)	568 (4.1)	39 (1.2)	544 (5.1)	9 (0.7)	501 (8.5)
Slovenia	52 (1.3)	547 (3.8)	42 (1.2)	524 (3.7)	6 (0.5)	496 (8.4)
Czech Republic	52 (1.5)	551 (4.8)	40 (1.2)	532 (4.8)	8 (0.8)	506 (7.3)
Latvia (LSS)	49 (1.5)	515 (5.9)	44 (1.4)	495 (5.1)	6 (0.7)	465 (8.2)
Finland	49 (1.3)	554 (4.0)	39 (1.0)	528 (3.6)	12 (0.9)	489 (7.9)
Macedonia, Rep. of	45 (1.1)	503 (4.0)	42 (1.0)	445 (6.1)	12 (0.9)	386 (8.6)
Bulgaria	42 (1.9)	543 (6.9)	43 (1.5)	515 (5.4)	15 (1.4)	484 (5.9)
Belgium (Flemish)	40 (1.2)	557 (3.9)	48 (1.2)	529 (2.9)	12 (0.8)	496 (6.3)
Lithuania [†]	39 (1.6)	513 (4.6)	52 (1.4)	480 (4.5)	8 (0.7)	438 (10.3)
Slovak Republic	39 (1.7)	557 (4.6)	46 (1.3)	535 (3.1)	15 (1.0)	488 (5.6)
Moldova	35 (1.5)	486 (5.1)	52 (1.3)	455 (4.3)	13 (1.0)	429 (8.5)
Romania	24 (1.3)	509 (7.4)	55 (1.0)	477 (5.7)	20 (1.2)	432 (5.9)
Morocco ^r	16 (0.7)	358 (7.2)	58 (0.8)	325 (3.7)	27 (0.8)	318 (7.1)
International Avg.	45 (0.4)	524 (1.4)	44 (0.3)	495 (1.2)	12 (0.2)	461 (2.1)
Physics (SCS-P)						
 Russian Federation	63 (1.1)	548 (6.5)	24 (0.8)	520 (7.0)	13 (0.8)	490 (10.0)
Netherlands ^c	44 (2.4)	563 (8.2)	45 (1.8)	533 (6.9)	11 (1.2)	526 (8.4)
Bulgaria	35 (1.8)	546 (6.3)	41 (0.9)	520 (7.1)	24 (1.6)	491 (5.1)
Slovenia	35 (1.2)	557 (4.1)	49 (1.1)	532 (4.1)	16 (0.8)	494 (4.8)
Hungary	34 (1.4)	579 (5.8)	46 (1.1)	549 (4.0)	20 (0.9)	519 (5.5)
Macedonia, Rep. of	33 (1.3)	498 (4.6)	44 (1.0)	461 (5.4)	22 (1.0)	419 (7.6)
Belgium (Flemish)	33 (1.8)	561 (6.9)	49 (1.5)	539 (5.9)	18 (1.1)	530 (7.5)
Czech Republic	33 (1.6)	564 (5.2)	47 (1.1)	534 (4.6)	20 (1.3)	512 (5.6)
Finland	31 (1.2)	559 (5.2)	40 (1.2)	534 (5.2)	29 (1.1)	504 (3.4)
Moldova	28 (1.3)	488 (5.2)	54 (1.4)	457 (4.9)	18 (1.1)	440 (7.6)
Slovak Republic	27 (1.3)	568 (6.0)	48 (1.1)	536 (3.2)	25 (1.0)	502 (4.4)
Latvia (LSS)	24 (1.4)	526 (5.3)	49 (1.1)	505 (5.4)	26 (1.3)	480 (6.2)
Morocco ^r	22 (1.0)	372 (7.3)	56 (0.8)	324 (3.8)	22 (0.9)	299 (8.3)
Lithuania [†]	22 (1.2)	526 (6.5)	55 (1.1)	488 (4.3)	23 (1.2)	458 (4.9)
Romania	13 (0.9)	496 (10.2)	47 (1.2)	483 (6.8)	40 (1.2)	462 (5.5)
International Avg.	32 (0.4)	530 (1.6)	46 (0.3)	501 (1.5)	22 (0.3)	475 (2.0)
Chemistry (SCS-C)						
 Russian Federation	53 (1.6)	551 (6.2)	28 (0.8)	524 (7.8)	19 (1.2)	499 (9.2)
Finland	40 (1.3)	562 (4.9)	40 (1.2)	529 (4.6)	20 (1.0)	498 (3.8)
Slovak Republic	35 (1.5)	558 (5.1)	46 (1.1)	535 (2.9)	19 (1.2)	500 (4.6)
Czech Republic	32 (1.7)	561 (5.6)	48 (1.3)	537 (3.8)	20 (1.4)	511 (5.9)
Macedonia, Rep. of	30 (1.2)	498 (5.3)	45 (0.9)	464 (5.4)	25 (1.2)	424 (7.9)
Slovenia	29 (1.1)	562 (4.3)	51 (0.9)	531 (3.9)	20 (0.9)	502 (5.3)
Bulgaria	28 (1.4)	541 (6.2)	43 (1.2)	524 (6.3)	29 (1.4)	503 (6.6)
Hungary	27 (1.3)	577 (4.9)	48 (1.0)	552 (3.8)	26 (1.1)	528 (5.0)
Moldova	25 (1.2)	481 (4.9)	56 (1.1)	461 (4.9)	20 (0.9)	444 (6.8)
Latvia (LSS)	24 (1.4)	525 (6.4)	51 (1.0)	506 (6.0)	25 (1.3)	479 (4.3)
Morocco ^r	17 (0.8)	363 (8.7)	57 (0.8)	324 (5.2)	27 (0.7)	309 (6.7)
Romania	15 (0.9)	498 (9.5)	47 (1.1)	481 (6.2)	39 (1.2)	462 (6.1)
Lithuania [†]	15 (0.9)	517 (6.3)	57 (1.1)	494 (4.4)	28 (1.2)	465 (5.0)
Belgium (Flemish)	--	--	--	--	--	--
Netherlands	--	--	--	--	--	--
International Avg.	28 (0.4)	523 (1.5)	47 (0.3)	497 (1.5)	24 (0.3)	471 (1.8)

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



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

Exhibit 4.9 Index of Students' Self-Concept in the Sciences (SCS) by Gender*

	High SCS		Medium SCS		Low SCS	
	Percent of Students		Percent of Students		Percent of Students	
	Girls	Boys	Girls	Boys	Girls	Boys
General/Integrated Science (SCS-G)						
G						
Australia	33 (1.5)	41 (1.7) ▲	48 (1.2) ▲	41 (1.5)	20 (1.2)	17 (1.4)
Canada	35 (1.3)	41 (1.3)	49 (1.4) ▲	42 (1.1)	16 (0.7)	17 (0.8)
Chile	29 (1.5)	25 (1.4)	52 (1.3)	51 (1.2)	20 (1.1)	24 (1.1)
Chinese Taipei ^a	10 (0.6)	18 (0.9) ▲	60 (0.9)	62 (1.1)	30 (1.0) ▲	20 (1.1)
Cyprus	23 (1.3)	24 (1.4)	54 (1.4)	56 (1.5)	23 (1.2)	20 (1.3)
England	36 (1.9)	48 (1.6) ▲	49 (1.6) ▲	42 (1.4)	15 (1.2) ▲	10 (1.0)
Hong Kong, SAR	16 (1.0)	24 (1.0) ▲	61 (1.0) ▲	56 (0.9)	23 (1.1)	20 (1.0)
Indonesia ^b	8 (0.7)	8 (0.8)	73 (1.0)	73 (1.1)	18 (1.0)	19 (1.0)
Iran, Islamic Rep.	36 (2.0)	34 (1.3)	52 (1.5)	54 (1.2)	12 (1.1)	12 (0.9)
Israel	39 (1.6)	42 (1.3)	48 (1.3)	46 (1.2)	14 (1.2)	12 (1.0)
Italy	40 (1.7)	36 (1.4)	49 (1.4)	50 (1.3)	11 (0.8)	14 (1.0)
Japan	15 (0.9)	27 (1.0) ▲	65 (1.0)	62 (0.9)	20 (0.9) ▲	11 (0.7)
Jordan	26 (1.5)	25 (1.6)	55 (1.4)	52 (1.2)	19 (1.1)	24 (1.3)
Korea, Rep. of	8 (0.5)	15 (0.8) ▲	83 (0.7) ▲	78 (0.9)	9 (0.6)	7 (0.5)
Malaysia	24 (1.2)	23 (1.4)	69 (1.2)	68 (1.2)	7 (0.7)	9 (0.7)
New Zealand	29 (1.6)	35 (1.4) ▲	49 (1.3)	48 (1.4)	21 (1.0) ▲	17 (1.0)
Philippines	8 (0.7)	8 (0.8)	69 (1.1)	65 (1.2)	23 (1.1)	26 (1.2)
Singapore	17 (1.0)	26 (1.5) ▲	61 (1.0)	58 (1.2)	23 (1.1) ▲	16 (1.0)
South Africa	12 (1.1)	12 (1.1)	57 (1.3)	58 (1.0)	31 (1.5)	30 (1.3)
Thailand	12 (0.7)	12 (0.7)	54 (1.1)	51 (1.2)	34 (1.2)	37 (1.3)
Tunisia	36 (1.1)	36 (1.3)	54 (1.1)	55 (1.1)	9 (0.7)	9 (0.7)
Turkey	34 (1.5)	33 (1.3)	47 (1.3)	48 (0.9)	18 (1.1)	19 (0.9)
United States	42 (1.2)	48 (1.6) ▲	42 (1.0) ▲	38 (1.1)	16 (0.7)	14 (0.9)
International Avg.	25 (0.3)	28 (0.3) ▲	57 (0.3) ▲	55 (0.2)	19 (0.2) ▲	18 (0.2)
Earth Science (SCS-E)						
M						
Belgium (Flemish)	33 (1.6)	38 (1.8)	50 (1.2)	48 (1.8)	17 (1.5)	14 (0.7)
Bulgaria	40 (2.4)	36 (2.0)	41 (2.4)	45 (2.1)	20 (1.4)	20 (1.5)
Czech Republic	48 (2.1)	48 (1.9)	43 (1.8)	43 (1.4)	9 (0.8)	9 (1.1)
Finland	40 (1.9)	54 (1.6) ▲	40 (1.8) ▲	32 (1.1)	19 (1.6) ▲	13 (1.1)
Hungary	46 (1.7)	47 (1.7)	42 (1.6)	39 (1.5)	12 (0.9)	14 (1.1)
Latvia (LSS)	--	--	--	--	--	--
Lithuania [†]	--	--	--	--	--	--
Macedonia, Rep. of	51 (1.9) ▲	44 (1.6)	39 (1.7)	39 (1.3)	10 (1.0)	17 (1.2) ▲
Moldova	40 (1.9)	41 (1.9)	49 (1.7)	45 (1.5)	11 (1.0)	15 (1.2)
Morocco ^s	16 (1.3)	13 (0.9)	55 (1.6)	58 (1.5)	30 (1.6)	28 (1.7)
Netherlands	43 (2.3)	57 (2.3) ▲	48 (2.0) ▲	37 (1.8)	9 (0.9)	6 (1.0)
Romania	25 (1.5) ▲	21 (1.5)	52 (1.6)	52 (1.4)	23 (1.4)	27 (1.5)
Russian Federation	70 (1.7)	66 (1.1)	21 (1.3)	23 (0.9)	9 (0.8)	11 (0.8)
Slovak Republic	48 (2.1)	50 (2.0)	41 (1.6)	37 (1.5)	11 (1.1)	12 (1.3)
Slovenia	--	--	--	--	--	--
International Avg.	42 (0.5)	43 (0.5) ▲	43 (0.5) ▲	42 (0.4)	15 (0.3)	16 (0.3) ▲

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

▲ Significantly higher than other gender

Significance tests adjusted for multiple comparisons

Background data provided by students.

* Countries administered either a general/integrated science or separate subject area form of the questionnaire. In countries that administered the separate subject area form, students were asked about each subject area separately.

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

^a Chinese Taipei: Students were asked about 'natural science'; data pertain to grade 8 physics/chemistry course.

^b Indonesia: Students were asked about 'IPA science'; data pertain to the composite course taught by biology and physics teachers.




^c Netherlands: Data in physics panel pertain to physics/chemistry course.

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

A dash (–) indicates data are not available.

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

Exhibit 4.9: Index of Students' Self-Concept in the Sciences (SCS) by Gender* (Continued)

		High SCS		Medium SCS		Low SCS	
		Percent of Students		Percent of Students		Percent of Students	
		Girls	Boys	Girls	Boys	Girls	Boys
Biology (SCS-B)							
	Belgium (Flemish)	42 (2.1)	39 (1.6)	47 (2.3)	49 (1.6)	10 (1.4)	13 (1.3)
	Bulgaria	48 (2.9)	36 (2.9)	40 (2.2)	47 (3.2)	13 (1.5)	17 (1.8)
	Czech Republic	57 (1.9) ▲	47 (1.5)	38 (1.7)	43 (1.3)	6 (0.9)	10 (1.1) ▲
	Finland	47 (1.9)	50 (1.8)	41 (1.5)	37 (1.3)	11 (1.2)	13 (1.3)
	Hungary	59 (1.9) ▲	46 (1.7)	35 (1.6)	42 (1.4) ▲	6 (0.8)	12 (1.0) ▲
	Latvia (LSS)	53 (2.0) ▲	45 (1.8)	42 (1.9)	47 (1.6)	5 (0.7)	8 (1.1)
	Lithuania †	42 (1.9)	37 (1.8)	52 (1.7)	53 (1.7)	6 (0.8)	11 (1.0) ▲
	Macedonia, Rep. of	53 (1.7) ▲	37 (1.4)	39 (1.6)	46 (1.3) ▲	8 (0.8)	17 (1.2) ▲
	Moldova	36 (1.9)	34 (1.8)	54 (1.7)	50 (1.5)	11 (1.0)	16 (1.4) ▲
	Morocco s	18 (1.2)	14 (0.9)	54 (1.3)	60 (1.1) ▲	28 (1.6)	25 (1.1)
	Netherlands	56 (1.7)	52 (1.9)	39 (1.5)	40 (1.9)	5 (0.8)	8 (1.1)
	Romania	29 (1.8) ▲	20 (1.4)	55 (1.5)	55 (1.5)	16 (1.4)	25 (1.5) ▲
	Russian Federation	82 (1.3) ▲	73 (1.5)	16 (1.0)	19 (1.1)	2 (0.4)	8 (0.8) ▲
	Slovak Republic	42 (2.2)	36 (2.1)	45 (1.8)	47 (1.7)	13 (1.1)	17 (1.2) ▲
	Slovenia	61 (1.7) ▲	43 (1.5)	36 (1.7)	50 (1.5) ▲	4 (0.6)	7 (0.7) ▲
	International Avg.	48 (0.5) ▲	41 (0.5)	42 (0.4)	46 (0.4) ▲	10 (0.3)	14 (0.3) ▲
Physics (SCS-P)							
	Belgium (Flemish)	30 (2.5)	36 (2.2)	50 (2.0)	47 (1.9)	20 (1.9)	17 (1.0)
	Bulgaria	34 (2.5)	36 (1.9)	41 (1.6)	42 (1.5)	25 (1.9)	22 (1.8)
	Czech Republic	26 (1.8)	40 (1.8) ▲	51 (1.7) ▲	43 (1.4)	23 (1.4)	17 (1.8)
	Finland	17 (1.3)	46 (1.6) ▲	45 (1.5) ▲	36 (1.5)	39 (1.7) ▲	18 (1.2)
	Hungary	28 (1.7)	40 (1.7) ▲	50 (1.6) ▲	41 (1.3)	22 (1.2)	19 (1.1)
	Latvia (LSS)	15 (1.3)	34 (2.0) ▲	52 (1.3)	47 (1.7)	33 (1.8) ▲	19 (1.3)
	Lithuania †	17 (1.5)	27 (1.7) ▲	56 (1.6)	55 (1.6)	27 (1.8) ▲	18 (1.2)
	Macedonia, Rep. of	35 (1.5)	32 (1.5)	44 (1.2)	45 (1.4)	21 (1.2)	24 (1.2)
	Moldova r	25 (1.5)	31 (1.6)	55 (1.6)	53 (1.7)	19 (1.3)	16 (1.4)
	Morocco	24 (1.7)	21 (1.0)	54 (1.4)	57 (1.1)	22 (1.3)	22 (1.0)
	Netherlands c	35 (3.4)	53 (3.1) ▲	52 (2.4) ▲	38 (2.6)	13 (1.6)	9 (1.6)
	Romania	11 (1.0)	15 (1.1) ▲	48 (1.4)	46 (1.6)	41 (1.7)	39 (1.5)
	Russian Federation	62 (1.2)	64 (1.3)	25 (1.0)	24 (1.0)	14 (0.9)	13 (0.9)
	Slovak Republic	21 (1.4)	34 (2.1) ▲	51 (1.5)	45 (1.8)	29 (1.5) ▲	21 (1.3)
	Slovenia	30 (1.5)	40 (1.5) ▲	50 (1.3)	48 (1.4)	19 (1.3) ▲	12 (0.9)
	International Avg.	27 (0.5)	36 (0.5) ▲	48 (0.4) ▲	44 (0.4)	25 (0.4) ▲	19 (0.3)
Chemistry (SCS-C)							
	Belgium (Flemish)	--	--	--	--	--	--
	Bulgaria	30 (1.8)	26 (1.5)	44 (1.4)	43 (1.6)	27 (1.8)	32 (1.4)
	Czech Republic	31 (2.1)	32 (1.8)	49 (1.6)	47 (1.7)	20 (1.5)	21 (1.7)
	Finland	27 (1.6)	53 (1.7) ▲	46 (1.6) ▲	34 (1.5)	27 (1.5) ▲	13 (1.1)
	Hungary	24 (1.3)	30 (1.6) ▲	49 (1.4)	46 (1.4)	27 (1.4)	24 (1.3)
	Latvia (LSS)	21 (1.6)	26 (1.6) ▲	52 (1.5)	50 (1.3)	28 (1.7)	23 (1.7)
	Lithuania †	13 (1.0)	17 (1.3)	57 (1.6)	58 (1.6)	30 (1.7)	25 (1.4)
	Macedonia, Rep. of	32 (1.6)	27 (1.4)	46 (1.2)	45 (1.3)	22 (1.4)	28 (1.4) ▲
	Moldova	24 (1.6)	25 (1.5)	57 (1.4)	54 (1.5)	18 (1.1)	21 (1.2)
	Morocco r	18 (1.4)	15 (1.1)	53 (1.8)	59 (1.6)	29 (1.4)	25 (1.1)
	Netherlands	--	--	--	--	--	--
	Romania	16 (1.3)	14 (1.1)	47 (1.5)	47 (1.5)	38 (1.9)	39 (1.3)
	Russian Federation	53 (1.7)	52 (2.0)	29 (1.1)	28 (1.1)	18 (1.3)	20 (1.4)
	Slovak Republic	35 (1.8)	36 (2.0)	46 (1.2)	45 (1.8)	19 (1.5)	19 (1.5)
	Slovenia	29 (1.4)	29 (1.4)	52 (1.3)	49 (1.4)	19 (1.3)	22 (1.1)
	International Avg.	27 (0.4)	29 (0.4) ▲	48 (0.4) ▲	47 (0.4)	25 (0.4) ▲	24 (0.4)

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

What Are Students' Attitudes Towards the Sciences?

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

- I like science
- I enjoy learning science
- Science is boring⁵
- Science is important to everyone's life
- I would like a job that involved using science.

In countries where the sciences are taught as separate subjects students were asked about each subject area separately.

For each statement, students responded on a four-point scale indicating whether their feelings about science 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 in a four-page display, in a single panel for the countries that teach science as a single subject and in separate panels for earth science, biology, physics, and chemistry for countries that teach the sciences separately.⁶

4.10



In countries where science is taught as a single subject, students generally had positive attitudes towards the sciences, with 40 percent on average across countries in the high category, and a further 49 percent in the medium category. Only 10 percent of students were in the low category. Countries with large percentages of students at the high level included Malaysia, the Philippines, Tunisia, Jordan, South Africa, Iran, and Indonesia, with more than half the students in this category. The countries with the least positive attitudes were Japan and Korea. Also low were Australia, Chinese Taipei, and Hong Kong. Since these are all countries with high average science achievement, it may be that the students follow

⁵ The response categories for this statement were reversed in constructing the index.

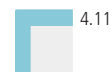
⁶ Additional information on students' liking science, one of the components of the index, is provided in Exhibit R1.15 in the reference section.



a demanding science curriculum, one that leads to high achievement but little enthusiasm for the subject matter. However, there was a clear positive association between attitudes towards the sciences and science achievement on average overall and in many of the countries.

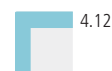
Attitudes towards the science subject areas were somewhat less positive among the separate science countries. Attitudes were most positive towards biology (32 percent in the high category, on average) and earth science (27 percent positive), and least positive towards physics and chemistry (19 and 23 percent, respectively). Macedonia had the largest percentage of students at the high level in all subject areas except chemistry. Bulgaria, Moldova, and the Russian Federation also had relatively large percentages of students at the high level in all subject areas. Romania was amongst the most positive in earth science and biology, but was less positive in physics and chemistry. The relationship between positive attitudes and science achievement was not as clear for the separate science subject areas as it was for science as a single subject. In physics and chemistry, students at the high level of the index had substantially higher average achievement than students at the medium and low levels, but this was not the case for earth science and biology.

Exhibit 4.11 presents the percentages of girls and boys in each country at each level of the positive attitudes towards the sciences index. For the single-science countries, internationally on average there was a significantly greater percentage of boys than girls at the high level of the index. For the separate-science countries, there were significantly greater percentages of boys than girls at the high level of the index in earth science, physics, and chemistry, but a larger percentage of girls in biology.



4.11

Exhibit 4.12 provides information on trends in the index of positive attitudes towards the sciences from 1995 to 1999. Again, data are presented separately for science as a single subject and for the separate science subject areas. There was little change overall among the general-science countries. Australia had an increase in the percentage of students at the high level in 1999, and Iran had a decrease. Among the separate-science countries, the Russian Federation had increases in the percentages at the high level in earth science, physics and chemistry, the Czech Republic had increases in biology and chemistry, and the Slovak Republic had an increase in chemistry. Decreased percentages of students at the high level of the index were found in Belgium (Flemish) and Latvia (LSS) in biology, in Latvia (LSS) and Romania in physics, and in Romania in chemistry.



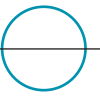
4.12



4.13



Exhibit 4.13 displays trends from 1995 to 1999 in the percentages of girls and boys at the high level of the index. There was very little change over time in the relative attitudes of girls and boys towards science; no country experienced a significant change, positive or negative, in the gender difference in attitudes. For most countries that had a gender difference in 1995, the difference persisted in 1999.



Exhibits 4.10–4.13 Overleaf

Exhibit 4.10 Index of Students' Positive Attitudes Towards the Sciences (PATS)

Index of Students' Positive Attitudes Towards the Sciences

Index based on students' responses to five statements about science: 1) I like science; 2) I enjoy learning science; 3) science is boring (reversed scale); 4) science is important to everyone's life; 5) I would like a job that involved using science. Average is computed across the five items based on a 4-point scale: 1 = strongly negative; 2 = negative; 3 = positive; 4 = strongly positive. In countries where science is taught as separate subjects, students were asked about each subject area separately. High level indicates average is greater than 3. Medium level indicates average is greater than 2 and less than or equal to 3. Low level indicates average is less than or equal to 2.

G

	High PATS		Medium PATS		Low PATS	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
General/Integrated Science (PATS-G)						
Malaysia	72 (1.0)	498 (4.7)	28 (1.0)	480 (5.8)	1 (0.1)	~ ~
Philippines	63 (1.4)	372 (7.3)	35 (1.3)	314 (8.9)	2 (0.2)	~ ~
Tunisia	63 (1.1)	430 (3.8)	33 (0.9)	430 (4.2)	4 (0.4)	429 (6.3)
Jordan	59 (1.4)	472 (3.7)	35 (1.1)	438 (5.1)	5 (0.6)	447 (11.1)
South Africa	58 (1.7)	251 (8.7)	35 (1.1)	234 (9.4)	6 (1.0)	232 (17.9)
Iran, Islamic Rep.	56 (1.4)	454 (4.5)	40 (1.3)	444 (5.1)	4 (0.3)	445 (10.8)
Indonesia ^b	52 (1.3)	435 (4.9)	47 (1.2)	438 (4.5)	0 (0.1)	~ ~
Chile	49 (1.3)	425 (4.5)	45 (1.0)	419 (4.3)	5 (0.5)	428 (8.6)
Singapore	46 (1.4)	594 (8.1)	49 (1.2)	549 (7.8)	5 (0.6)	509 (12.3)
Turkey	45 (1.2)	443 (5.3)	49 (0.9)	431 (4.0)	5 (0.5)	428 (7.3)
Thailand	43 (1.3)	492 (4.9)	55 (1.3)	476 (4.6)	1 (0.2)	~ ~
England	39 (1.1)	559 (5.5)	53 (1.1)	532 (5.6)	8 (0.6)	514 (10.2)
Cyprus	33 (0.9)	494 (2.9)	53 (0.8)	448 (2.7)	13 (0.8)	434 (6.4)
United States	32 (0.9)	543 (5.9)	51 (0.8)	515 (4.5)	16 (0.6)	489 (4.3)
Israel	30 (1.2)	484 (7.2)	50 (0.9)	474 (4.7)	20 (1.1)	461 (6.8)
Canada	30 (0.8)	556 (2.8)	52 (0.8)	530 (2.6)	18 (0.8)	511 (4.0)
Italy	29 (1.2)	514 (4.9)	58 (1.1)	489 (4.2)	13 (0.9)	475 (6.1)
New Zealand	28 (1.0)	525 (7.3)	56 (0.8)	511 (5.3)	16 (0.9)	493 (5.7)
Australia	27 (1.1)	569 (5.5)	53 (1.0)	541 (4.6)	20 (1.2)	507 (6.6)
Chinese Taipei ^a	27 (0.8)	607 (4.7)	64 (0.7)	561 (4.4)	10 (0.6)	528 (6.7)
Hong Kong, SAR	25 (1.0)	555 (5.1)	65 (0.8)	526 (3.7)	9 (0.6)	497 (4.8)
Korea, Rep. of	10 (0.5)	613 (4.3)	66 (0.7)	550 (2.6)	24 (0.8)	519 (3.4)
Japan	10 (0.5)	599 (6.3)	60 (0.9)	554 (2.6)	30 (1.0)	527 (3.0)
International Avg.	40 (0.2)	499 (1.1)	49 (0.2)	473 (1.0)	10 (0.1)	467 (2.4)
Earth Science (PATS-E)						
Macedonia, Rep. of	58 (1.6)	464 (5.9)	40 (1.4)	466 (5.5)	3 (0.4)	484 (14.9)
Romania	40 (1.5)	488 (6.1)	56 (1.3)	468 (5.8)	4 (0.6)	454 (16.4)
Bulgaria	35 (1.8)	522 (5.9)	54 (1.5)	514 (5.3)	11 (2.1)	533 (17.1)
Moldova	33 (1.1)	468 (5.5)	65 (1.1)	459 (4.2)	2 (0.3)	~ ~
Russian Federation	28 (1.8)	542 (10.2)	65 (1.6)	529 (6.2)	7 (0.6)	526 (8.7)
Slovak Republic	24 (1.2)	539 (6.2)	66 (1.0)	535 (3.3)	11 (1.1)	541 (6.0)
Czech Republic	23 (1.4)	544 (6.1)	64 (1.2)	538 (4.4)	13 (1.0)	547 (7.6)
Finland	19 (0.9)	547 (6.7)	65 (1.1)	536 (3.8)	15 (1.1)	518 (5.3)
Hungary	14 (0.8)	565 (6.1)	67 (1.0)	549 (3.7)	18 (1.0)	563 (5.0)
Netherlands	11 (1.3)	544 (12.0)	65 (1.5)	548 (7.2)	23 (1.7)	540 (9.6)
Belgium (Flemish)	9 (0.7)	546 (7.4)	56 (1.2)	545 (3.8)	35 (1.5)	539 (3.4)
Morocco	x x	x x	x x	x x	x x	x x
Latvia (LSS)	--	--	--	--	--	--
Lithuania [†]	--	--	--	--	--	--
Slovenia	--	--	--	--	--	--
International Avg.	27 (0.4)	524 (2.1)	60 (0.4)	517 (1.4)	13 (0.4)	525 (3.3)

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.

^a Chinese Taipei: Students were asked about 'natural science'; data pertain to grade 8 physics/chemistry course.

^b Indonesia: Students were asked about 'IPA science'; data pertain to the composite course taught by biology and physics teachers.

^c Netherlands: Data in physics panel pertain to physics/chemistry course.




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

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

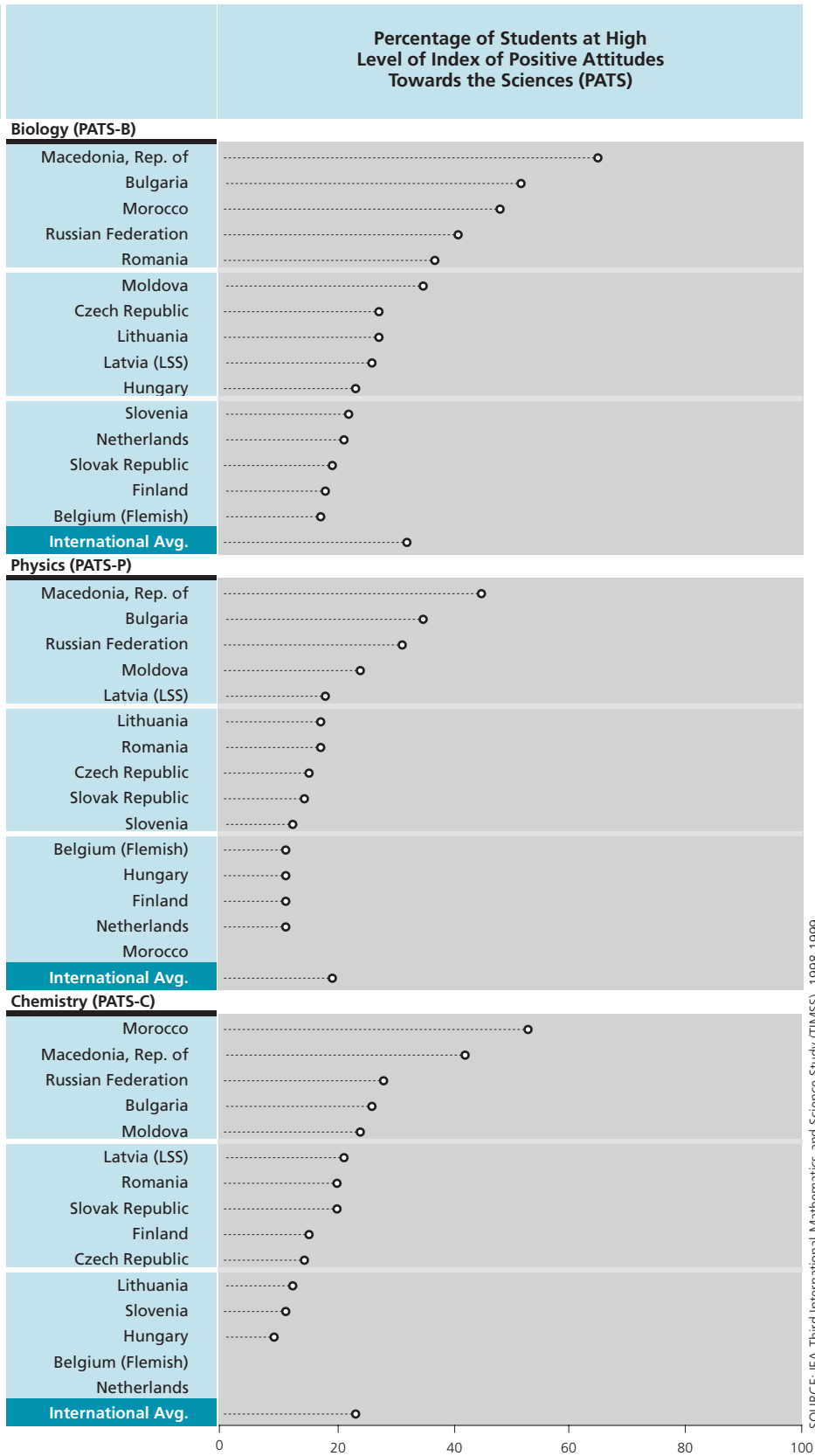
An "s" indicates a 50-69% student response rate. An "x" indicates a <50% student response rate.



Exhibit 4.10: Index of Students' Positive Attitudes Towards the Sciences (PATS) (Continued 2)


	High PATS		Medium PATS		Low PATS	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Biology (PATS-B)						
 Macedonia, Rep. of	65 (1.2)	466 (5.3)	34 (1.2)	458 (6.5)	1 (0.2)	~ ~
Bulgaria	52 (1.4)	520 (7.2)	43 (1.3)	519 (6.1)	5 (0.5)	500 (9.4)
Morocco ^s	48 (1.3)	335 (7.0)	46 (1.1)	327 (3.9)	7 (0.6)	312 (14.5)
Russian Federation	41 (1.6)	536 (7.6)	55 (1.5)	529 (6.6)	4 (0.3)	530 (11.9)
Romania	37 (1.4)	479 (7.4)	55 (1.2)	473 (5.5)	7 (0.7)	473 (10.5)
Moldova	35 (1.5)	459 (6.1)	64 (1.4)	462 (4.2)	1 (0.3)	~ ~
Czech Republic	27 (1.5)	546 (5.1)	60 (1.1)	537 (4.5)	12 (1.2)	541 (7.3)
Lithuania [†]	27 (1.3)	493 (6.2)	65 (1.2)	488 (4.8)	8 (0.7)	486 (8.4)
Latvia (LSS)	26 (1.5)	502 (8.0)	66 (1.3)	503 (4.9)	8 (0.8)	508 (6.2)
Hungary	23 (1.1)	566 (6.2)	65 (1.1)	548 (3.6)	12 (0.8)	553 (7.9)
Slovenia	22 (1.1)	538 (5.4)	64 (1.0)	532 (3.9)	14 (1.0)	540 (5.3)
Netherlands	21 (1.8)	543 (11.7)	63 (1.4)	541 (9.1)	16 (1.3)	550 (8.3)
Slovak Republic	19 (1.2)	549 (5.0)	70 (1.2)	532 (3.5)	11 (0.9)	539 (6.0)
Finland	18 (0.7)	549 (6.2)	65 (1.1)	536 (3.8)	18 (1.1)	519 (5.5)
Belgium (Flemish)	17 (0.9)	555 (3.4)	61 (1.2)	541 (3.6)	23 (1.1)	518 (4.5)
International Avg.	32 (0.3)	509 (1.7)	58 (0.3)	502 (1.2)	10 (0.2)	505 (3.0)
Physics (PATS-P)						
 Macedonia, Rep. of	45 (1.5)	461 (6.1)	47 (1.2)	468 (5.4)	9 (0.8)	481 (8.4)
Bulgaria	35 (2.0)	527 (6.8)	53 (1.9)	515 (5.6)	12 (1.3)	509 (13.1)
Russian Federation	31 (1.4)	551 (8.0)	63 (1.3)	526 (6.7)	6 (0.6)	516 (9.3)
Moldova	24 (1.1)	461 (5.0)	72 (1.0)	463 (4.4)	4 (0.4)	462 (13.4)
Latvia (LSS)	18 (1.1)	511 (6.8)	68 (1.1)	502 (4.8)	14 (1.1)	500 (7.9)
Lithuania [†]	17 (1.0)	509 (6.6)	65 (1.2)	486 (4.7)	18 (1.2)	481 (4.7)
Romania	17 (1.2)	479 (9.0)	64 (1.0)	474 (5.6)	18 (1.3)	480 (7.6)
Czech Republic	15 (1.3)	565 (9.2)	59 (1.5)	539 (4.6)	26 (1.8)	533 (4.5)
Slovak Republic	14 (0.8)	559 (7.5)	64 (1.1)	531 (3.4)	22 (1.2)	539 (3.8)
Slovenia	12 (0.7)	558 (7.4)	60 (1.2)	532 (4.1)	28 (1.3)	530 (4.0)
Belgium (Flemish)	11 (0.9)	564 (7.9)	58 (1.5)	548 (5.1)	31 (1.9)	533 (6.8)
Hungary	11 (0.7)	580 (8.1)	62 (1.1)	548 (4.2)	27 (1.2)	557 (4.7)
Finland	11 (0.8)	563 (9.5)	55 (1.2)	536 (4.0)	34 (1.4)	518 (4.8)
Netherlands ^c	11 (0.8)	564 (12.8)	59 (1.7)	550 (7.9)	30 (2.0)	532 (7.2)
Morocco	x x	x x	x x	x x	x x	x x
International Avg.	19 (0.3)	532 (2.2)	61 (0.3)	516 (1.3)	20 (0.4)	512 (2.3)
Chemistry (PATS-C)						
 Morocco ^s	53 (1.6)	334 (6.5)	42 (1.3)	318 (8.6)	5 (0.5)	328 (20.3)
Macedonia, Rep. of	42 (1.6)	458 (6.4)	50 (1.3)	467 (4.8)	8 (0.8)	481 (10.0)
Russian Federation	28 (1.2)	546 (8.4)	62 (1.0)	528 (6.5)	10 (0.9)	522 (8.2)
Bulgaria	26 (1.3)	519 (6.5)	56 (1.3)	517 (5.4)	18 (1.7)	521 (10.6)
Moldova	24 (1.2)	459 (6.1)	71 (1.1)	462 (4.2)	6 (0.6)	469 (10.4)
Latvia (LSS)	21 (1.2)	507 (6.1)	67 (1.0)	503 (5.2)	12 (1.0)	505 (8.2)
Romania	20 (1.0)	482 (7.8)	61 (1.1)	472 (5.7)	18 (1.1)	479 (7.8)
Slovak Republic	20 (1.2)	554 (6.7)	65 (1.2)	531 (3.3)	16 (1.3)	537 (4.7)
Finland	15 (1.0)	563 (6.9)	62 (1.1)	536 (3.9)	23 (1.1)	515 (4.4)
Czech Republic	14 (1.0)	560 (8.5)	60 (1.5)	538 (4.2)	25 (1.7)	533 (5.1)
Lithuania [†]	12 (0.9)	509 (8.9)	65 (1.2)	487 (4.5)	23 (1.4)	485 (5.2)
Slovenia	11 (0.7)	564 (6.8)	58 (1.3)	531 (3.7)	31 (1.3)	530 (5.1)
Hungary	9 (0.6)	573 (9.3)	61 (1.3)	549 (4.3)	30 (1.5)	556 (5.7)
Belgium (Flemish)	--	--	--	--	--	--
Netherlands	--	--	--	--	--	--
International Avg.	23 (0.3)	510 (2.1)	60 (0.3)	495 (1.7)	17 (0.3)	497 (3.0)

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



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

Exhibit 4.11 Index of Positive Attitudes Towards the Sciences (PATS) by Gender*

	High PATS		Medium PATS		Low PATS	
	Percent of Students		Percent of Students		Percent of Students	
	Girls	Boys	Girls	Boys	Girls	Boys
General/Integrated Science (PATS-G)						
G Australia	25 (1.4)	29 (1.5)	53 (1.2)	54 (1.5)	23 (1.5) ▲	17 (1.5)
Canada	28 (1.1)	32 (1.1)	55 (1.3) ▲	49 (0.9)	17 (0.9)	19 (1.2)
Chile	53 (1.7) ▲	46 (1.3)	43 (1.4)	48 (1.1) ▲	4 (0.6)	6 (0.6)
Chinese Taipei ^a	19 (0.9)	34 (1.2) ▲	69 (0.8) ▲	59 (1.1)	12 (0.8) ▲	7 (0.6)
Cyprus	29 (1.6)	37 (1.3) ▲	57 (1.4)	50 (1.3)	14 (1.0)	12 (1.0)
England	33 (1.7)	46 (1.4) ▲	58 (1.8) ▲	48 (1.4)	9 (0.9)	6 (0.8)
Hong Kong, SAR	20 (1.2)	31 (1.3) ▲	69 (1.1) ▲	61 (1.2)	11 (1.0) ▲	7 (0.6)
Indonesia ^b	54 (1.4)	51 (1.6)	46 (1.4)	49 (1.6)	0 (0.2)	0 (0.1)
Iran, Islamic Rep.	59 (2.5)	54 (1.7)	38 (2.5)	42 (1.6)	3 (0.4)	4 (0.5)
Israel	26 (1.4)	35 (1.4) ▲	52 (1.5)	48 (1.0)	22 (1.4) ▲	17 (1.2)
Italy	28 (1.6)	31 (1.2)	59 (1.4)	56 (1.2)	12 (1.2)	13 (1.0)
Japan	6 (0.6)	13 (0.8) ▲	57 (1.2)	64 (1.2) ▲	37 (1.4) ▲	23 (1.3)
Jordan	57 (2.0)	62 (1.7)	38 (1.7)	33 (1.4)	5 (0.9)	5 (0.7)
Korea, Rep. of	7 (0.6)	14 (0.7) ▲	65 (1.0)	67 (0.9)	28 (1.1) ▲	19 (0.9)
Malaysia	71 (1.2)	72 (1.3)	28 (1.2)	28 (1.3)	1 (0.2)	1 (0.2)
New Zealand	24 (1.0)	32 (1.4) ▲	58 (1.0)	54 (1.3)	18 (1.3)	14 (1.2)
Philippines	66 (1.6) ▲	60 (1.5)	32 (1.6)	38 (1.5) ▲	2 (0.2)	3 (0.3)
Singapore	39 (1.7)	52 (1.5) ▲	55 (1.4) ▲	44 (1.3)	6 (0.7)	4 (0.6)
South Africa	57 (2.0)	60 (1.6)	37 (1.3)	34 (1.2)	7 (1.1)	6 (0.9)
Thailand	44 (1.6)	43 (1.6)	55 (1.6)	56 (1.5)	1 (0.2)	2 (0.3)
Tunisia	64 (1.2)	62 (1.6)	32 (1.0)	34 (1.3)	4 (0.5)	4 (0.6)
Turkey	44 (1.6)	47 (1.4)	50 (1.3)	49 (1.2)	6 (1.0)	5 (0.5)
United States	29 (1.1)	35 (1.2) ▲	54 (0.9) ▲	49 (1.0)	17 (0.8)	15 (0.9)
International Avg.	38 (0.3)	42 (0.3) ▲	50 (0.3) ▲	48 (0.3)	11 (0.2) ▲	9 (0.2)
Earth Science (PATS-E)						
 Belgium (Flemish)	7 (0.7)	11 (0.9) ▲	53 (1.7)	59 (1.4)	40 (2.0) ▲	30 (1.6)
Bulgaria	31 (2.7)	39 (2.5)	58 (2.1)	51 (2.4)	12 (2.4)	11 (2.2)
Czech Republic	21 (1.9)	26 (2.0)	64 (1.5)	63 (2.0)	14 (1.3)	12 (1.1)
Finland	17 (1.5)	22 (1.2)	67 (1.5)	64 (1.5)	16 (1.6)	15 (1.2)
Hungary	11 (1.0)	17 (1.1) ▲	70 (1.3) ▲	65 (1.3)	19 (1.2)	18 (1.4)
Latvia (LSS)	--	--	--	--	--	--
Lithuania [†]	--	--	--	--	--	--
Macedonia, Rep. of	54 (2.2)	62 (1.6) ▲	44 (2.0) ▲	36 (1.4)	2 (0.4)	3 (0.5)
Moldova	33 (1.3)	34 (1.4)	66 (1.3)	64 (1.5)	2 (0.3)	2 (0.6)
Morocco	x x	x x	x x	x x	x x	x x
Netherlands	8 (1.0)	15 (1.8) ▲	64 (2.0)	66 (1.9)	28 (2.3) ▲	18 (1.8)
Romania	40 (2.1)	40 (1.8)	56 (1.9)	55 (1.6)	4 (0.7)	4 (0.7)
Russian Federation	24 (1.9)	33 (2.0) ▲	69 (1.8) ▲	61 (1.9)	7 (0.8)	7 (0.8)
Slovak Republic	19 (1.3)	29 (1.6) ▲	69 (1.3) ▲	62 (1.4)	12 (1.3)	9 (1.3)
Slovenia	--	--	--	--	--	--
International Avg.	24 (0.5)	30 (0.5) ▲	62 (0.5) ▲	59 (0.5)	14 (0.4) ▲	12 (0.4)

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

▲ Significantly higher than other gender

Significance tests adjusted for multiple comparisons

Background data provided by students.

* Countries administered either a general/integrated science or separate subject area form of the questionnaire. In countries that administered the separate subject area form, students were asked about each subject area separately.

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

a Chinese Taipei: Students were asked about 'natural science'; data pertain to grade 8 physics/chemistry course.

b Indonesia: Students were asked about 'IPA science'; data pertain to the composite course taught by biology and physics teachers.




c Netherlands: Data in physics panel pertain to physics/chemistry course.

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

A dash (-) indicates data are not available.

An "s" indicates a 50-69% student response rate. An "x" indicates a <50% student response rate.

Exhibit 4.11: Index of Positive Attitudes Towards the Sciences (PATS) by Gender* (Continued)

		High PATS		Medium PATS		Low PATS	
		Percent of Students		Percent of Students		Percent of Students	
		Girls	Boys	Girls	Boys	Girls	Boys
Biology (PATS-B)							
	Belgium (Flemish)	19 (1.4) ▲	14 (0.9)	61 (1.3)	60 (1.6)	20 (1.3)	25 (1.6)
	Bulgaria	56 (1.8) ▲	49 (1.8)	41 (1.7)	44 (1.7)	3 (0.7)	7 (0.7) ▲
	Czech Republic	34 (2.0) ▲	20 (1.8)	57 (1.6)	64 (1.5)	9 (1.3)	16 (1.4) ▲
	Finland	21 (1.2) ▲	14 (1.1)	64 (1.3)	65 (1.6)	15 (1.4)	20 (1.6)
	Hungary	28 (1.6) ▲	18 (1.2)	65 (1.5)	66 (1.4)	7 (0.8)	16 (1.4) ▲
	Latvia (LSS)	27 (1.7)	25 (1.8)	65 (1.6)	67 (1.7)	8 (0.9)	8 (0.9)
	Lithuania †	31 (1.6) ▲	23 (1.6)	63 (1.6)	67 (1.7)	6 (0.8)	10 (1.0) ▲
	Macedonia, Rep. of	70 (1.3) ▲	60 (1.5)	29 (1.3)	38 (1.4) ▲	1 (0.2)	2 (0.4) ▲
	Moldova	37 (1.8)	32 (1.5)	63 (1.8)	66 (1.5)	1 (0.2)	2 (0.5)
	Morocco s	50 (1.5)	46 (1.9)	44 (1.4)	47 (1.5)	6 (0.8)	7 (0.8)
	Netherlands	27 (2.6) ▲	14 (1.6)	61 (2.0)	66 (1.7)	12 (1.5)	20 (1.8) ▲
	Romania	41 (1.9)	34 (1.8)	53 (1.7)	58 (1.7)	6 (0.9)	8 (1.0)
	Russian Federation	44 (1.9)	39 (1.7)	53 (1.9)	57 (1.5)	3 (0.4)	4 (0.5)
	Slovak Republic	21 (1.5)	16 (1.4)	69 (1.7)	71 (1.4)	10 (1.0)	12 (1.4)
	Slovenia	27 (1.5) ▲	17 (1.2)	62 (1.4)	65 (1.5)	11 (1.0)	18 (1.3) ▲
	International Avg.	35 (0.4) ▲	28 (0.4)	57 (0.4)	60 (0.4) ▲	8 (0.3)	12 (0.3) ▲
Physics (PATS-P)							
	Belgium (Flemish)	9 (1.2)	13 (1.4)	57 (2.1)	59 (1.8)	34 (2.3)	28 (2.6)
	Bulgaria	26 (2.3)	44 (1.9) ▲	59 (2.8) ▲	46 (1.9)	15 (1.6)	9 (1.6)
	Czech Republic	8 (1.4)	22 (1.6) ▲	58 (1.8)	60 (1.9)	34 (2.2) ▲	18 (1.8)
	Finland	4 (0.6)	18 (1.4) ▲	52 (1.7)	58 (1.6)	44 (1.7) ▲	24 (1.4)
	Hungary	5 (0.7)	17 (1.2) ▲	62 (1.4)	62 (1.5)	33 (1.5) ▲	20 (1.4)
	Latvia (LSS)	10 (0.9)	26 (1.8) ▲	71 (1.4)	66 (1.8)	20 (1.5) ▲	8 (1.0)
	Lithuania †	11 (1.1)	24 (1.4) ▲	66 (1.5)	64 (1.6)	23 (1.6) ▲	12 (1.5)
	Macedonia, Rep. of	39 (1.6)	50 (1.8) ▲	51 (1.5) ▲	43 (1.5)	10 (1.0) ▲	7 (0.8)
	Moldova	23 (1.2)	26 (1.5)	73 (1.2)	71 (1.5)	4 (0.5)	3 (0.5)
	Morocco	x x	x x	x x	x x	x x	x x
	Netherlands c	5 (1.1)	17 (1.4) ▲	56 (2.4)	62 (1.7)	38 (2.6) ▲	21 (2.0)
	Romania	13 (1.3)	21 (1.6) ▲	65 (1.3)	64 (1.5)	22 (1.6) ▲	15 (1.5)
	Russian Federation	24 (1.7)	39 (1.6) ▲	68 (1.5) ▲	57 (1.6)	8 (0.9) ▲	4 (0.5)
	Slovak Republic	6 (0.7)	22 (1.4) ▲	66 (1.5)	62 (1.3)	28 (1.6) ▲	16 (1.3)
	Slovenia	6 (0.6)	18 (1.2) ▲	56 (1.7)	65 (1.5) ▲	37 (1.8) ▲	17 (1.2)
	International Avg.	14 (0.3)	29 (0.4) ▲	61 (0.5) ▲	58 (0.4)	25 (0.5) ▲	14 (0.4)
Chemistry (PATS-C)							
	Belgium (Flemish)	--	--	--	--	--	--
	Bulgaria	25 (1.6)	27 (1.7)	59 (1.5)	53 (1.8)	17 (1.7)	20 (2.3)
	Czech Republic	15 (1.4)	14 (1.3)	61 (2.2)	60 (1.9)	24 (2.2)	27 (1.8)
	Finland	9 (1.2)	21 (1.3) ▲	62 (1.5)	62 (1.4)	29 (1.6) ▲	17 (1.3)
	Hungary	8 (0.8)	10 (0.9)	62 (1.7)	61 (1.6)	30 (1.8)	29 (1.8)
	Latvia (LSS)	20 (1.3)	23 (1.7)	68 (1.2)	66 (1.5)	13 (1.2)	11 (1.2)
	Lithuania †	12 (1.2)	12 (1.2)	65 (1.6)	66 (1.6)	24 (1.6)	22 (1.8)
	Macedonia, Rep. of	41 (2.0)	43 (1.8)	51 (1.7)	49 (1.5)	8 (0.9)	8 (0.9)
	Moldova	24 (1.3)	23 (1.7)	72 (1.3)	69 (1.7)	4 (0.5)	8 (0.9) ▲
	Morocco	x x	x x	x x	x x	x x	x x
	Netherlands	--	--	--	--	--	--
	Romania	22 (1.5)	19 (1.2)	60 (1.6)	63 (1.5)	18 (1.4)	18 (1.4)
	Russian Federation	28 (1.5)	28 (1.3)	63 (1.3)	61 (1.2)	9 (1.2)	10 (0.9)
	Slovak Republic	18 (1.4)	21 (1.6)	67 (1.5)	63 (1.6)	16 (1.7)	16 (1.4)
	Slovenia	11 (1.0)	11 (0.9)	58 (1.7)	58 (1.5)	32 (1.7)	31 (1.4)
	International Avg.	19 (0.4)	24 (0.4) ▲	62 (0.5) ▲	59 (0.4)	19 (0.4) ▲	17 (0.4)

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

Exhibit 4.12 Trends in Index of Positive Attitudes Towards the Sciences (PATS)*

	High PATS			Medium PATS			Low PATS		
	Percent of Students			Percent of Students			Percent of Students		
	1995	1999	1995-1999 Difference	1995	1999	1995-1999 Difference	1995	1999	1995-1999 Difference
General/Integrated Science (PATS-G)									
G									
Australia	22 (0.8)	27 (1.1)	5 (1.4) ▲	53 (0.9)	53 (1.0)	0 (1.4) ●	25 (1.0)	20 (1.2)	-5 (1.5) ▼
Canada	29 (1.1)	30 (0.8)	1 (1.4) ●	52 (1.2)	52 (0.8)	0 (1.4) ●	19 (1.1)	18 (0.8)	-1 (1.4) ●
Cyprus	31 (1.2)	33 (0.9)	2 (1.5) ●	53 (1.0)	53 (0.8)	0 (1.3) ●	15 (1.0)	13 (0.8)	-2 (1.2) ●
England	36 (1.4)	39 (1.1)	3 (1.8) ●	52 (1.3)	53 (1.1)	1 (1.7) ●	12 (0.9)	8 (0.6)	-4 (1.1) ▼
Hong Kong, SAR	21 (1.1)	25 (1.0)	4 (1.5) ●	65 (1.1)	65 (0.8)	0 (1.4) ●	13 (1.0)	9 (0.6)	-4 (1.2) ▼
Iran, Islamic Rep.	63 (1.2)	56 (1.4)	-7 (1.8) ▼	34 (1.2)	40 (1.3)	7 (1.8) ▲	3 (0.4)	4 (0.3)	1 (0.5) ●
Israel †	25 (2.4)	26 (1.3)	1 (2.7) ●	55 (2.0)	52 (1.0)	-3 (2.2) ●	20 (1.6)	22 (1.3)	2 (2.0) ●
Italy	30 (1.4)	29 (1.4)	-1 (2.0) ●	58 (1.2)	58 (1.3)	0 (1.8) ●	12 (1.3)	13 (1.1)	0 (1.7) ●
Japan	10 (0.6)	10 (0.5)	0 (0.8) ●	64 (1.0)	60 (0.9)	-3 (1.3) ●	26 (1.0)	30 (1.0)	4 (1.5) ●
Korea, Rep. of	12 (0.7)	10 (0.5)	-2 (0.9) ●	72 (0.9)	66 (0.7)	-6 (1.1) ▼	16 (0.9)	24 (0.8)	7 (1.2) ▲
New Zealand	27 (1.3)	28 (1.0)	1 (1.6) ●	55 (0.9)	56 (0.8)	1 (1.2) ●	17 (0.9)	16 (0.9)	-1 (1.2) ●
Singapore	48 (1.7)	46 (1.4)	-2 (2.2) ●	48 (1.5)	49 (1.2)	1 (1.9) ●	3 (0.4)	5 (0.6)	2 (0.7) ●
Thailand †	49 (1.4)	43 (1.3)	-5 (1.9) ●	50 (1.3)	55 (1.3)	5 (1.8) ●	1 (0.2)	1 (0.2)	0 (0.3) ●
United States	33 (1.2)	32 (0.9)	-1 (1.5) ●	51 (1.0)	51 (0.8)	0 (1.3) ●	16 (0.7)	16 (0.6)	0 (0.9) ●
International Avg. §	30 (0.3)	31 (0.3)	0 (0.5) ●	55 (0.3)	55 (0.3)	0 (0.4) ●	15 (0.3)	15 (0.2)	0 (0.4) ●
Earth Science (PATS-E)									
M									
Belgium (Flemish)	12 (1.0)	9 (0.7)	-3 (1.2) ●	56 (1.6)	56 (1.2)	0 (2.0) ●	32 (1.9)	35 (1.5)	3 (2.4) ●
Czech Republic	19 (1.2)	23 (1.4)	4 (1.9) ●	66 (1.1)	64 (1.2)	-2 (1.6) ●	15 (1.5)	13 (1.0)	-2 (1.8) ●
Hungary	13 (0.8)	14 (0.8)	1 (1.1) ●	67 (1.1)	67 (1.0)	1 (1.5) ●	20 (1.3)	18 (1.0)	-2 (1.7) ●
Latvia (LSS)	--	--	--	--	--	--	--	--	--
Lithuania	--	--	--	--	--	--	--	--	--
Netherlands	9 (0.9)	11 (1.3)	2 (1.6) ●	63 (1.9)	65 (1.5)	3 (2.4) ●	28 (2.4)	23 (1.7)	-5 (2.9) ●
Romania	37 (1.3)	40 (1.5)	3 (2.0) ●	56 (1.2)	56 (1.3)	0 (1.7) ●	7 (0.5)	4 (0.6)	-3 (0.8) ▼
Russian Federation	21 (1.1)	28 (1.8)	7 (2.1) ▲	67 (0.9)	65 (1.6)	-3 (1.9) ●	11 (0.9)	7 (0.6)	-4 (1.1) ▼
Slovak Republic	21 (1.1)	24 (1.2)	3 (1.6) ●	67 (0.9)	66 (1.0)	-2 (1.4) ●	12 (0.9)	11 (1.1)	-2 (1.4) ●
Slovenia	--	--	--	--	--	--	--	--	--
International Avg. §	20 (0.4)	21 (0.5)	2 (0.6) ●	64 (0.5)	63 (0.5)	-1 (0.7) ●	17 (0.5)	16 (0.4)	-1 (0.7) ●

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

▲ 1999 significantly higher than 1995

● No significant difference between 1995 and 1999

▼ 1999 significantly lower than 1995

Significance tests adjusted for multiple comparisons

Background data provided by students.

* Countries administered either a general/integrated science or separate subject area form of the questionnaire. In countries that administered the separate subject area form, students were asked about each subject area separately.

† 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.

¶ Netherlands: Data in physics panel pertain to physics/chemistry course.

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.

	High PATS			Medium PATS			Low PATS		
	Percent of Students			Percent of Students			Percent of Students		
	1995	1999	1995-1999 Difference	1995	1999	1995-1999 Difference	1995	1999	1995-1999 Difference
Biology (PATS-B)									
Belgium (Flemish)	24 (1.6)	17 (0.9)	-7 (1.8) ▼	57 (1.2)	61 (1.2)	3 (1.7) ●	19 (1.8)	23 (1.1)	3 (2.1) ●
Czech Republic	16 (1.2)	27 (1.5)	11 (1.9) ▲	66 (1.0)	60 (1.1)	-5 (1.5) ▼	19 (1.4)	12 (1.2)	-6 (1.8) ▼
Hungary	22 (1.1)	23 (1.1)	1 (1.6) ●	66 (1.1)	65 (1.1)	-1 (1.6) ●	12 (1.0)	12 (0.8)	0 (1.3) ●
Latvia (LSS)	41 (1.6)	26 (1.5)	-15 (2.1) ▼	45 (1.2)	66 (1.3)	21 (1.8) ▲	13 (1.1)	8 (0.8)	-6 (1.3) ▼
Lithuania	32 (1.3)	27 (1.3)	-5 (1.8) ●	60 (1.1)	65 (1.2)	5 (1.6) ▲	8 (0.6)	8 (0.7)	0 (1.0) ●
Netherlands	23 (1.3)	21 (1.8)	-2 (2.2) ●	62 (1.2)	63 (1.4)	1 (1.8) ●	15 (1.3)	16 (1.3)	1 (1.8) ●
Romania	40 (1.5)	37 (1.4)	-2 (2.0) ●	54 (1.3)	55 (1.2)	2 (1.8) ●	7 (0.6)	7 (0.7)	1 (1.0) ●
Russian Federation	36 (1.3)	41 (1.6)	5 (2.1) ●	59 (1.2)	55 (1.5)	-4 (1.9) ●	5 (0.5)	4 (0.3)	-1 (0.6) ●
Slovak Republic	18 (1.0)	19 (1.2)	1 (1.6) ●	69 (1.1)	70 (1.2)	1 (1.6) ●	13 (0.9)	11 (0.9)	-2 (1.3) ●
Slovenia	25 (1.5)	22 (1.1)	-3 (1.9) ●	59 (1.2)	64 (1.0)	4 (1.6) ●	15 (1.3)	14 (1.0)	-1 (1.7) ●
International Avg. [§]	28 (0.4)	26 (0.4)	-2 (0.6) ●	60 (0.4)	63 (0.4)	3 (0.5) ▲	13 (0.4)	11 (0.3)	-1 (0.5) ●
Physics (PATS-P)									
Belgium (Flemish)	13 (1.3)	11 (0.9)	-2 (1.6) ●	58 (2.2)	58 (1.5)	0 (2.6) ●	29 (2.2)	31 (1.9)	2 (2.9) ●
Czech Republic	11 (0.8)	15 (1.3)	3 (1.5) ●	57 (1.5)	59 (1.5)	1 (2.1) ●	31 (1.6)	26 (1.8)	-5 (2.4) ●
Hungary	10 (0.8)	11 (0.7)	1 (1.0) ●	62 (1.1)	62 (1.1)	0 (1.5) ●	28 (1.3)	27 (1.2)	-2 (1.8) ●
Latvia (LSS)	23 (1.2)	18 (1.1)	-5 (1.7) ▼	66 (1.2)	68 (1.1)	2 (1.6) ●	11 (1.0)	14 (1.1)	3 (1.5) ●
Lithuania	15 (1.0)	17 (1.0)	2 (1.4) ●	66 (1.1)	65 (1.2)	-1 (1.6) ●	18 (1.2)	18 (1.2)	-1 (1.7) ●
Netherlands ^c	14 (1.3)	11 (0.8)	-3 (1.5) ●	60 (1.6)	59 (1.7)	-1 (2.3) ●	26 (2.0)	30 (2.0)	4 (2.8) ●
Romania	25 (1.2)	17 (1.2)	-7 (1.7) ▼	62 (1.1)	64 (1.0)	2 (1.5) ●	13 (1.0)	18 (1.3)	5 (1.6) ▲
Russian Federation	26 (1.1)	31 (1.4)	5 (1.8) ▲	63 (1.4)	63 (1.3)	0 (1.9) ●	11 (1.1)	6 (0.6)	-5 (1.2) ▼
Slovak Republic	13 (0.8)	14 (0.8)	1 (1.1) ●	59 (1.2)	64 (1.1)	5 (1.6) ▲	28 (1.4)	22 (1.2)	-6 (1.9) ▼
Slovenia	13 (0.8)	12 (0.7)	-1 (1.0) ●	62 (1.3)	60 (1.2)	-2 (1.8) ●	25 (1.4)	28 (1.3)	3 (1.9) ●
International Avg. [§]	16 (0.3)	16 (0.3)	-1 (0.5) ●	62 (0.4)	62 (0.4)	1 (0.6) ●	22 (0.5)	22 (0.4)	0 (0.6) ●
Chemistry (PATS-C)									
Belgium (Flemish)	--	--	--	--	--	--	--	--	--
Czech Republic	9 (0.6)	14 (1.0)	5 (1.2) ▲	57 (1.4)	60 (1.5)	3 (2.1) ●	33 (1.7)	25 (1.7)	-8 (2.4) ▼
Hungary	10 (0.8)	9 (0.6)	-1 (1.0) ●	60 (1.3)	61 (1.3)	2 (1.8) ●	30 (1.4)	30 (1.5)	-1 (2.0) ●
Latvia (LSS)	25 (1.3)	21 (1.2)	-4 (1.7) ●	65 (1.1)	67 (1.0)	2 (1.5) ●	10 (0.9)	12 (1.0)	2 (1.4) ●
Lithuania	15 (0.8)	12 (0.9)	-3 (1.3) ●	68 (1.1)	65 (1.2)	-3 (1.6) ●	17 (1.1)	23 (1.4)	6 (1.8) ▲
Netherlands	--	--	--	--	--	--	--	--	--
Romania	25 (1.1)	20 (1.0)	-5 (1.5) ▼	61 (1.1)	61 (1.1)	0 (1.5) ●	14 (0.9)	18 (1.1)	4 (1.5) ▲
Russian Federation	19 (0.6)	28 (1.2)	9 (1.3) ▲	69 (1.0)	62 (1.0)	-7 (1.4) ▼	11 (1.0)	10 (0.9)	-1 (1.3) ●
Slovak Republic	8 (0.6)	20 (1.2)	11 (1.3) ▲	65 (1.2)	65 (1.2)	0 (1.7) ●	27 (1.3)	16 (1.3)	-11 (1.9) ▼
Slovenia	11 (0.7)	11 (0.7)	0 (1.0) ●	60 (1.3)	58 (1.3)	-2 (1.9) ●	29 (1.4)	31 (1.3)	2 (1.9) ●
International Avg. [§]	15 (0.3)	17 (0.4)	2 (0.5) ▲	63 (0.4)	62 (0.4)	-1 (0.6) ●	21 (0.4)	21 (0.5)	-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

Exhibit 4.13 Trends in Gender Differences in Percentages of Students at High Level of Index of Positive Attitudes Towards the Sciences (PATS)*

	1995			1999			Change in Gender Difference ¹
	Girls	Boys	Difference (Absolute Value)	Girls	Boys	Difference (Absolute Value)	
General/Integrated Science (PATS-G)							
G Thailand [†]	48 (1.4)	50 (1.8)	2 (1.7)	44 (1.6)	43 (1.6)	1 (1.9)	↔
Italy	26 (1.9)	34 (1.5) ▲	8 (2.2)	29 (2.1)	30 (1.5)	2 (2.2)	↔
Canada	26 (1.2)	31 (1.4) ▲	5 (1.3)	28 (1.1)	32 (1.1)	4 (1.5)	↔
Australia	20 (1.0)	24 (1.1)	4 (1.3)	25 (1.4)	29 (1.5)	5 (1.9)	↔
Iran, Islamic Rep.	62 (1.7)	64 (2.0)	2 (2.9)	59 (2.5)	54 (1.7)	5 (3.2)	↔
United States	31 (1.2)	34 (1.6)	3 (1.4)	29 (1.1)	35 (1.2) ▲	6 (1.4)	↔
Korea, Rep. of	8 (0.8)	15 (1.0) ▲	7 (1.2)	7 (0.6)	14 (0.7) ▲	7 (0.8)	↔
Japan	6 (0.5)	14 (0.9) ▲	9 (0.9)	6 (0.6)	13 (0.8) ▲	7 (0.9)	↔
New Zealand	23 (1.6)	32 (1.6) ▲	9 (2.0)	24 (1.0)	32 (1.4) ▲	8 (1.6)	↔
Cyprus	30 (1.4)	33 (1.5)	3 (1.7)	29 (1.6)	37 (1.3) ▲	8 (2.3)	↔
Hong Kong, SAR	15 (1.1)	27 (1.5) ▲	12 (1.5)	20 (1.2)	31 (1.3) ▲	12 (1.6)	↔
Israel [†]	21 (3.0)	29 (2.6)	8 (3.0)	20 (1.4)	32 (1.6) ▲	13 (1.5)	↔
Singapore	43 (1.8)	54 (2.1) ▲	11 (2.1)	39 (1.7)	52 (1.5) ▲	13 (1.6)	↔
England	28 (1.7)	44 (1.9) ▲	16 (2.4)	33 (1.7)	46 (1.4) ▲	14 (2.1)	↔
International Avg. [§]	28 (0.4)	35 (0.4) ▲	7 (0.5)	28 (0.4)	34 (0.4) ▲	6 (0.5)	↔
Earth Science (PATS-E)							
Latvia (LSS)	--	--	--	--	--	--	↔
Lithuania	--	--	--	--	--	--	↔
Slovenia	--	--	--	--	--	--	↔
Romania	34 (1.6)	39 (1.5) ▲	6 (1.8)	40 (2.1)	40 (1.8)	0 (2.5)	↔
Czech Republic	16 (1.6)	22 (1.5) ▲	6 (1.8)	21 (1.9)	26 (2.0)	4 (2.6)	↔
Belgium (Flemish)	7 (0.8)	16 (1.4) ▲	9 (1.5)	7 (0.7)	11 (0.9) ▲	5 (0.9)	↔
Hungary	12 (1.1)	15 (1.1)	3 (1.4)	11 (1.0)	17 (1.1) ▲	6 (1.3)	↔
Netherlands	7 (1.0)	12 (1.3) ▲	5 (1.4)	8 (1.0)	15 (1.8) ▲	7 (1.3)	↔
Russian Federation	17 (1.0)	26 (1.8) ▲	10 (1.8)	24 (1.9)	33 (2.0) ▲	9 (1.7)	↔
Slovak Republic	18 (1.4)	23 (1.5) ▲	5 (1.8)	19 (1.3)	29 (1.6) ▲	10 (1.7)	↔
International Avg. [§]	16 (0.5)	22 (0.5) ▲	6 (0.6)	18 (0.6)	24 (0.6) ▲	6 (0.7)	↔

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

▲ Significantly higher than other gender

Significance tests adjusted for multiple comparisons

Increased



Decreased



No change



Background data provided by students.

* Countries administered either a general/integrated science or separate subject area form of the questionnaire. In countries that administered the separate subject area form, students were asked about each subject area separately.

¹ 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.

^c Netherlands: Data in physics panel pertain to physics/chemistry course.

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

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

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

A dash (–) indicates data are not available.

Exhibit 4.13: Trends in Gender Differences in Percentages of Students at High Level of Index of Positive Attitudes Towards the Sciences (PATS)* (Continued)

	1995			1999			Change in Gender Difference ¹
	Girls	Boys	Difference (Absolute Value)	Girls	Boys	Difference (Absolute Value)	
Biology (PATS-B)							
Latvia (LSS)	44 (2.0)	38 (1.8)	6 (2.3)	27 (1.7)	25 (1.8)	2 (2.1)	↔
Belgium (Flemish)	25 (2.5)	22 (1.4)	2 (2.6)	19 (1.4) ▲	14 (0.9)	5 (1.5)	↔
Slovak Republic	21 (1.2) ▲	15 (1.3)	6 (1.3)	21 (1.5)	16 (1.4)	5 (1.7)	↔
Russian Federation	39 (1.7) ▲	33 (1.5)	6 (1.8)	44 (1.9) ▲	39 (1.7)	5 (1.8)	↔
Romania	42 (1.7)	38 (1.6)	4 (1.6)	41 (1.9)	34 (1.8)	6 (2.3)	↔
Lithuania	33 (1.9)	31 (1.3)	2 (2.2)	31 (1.6) ▲	23 (1.6)	7 (1.9)	↔
Slovenia	31 (1.8) ▲	20 (1.6)	11 (1.6)	27 (1.5) ▲	17 (1.2)	10 (1.7)	↔
Hungary	26 (1.5) ▲	18 (1.4)	9 (1.7)	28 (1.6) ▲	18 (1.2)	10 (1.8)	↔
Netherlands	28 (2.0) ▲	17 (1.8)	10 (2.7)	27 (2.6) ▲	14 (1.6)	13 (2.9)	↔
Czech Republic	19 (1.8) ▲	13 (1.1)	7 (1.8)	34 (2.0) ▲	20 (1.8)	14 (2.2)	↔
International Avg. [§]	31 (0.6) ▲	24 (0.5)	6 (0.6)	30 (0.6) ▲	22 (0.5)	8 (0.6)	↔
Physics (PATS-P)							
Belgium (Flemish)	8 (2.1)	18 (1.6) ▲	10 (2.8)	9 (1.2)	13 (1.4)	5 (1.7)	↔
Romania	21 (1.3)	29 (1.7) ▲	8 (1.9)	13 (1.3)	21 (1.6) ▲	9 (1.7)	↔
Netherlands ^c	6 (0.9)	22 (2.0) ▲	16 (1.9)	5 (1.1)	17 (1.4) ▲	11 (1.8)	↔
Slovenia	6 (0.7)	20 (1.4) ▲	14 (1.5)	6 (0.6)	18 (1.2) ▲	12 (1.4)	↔
Hungary	5 (0.7)	15 (1.3) ▲	9 (1.4)	5 (0.7)	17 (1.2) ▲	13 (1.3)	↔
Lithuania	11 (1.3)	21 (1.5) ▲	10 (1.9)	11 (1.1)	24 (1.4) ▲	13 (1.5)	↔
Czech Republic	5 (0.7)	18 (1.3) ▲	13 (1.3)	8 (1.4)	22 (1.6) ▲	14 (2.0)	↔
Russian Federation	18 (1.2)	35 (1.7) ▲	17 (1.9)	24 (1.7)	39 (1.6) ▲	15 (1.8)	↔
Slovak Republic	5 (0.7)	22 (1.2) ▲	17 (1.2)	6 (0.7)	22 (1.4) ▲	16 (1.5)	↔
Latvia (LSS)	13 (1.4)	33 (1.9) ▲	19 (2.3)	10 (0.9)	26 (1.8) ▲	17 (1.9)	↔
International Avg. [§]	10 (0.4)	23 (0.5) ▲	13 (0.6)	10 (0.4)	22 (0.5) ▲	12 (0.5)	↔
Chemistry (PATS-C)							
Netherlands	--	--	--	--	--	--	↔
Belgium (Flemish)	--	--	--	--	--	--	↔
Slovenia	11 (1.0)	10 (1.0)	1 (1.3)	11 (1.0)	11 (0.9)	0 (1.4)	↔
Lithuania	14 (1.1)	17 (1.2)	3 (1.6)	12 (1.2)	12 (1.2)	1 (1.5)	↔
Czech Republic	9 (0.7)	9 (0.9)	0 (1.0)	15 (1.4)	14 (1.3)	1 (1.8)	↔
Russian Federation	17 (1.1)	22 (1.0)	4 (1.7)	28 (1.5)	28 (1.3)	1 (1.4)	↔
Hungary	7 (0.9)	13 (1.1) ▲	5 (1.2)	8 (0.8)	10 (0.9)	2 (1.2)	↔
Romania	25 (1.4)	26 (1.6)	1 (1.9)	22 (1.5)	19 (1.2)	2 (1.6)	↔
Latvia (LSS)	24 (1.6)	27 (1.7)	3 (2.1)	20 (1.3)	23 (1.7)	3 (1.9)	↔
Slovak Republic	7 (0.6)	9 (0.9)	2 (1.0)	18 (1.4)	21 (1.6)	4 (1.9)	↔
International Avg. [§]	14 (0.4)	17 (0.4) ▲	2 (0.5)	16 (0.5)	17 (0.5) ▲	1 (0.6)	↔

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

▲ Significantly higher than other gender

Significance tests adjusted for multiple comparisons

Increased



Decreased



No change



