CHAPTER 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.

To provide an educational context for interpreting the achievement results of the Benchmarking participants, TIMSS collected detailed information from students about their home backgrounds, how they spend their time, and their attitudes towards science. This chapter presents eighth-grade students' responses to a subset of these questions. One set addresses home resources and support for academic achievement. Another examines how much out-of-school time students spend on their schoolwork. A third addresses 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 from the component questions and more detail about some areas are provided in the reference section of this report (see reference section R1).

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. TIMSS in 1995 showed that this was true of students from homes with large numbers of books, with a range of educational study aids, or with parents with university-level education.[1] The TIMSS 1999 international report presented combined student responses to these three variables in an index of home educational resources (HER) that was clearly related to achievement in science.[2]

Exhibit 4.1 summarizes the home educational resources index in a two-page display. The index is described on the first page. Students at 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 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.

2 Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., Gregory, K.D., Smith, T.A., Chrostowski, S.J., Garden, R.A., and O'Connor, K.M. (2000), *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade*, Chestnut Hill, MA: Boston College.

parent finished university. Students at 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 Benchmarking participant and for selected reference countries, together with the average science achievement for those students. Standard errors are also shown. Entities are ordered by the percentage of students at the high index level. The international average across all TIMSS 1999 countries is shown at the bottom. The second page of the display graphically shows the percentage of students at the high index level for each entity. There was a substantial difference in the average science achievement of students at the index levels in every entity for which data were available. This is reflected in the international average for the TIMSS 1999 countries, where the achievement difference between students at the high level (558) and the low level (431) amounted to 127 score points.

Relative to other countries, the United States had a large percentage of students at the high level of the home educational resources index (22 percent). Of the TIMSS 1999 countries included in Exhibit 4.1, only Canada had a comparable percentage of students at the high level (27 percent). The relatively high standing of the United States on this index was reflected in the results for the Benchmarking jurisdictions, most of which had larger percentages of students in the high category of home educational resources than did most of the comparison countries.

The Benchmarking participants with the greatest percentages of students at the high level included the Naperville School District (56 percent), the First in the World Consortium (45 percent), the Academy School District (44 percent), and Montgomery County (39 percent). With the exception of Montgomery County, these were also among the top-performing jurisdictions in science. The four urban Benchmarking school districts that had the lowest student achievement in science – the Rochester City School District, the Chicago Public Schools, the Jersey City Public Schools, and the Miami-Dade County Public Schools – also had the lowest percentages of students at the high level of the home educational resources index (only 7 to 10 percent).

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 the less wealthy areas 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, clearly other influences are also at work. For example, Chinese Taipei had about the same percentage of students (eight percent) at the high index level as Rochester, Chicago, Jersey City, and Miami-Dade, but the average science achievement of its students at that level was considerably higher. In fact, the international average for all 38 TIMSS 1999 countries was just nine percent. There is also evidence that financial resources alone will not result in high academic achievement. According to OECD analyses for 1994, U.S. schools ranked third highest among 22 countries in per-student expenditures on primary schools and third highest among 23 countries on secondary schools.[3]

Exhibits R1.1 through R1.3 in the reference section present more detailed information on the student responses that were combined in the home educational resources index. Exhibit R1.1 shows the percentage of eighth-grade students in each of the Benchmarking jurisdictions and comparison countries who 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.

Exhibit R1.2 shows for each entity the percentage of students at each of five ranges of numbers of books in the home in relation to average science achievement. In most jurisdictions, the more books students reported in the home, the higher their science achievement.

The percentages of students in each of five categories of parents' educational level are shown in Exhibit R1.3, together with their average science achievement. Although countries 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 R1.4 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 1999 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. The same was true for nearly all Benchmarking jurisdictions.

As information technology and the Internet become more and more important as an educational resource, those who do not have access to this technology will be increasingly at a disadvantage. To provide information about this "digital divide," Exhibit 4.2 presents the percentage of students in each entity that reported having a computer at home,

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3 *Education at a Glance: OECD Indicators* (1997), Paris, France: Organization for Economic Cooperation and Development. The OECD adjusted the expenditure estimates for the purchasing power of each country's currency.

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). 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 R1.4 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.

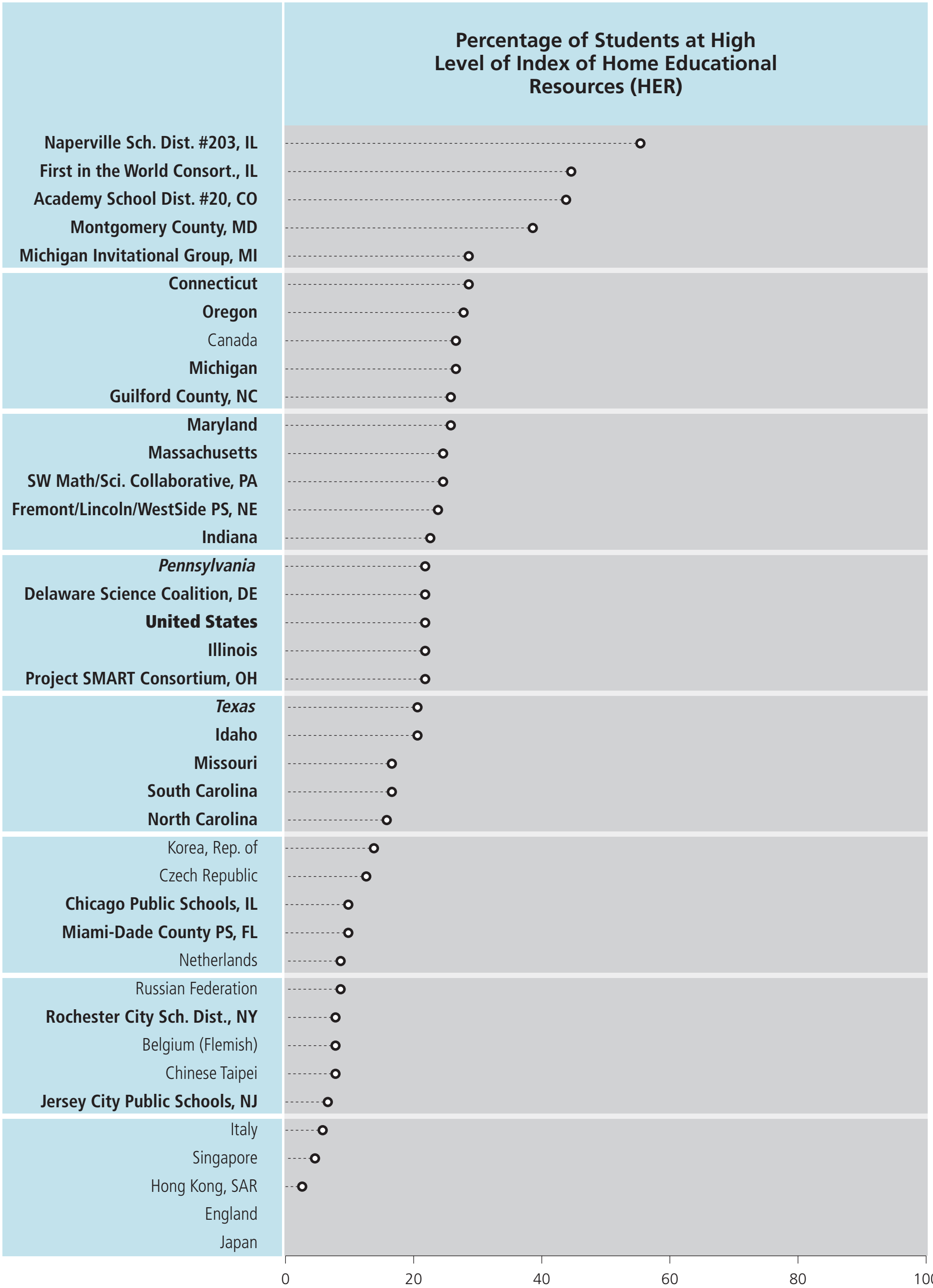
	High HER		Medium HER		Low HER	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Naperville Sch. Dist. #203, IL	56 (1.3)	599 (5.2)	43 (1.3)	565 (4.5)	0 (0.2)	~ ~
First in the World Consort., IL	45 (2.5)	587 (7.2)	53 (2.5)	552 (5.5)	2 (0.3)	~ ~
Academy School Dist. #20, CO	44 (1.6)	581 (3.0)	55 (1.6)	544 (3.1)	1 (0.3)	~ ~
Montgomery County, MD	39 (2.5)	575 (6.5)	59 (2.4)	509 (3.9)	2 (0.8)	~ ~
Michigan Invitational Group, MI	29 (2.6)	591 (11.8)	70 (2.6)	555 (5.7)	1 (0.3)	~ ~
Connecticut	29 (2.8)	573 (11.7)	68 (2.5)	516 (8.9)	3 (0.8)	426 (15.8)
Oregon	28 (2.6)	586 (6.7)	68 (2.6)	523 (5.1)	3 (0.6)	413 (26.6)
Canada	27 (1.0)	559 (3.8)	71 (1.0)	526 (2.1)	2 (0.2)	~ ~
Michigan	27 (2.9)	592 (7.8)	71 (2.7)	531 (8.3)	2 (0.5)	~ ~
Guilford County, NC	26 (2.0)	586 (5.6)	72 (1.7)	517 (7.8)	3 (0.4)	486 (17.4)
Maryland	26 (2.0)	559 (6.3)	71 (1.8)	492 (7.4)	3 (0.5)	417 (13.7)
Massachusetts	25 (2.1)	579 (8.3)	72 (1.8)	521 (6.9)	3 (0.6)	442 (14.0)
SW Math/Sci. Collaborative, PA	25 (2.8)	585 (7.6)	72 (2.9)	532 (6.6)	3 (0.8)	474 (18.3)
Fremont/Lincoln/WestSide PS, NE	24 (1.7)	560 (7.1)	72 (1.7)	499 (6.5)	3 (0.4)	433 (22.1)
Indiana	23 (2.6)	578 (8.0)	74 (2.4)	524 (6.1)	3 (0.5)	456 (14.1)
Pennsylvania	22 (2.7)	569 (6.9)	75 (2.6)	519 (5.6)	2 (0.4)	~ ~
Delaware Science Coalition, DE	22 (2.6)	562 (9.3)	75 (2.4)	488 (6.9)	3 (0.9)	426 (17.6)
United States	22 (1.5)	573 (3.8)	73 (1.4)	506 (4.2)	4 (0.5)	420 (7.3)
Illinois	22 (2.7)	577 (8.2)	74 (2.6)	509 (6.1)	4 (0.7)	438 (10.0)
Project SMART Consortium, OH	22 (2.3)	577 (10.0)	76 (2.1)	532 (7.7)	2 (0.5)	~ ~
Texas	21 (2.8)	581 (5.5)	70 (2.1)	504 (10.0)	9 (1.6)	408 (15.3)
Idaho	21 (1.8)	566 (7.0)	74 (1.6)	523 (5.5)	5 (1.1)	423 (13.1)
Missouri	17 (1.4)	567 (10.1)	79 (1.4)	517 (6.1)	4 (0.5)	453 (15.1)
South Carolina	17 (1.6)	570 (7.5)	79 (1.6)	503 (6.8)	4 (0.6)	433 (10.3)
North Carolina	16 (1.9)	559 (8.0)	81 (1.6)	502 (6.0)	4 (0.6)	430 (15.6)
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)
Chicago Public Schools, IL	10 (2.4)	493 (19.4)	81 (1.8)	449 (8.5)	9 (1.4)	408 (13.5)
Miami-Dade County PS, FL	10 (2.2)	511 (19.7)	80 (2.3)	426 (9.1)	11 (1.4)	361 (11.3)
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)
Rochester City Sch. Dist., NY	8 (1.5)	504 (24.3)	82 (1.4)	452 (6.5)	10 (0.9)	422 (10.7)
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)
Jersey City Public Schools, NJ	7 (1.2)	488 (21.7)	82 (1.3)	444 (9.3)	11 (1.0)	389 (8.1)
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)
Hong Kong, SAR	3 (0.3)	558 (9.6)	78 (0.8)	533 (3.7)	19 (0.9)	515 (4.5)
England	– –	– –	– –	– –	– –	– –
Japan	– –	– –	– –	– –	– –	– –
International Avg. (All Countries)	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.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

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

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



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

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together with their average science achievement. Compared with some of the reference countries as well as the international average (45 percent), students in the Benchmarking jurisdictions reported relatively high levels of computer ownership; more than 70 percent of students in each state reported having a computer at home. In the wealthier districts and consortia such as the Academy School District, the First in the World Consortium, Montgomery County, and the Naperville School District, more than 90 percent of students so reported. Even in the less advantaged public school districts, more than half the students reported having a computer at home. In almost every entity, students with a computer at home had higher average science achievement than those without.

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, when they are still developing proficiency in the language of instruction they can be at a disadvantage in learning situations. Exhibit 4.3 contains students' reports of how frequently they speak 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. In all of the Benchmarking states except Massachusetts and Texas, 90 percent or more of the students reported always or almost always speaking the language of the test at home. The percentage of students speaking the language of the test at home was lower in a number of school districts, however, particularly the public school systems in Chicago, Jersey City, and Miami-Dade.

Exhibit 4.4 presents students' reports of their race/ethnicity. Across the United States as a whole, 63 percent reported that they were white, 15 percent black, 12 percent Hispanic, five percent Asian or Pacific Islander, one percent American Indian or Alaskan Native, and four percent other. There was a pronounced relationship between race/ethnicity and science achievement, with white students having the highest average achievement, followed by Asian/Pacific Islander, Hispanic, and black students. This pattern was found even in the higher-performing and more affluent Benchmarking districts and consortia. Because minority students are often concentrated in urban schools, the resource disparities between urban and non-urban schools summarized in the introduction to this report are particularly troubling in light of the persistent achievement gaps between many minority and non-minority students.

Among Benchmarking states, Maryland, North Carolina, and South Carolina had more than 30 percent black students, and Texas more than 30 percent Hispanic. Racial composition varied even more among the Benchmarking districts and consortia. Predominantly white jurisdictions included the Academy School District, the Fremont/Lincoln/Westside Public Schools, the Michigan Invitational Group, Naperville, and the

Southwest Pennsylvania Math and Science Collaborative, with more than 80 percent white students. Ethnically more diverse jurisdictions included Chicago (47 percent black, 37 percent Hispanic), Jersey City (35 percent black, 35 percent Hispanic, 16 percent Asian/Pacific Islander), Miami-Dade (31 percent black, 55 percent Hispanic), Montgomery County (16 percent black, 12 percent Hispanic, 15 percent Asian/Pacific Islander), and Rochester (56 percent black, 16 percent Hispanic).

By the end of the eighth grade, students in most countries can say what their expectations are for further education. Although one-quarter or more of the students in some countries did not know, Exhibit 4.5 shows that, on average across countries, more than half the students reported that they expected to finish university (a four-year degree program or equivalent). The United States was among the countries that had the highest percentage, with almost 80 percent expecting to finish university. In almost every country, also, there was a positive association between educational expectations and science achievement. Among Benchmarking participants, the percentage of students expecting to finish university was also high, even in areas with low student achievement, as more than 70 percent of students in all Benchmarking entities reported that they expected to finish university.

Exhibits R1.5 to R1.7 in the reference section present eighth-grade students' reports about how they, their mothers, and their friends feel about the importance of doing well in various academic and non-academic activities. On average across the TIMSS 1999 countries, more than 90 percent of 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 (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). In general, the reports of students in the Benchmarking jurisdictions resembled those in the United States overall. It is noteworthy, however, that students in the U.S. and in many Benchmarking jurisdictions were less likely than their counterparts internationally, on average, to report that their friends think it is important to do well in science, mathematics, and language, and were more likely to report that they, their mothers, and their friends think it is important to have fun.

Students were also asked why they needed to do well in science (see Exhibit R1.8). In most entities, getting into their desired secondary school or university was a stronger motivating factor than was pleasing their parents or getting their desired job.

Exhibit 4.2 Students Having a Computer at Home

8th Grade Science

	Have Computer at Home		Do Not Have Computer at Home	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Countries				
United States	80 (1.2)	531 (3.9)	20 (1.2)	464 (6.5)
Belgium (Flemish)	86 (1.0)	540 (2.9)	14 (1.0)	507 (6.6)
Canada	85 (0.8)	538 (2.1)	15 (0.8)	506 (4.7)
Chinese Taipei	63 (1.0)	585 (4.2)	37 (1.0)	542 (5.6)
Czech Republic	47 (1.2)	558 (4.6)	53 (1.2)	523 (4.7)
England	85 (0.8)	545 (4.8)	15 (0.8)	509 (8.0)
Hong Kong, SAR	72 (1.3)	536 (3.6)	28 (1.3)	515 (4.9)
Italy	63 (1.0)	502 (4.5)	37 (1.0)	479 (4.4)
Japan	52 (0.9)	563 (2.8)	48 (0.9)	536 (2.7)
Korea, Rep. of	67 (0.9)	562 (2.9)	33 (0.9)	523 (3.1)
Netherlands	96 (1.0)	547 (6.8)	4 (1.0)	498 (21.2)
Russian Federation	22 (1.2)	534 (7.2)	78 (1.2)	528 (6.9)
Singapore	80 (1.3)	581 (7.6)	20 (1.3)	515 (10.1)
States				
Connecticut	88 (1.7)	539 (9.7)	12 (1.7)	461 (11.5)
Idaho	82 (2.1)	537 (5.5)	18 (2.1)	481 (9.6)
Illinois	80 (2.1)	533 (6.5)	20 (2.1)	470 (6.2)
Indiana	81 (1.5)	544 (6.8)	19 (1.5)	493 (8.7)
Maryland	86 (1.4)	515 (6.9)	14 (1.4)	453 (11.1)
Massachusetts	87 (1.6)	542 (7.2)	13 (1.6)	478 (6.5)
Michigan	85 (1.7)	555 (7.3)	15 (1.7)	486 (12.6)
Missouri	76 (1.8)	535 (6.5)	24 (1.8)	486 (7.7)
North Carolina	74 (1.8)	521 (6.0)	26 (1.8)	471 (7.8)
Oregon	86 (1.7)	547 (5.1)	14 (1.7)	474 (10.4)
Pennsylvania	83 (2.0)	538 (5.6)	17 (2.0)	483 (10.4)
South Carolina	75 (2.2)	524 (6.5)	25 (2.2)	473 (8.4)
Texas	73 (3.3)	536 (8.3)	27 (3.3)	447 (11.6)
Districts and Consortia				
Academy School Dist. #20, CO	96 (0.5)	561 (2.2)	4 (0.5)	509 (11.9)
Chicago Public Schools, IL	61 (1.7)	462 (10.0)	39 (1.7)	432 (9.7)
Delaware Science Coalition, DE	82 (1.6)	512 (8.5)	18 (1.6)	454 (10.0)
First in the World Consort., IL	96 (0.6)	569 (4.9)	4 (0.6)	491 (20.0)
Fremont/Lincoln/WestSide PS, NE	81 (1.6)	525 (6.0)	19 (1.6)	456 (10.1)
Guilford County, NC	81 (1.6)	546 (6.9)	19 (1.6)	482 (9.8)
Jersey City Public Schools, NJ	58 (2.3)	458 (12.7)	42 (2.3)	417 (6.7)
Miami-Dade County PS, FL	66 (2.8)	442 (11.4)	34 (2.8)	397 (9.4)
Michigan Invitational Group, MI	89 (1.6)	570 (5.9)	11 (1.6)	522 (11.4)
Montgomery County, MD	91 (1.4)	540 (4.2)	9 (1.4)	450 (11.8)
Naperville Sch. Dist. #203, IL	98 (0.4)	585 (4.1)	2 (0.4)	~ ~
Project SMART Consortium, OH	83 (1.2)	547 (8.9)	17 (1.2)	501 (8.9)
Rochester City Sch. Dist., NY	61 (2.3)	455 (9.0)	39 (2.3)	452 (8.2)
SW Math/Sci. Collaborative, PA	82 (1.9)	553 (6.6)	18 (1.9)	498 (11.0)
International Avg. (All Countries)	45 (0.2)	509 (1.1)	55 (0.2)	470 (1.0)

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

Background data provided by students.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) 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 Frequency with Which Students Speak Language of the Test at Home

8th Grade Science

	Always or Almost Always		Sometimes		Never	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Countries						
United States	90 (1.0)	524 (4.3)	9 (1.0)	456 (7.4)	1 (0.1)	~ ~
Belgium (Flemish)	86 (1.3)	542 (2.8)	8 (0.7)	504 (10.7)	6 (0.9)	496 (18.1)
Canada	91 (0.6)	537 (2.3)	8 (0.5)	494 (7.4)	2 (0.2)	~ ~
Chinese Taipei	67 (1.4)	587 (4.8)	31 (1.3)	535 (5.5)	2 (0.2)	~ ~
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)	~ ~
Hong Kong, SAR r	80 (2.4)	523 (4.2)	17 (1.9)	536 (8.8)	3 (0.5)	551 (11.5)
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)	~ ~
Korea, Rep. of	96 (0.3)	551 (2.6)	4 (0.3)	504 (8.6)	0 (0.0)	~ ~
Netherlands	86 (2.4)	550 (6.9)	8 (1.2)	509 (14.8)	6 (1.8)	536 (11.7)
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)
States						
Connecticut	90 (1.4)	537 (9.4)	8 (1.4)	464 (19.0)	2 (0.3)	~ ~
Idaho	92 (1.4)	534 (5.9)	7 (1.3)	444 (15.4)	1 (0.3)	~ ~
Illinois	91 (1.3)	528 (6.7)	8 (1.2)	465 (7.1)	1 (0.2)	~ ~
Indiana	96 (0.6)	538 (6.8)	3 (0.5)	473 (18.1)	1 (0.3)	~ ~
Maryland	91 (0.8)	510 (7.5)	8 (0.7)	485 (12.8)	1 (0.3)	~ ~
Massachusetts	88 (1.6)	541 (7.0)	10 (1.4)	484 (14.6)	2 (0.3)	~ ~
Michigan	96 (0.6)	549 (8.1)	3 (0.4)	481 (19.9)	1 (0.2)	~ ~
Missouri	95 (0.6)	527 (7.0)	4 (0.5)	472 (15.6)	1 (0.2)	~ ~
North Carolina	96 (0.5)	510 (6.5)	3 (0.4)	485 (14.6)	1 (0.2)	~ ~
Oregon	92 (1.1)	544 (5.4)	7 (0.9)	464 (17.0)	1 (0.4)	~ ~
Pennsylvania	95 (1.1)	532 (6.4)	5 (0.9)	491 (16.6)	1 (0.3)	~ ~
South Carolina	97 (0.4)	514 (6.9)	2 (0.4)	~ ~	0 (0.2)	~ ~
Texas	82 (2.9)	527 (9.8)	17 (2.8)	442 (12.2)	1 (0.4)	~ ~
Districts and Consortia						
Academy School Dist. #20, CO	93 (0.8)	562 (2.2)	6 (0.7)	539 (13.7)	1 (0.3)	~ ~
Chicago Public Schools, IL	77 (4.7)	453 (10.7)	21 (4.6)	444 (13.1)	2 (0.7)	~ ~
Delaware Science Coalition, DE	91 (0.9)	507 (8.4)	6 (0.9)	466 (12.4)	3 (0.5)	454 (17.7)
First in the World Consort., IL	85 (1.3)	571 (5.2)	14 (1.3)	533 (8.7)	1 (0.3)	~ ~
Fremont/Lincoln/WestSide PS, NE	92 (1.1)	518 (6.3)	7 (0.9)	454 (11.1)	1 (0.3)	~ ~
Guilford County, NC	95 (0.7)	537 (6.8)	4 (0.7)	495 (19.1)	1 (0.5)	~ ~
Jersey City Public Schools, NJ	74 (1.5)	442 (10.1)	26 (1.4)	444 (13.5)	1 (0.3)	~ ~
Miami-Dade County PS, FL	59 (4.1)	436 (11.0)	36 (3.6)	418 (13.1)	5 (0.8)	424 (12.8)
Michigan Invitational Group, MI	96 (0.6)	567 (6.4)	3 (0.5)	533 (14.2)	1 (0.3)	~ ~
Montgomery County, MD	83 (1.9)	541 (4.8)	15 (2.0)	494 (10.0)	2 (0.6)	~ ~
Naperville Sch. Dist. #203, IL	93 (0.5)	585 (4.2)	6 (0.6)	581 (10.6)	1 (0.2)	~ ~
Project SMART Consortium, OH	95 (0.9)	543 (8.3)	4 (0.7)	480 (15.9)	1 (0.3)	~ ~
Rochester City Sch. Dist., NY	86 (1.3)	457 (7.9)	13 (1.1)	444 (11.4)	2 (0.6)	~ ~
SW Math/Sci. Collaborative, PA	98 (0.4)	545 (7.2)	1 (0.3)	~ ~	1 (0.2)	~ ~
International Avg. (All Countries)	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.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

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

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

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

Exhibit 4.4 Students' Race/Ethnicity

8th Grade Science

	White		Black		Hispanic	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
States						
Connecticut	74 (4.5)	553 (7.7)	10 (3.0)	444 (9.4)	9 (2.2)	453 (17.5)
Idaho	83 (2.0)	537 (5.3)	1 (0.3)	~ ~	10 (1.7)	451 (11.0)
Illinois	65 (3.4)	550 (6.3)	17 (2.9)	448 (8.2)	12 (2.3)	457 (9.5)
Indiana	83 (2.3)	548 (6.5)	10 (2.2)	438 (9.7)	3 (0.6)	507 (16.7)
Maryland	55 (4.2)	540 (5.0)	30 (3.9)	443 (9.1)	4 (0.6)	485 (14.2)
Massachusetts	74 (3.4)	550 (6.6)	7 (1.6)	461 (16.0)	8 (1.4)	464 (10.5)
Michigan	82 (3.4)	564 (5.5)	10 (3.4)	413 (10.5)	3 (0.6)	507 (18.5)
Missouri	78 (3.2)	543 (4.8)	15 (3.1)	438 (13.9)	2 (0.4)	~ ~
North Carolina	62 (3.5)	539 (5.6)	31 (3.2)	450 (8.7)	3 (0.5)	463 (18.1)
Oregon	80 (1.9)	549 (4.8)	1 (0.5)	~ ~	8 (1.1)	451 (15.9)
Pennsylvania	78 (4.5)	545 (5.0)	12 (3.7)	448 (13.6)	3 (1.3)	500 (9.7)
South Carolina	63 (4.0)	549 (5.5)	32 (4.0)	443 (6.8)	1 (0.4)	~ ~
Texas	47 (5.2)	563 (4.8)	13 (2.5)	444 (18.4)	32 (4.7)	461 (9.5)
Districts and Consortia						
Academy School Dist. #20, CO	82 (1.0)	565 (2.6)	3 (0.5)	508 (15.8)	7 (0.6)	528 (10.1)
Chicago Public Schools, IL	11 (3.2)	475 (14.8)	47 (10.6)	433 (12.3)	37 (8.9)	460 (13.4)
Delaware Science Coalition, DE	63 (2.3)	527 (8.8)	24 (2.0)	450 (7.6)	5 (0.7)	465 (12.1)
First in the World Consort., IL	74 (1.8)	573 (5.7)	1 (0.3)	~ ~	7 (0.8)	484 (10.3)
Fremont/Lincoln/WestSide PS, NE	83 (1.6)	524 (6.3)	3 (0.8)	461 (27.3)	4 (0.7)	440 (17.7)
Guilford County, NC	57 (2.1)	568 (5.4)	35 (2.3)	479 (8.5)	2 (0.5)	~ ~
Jersey City Public Schools, NJ	7 (0.9)	482 (21.4)	35 (1.7)	410 (10.1)	35 (1.1)	451 (7.6)
Miami-Dade County PS, FL	7 (2.5)	522 (21.7)	31 (5.6)	388 (11.8)	55 (6.8)	445 (7.8)
Michigan Invitational Group, MI	88 (1.2)	567 (5.9)	4 (1.0)	497 (16.6)	1 (0.5)	~ ~
Montgomery County, MD	50 (2.7)	568 (7.3)	16 (1.3)	470 (7.9)	12 (1.8)	475 (15.1)
Naperville Sch. Dist. #203, IL	82 (1.0)	585 (4.2)	1 (0.4)	~ ~	2 (0.5)	~ ~
Project SMART Consortium, OH	79 (1.9)	552 (8.7)	10 (1.5)	478 (15.5)	4 (0.7)	462 (23.1)
Rochester City Sch. Dist., NY	16 (2.2)	521 (14.0)	56 (2.6)	430 (5.5)	16 (1.7)	452 (9.9)
SW Math/Sci. Collaborative, PA	87 (2.9)	555 (6.3)	10 (2.6)	448 (11.1)	1 (0.3)	~ ~
United States	63 (2.4)	547 (4.2)	15 (1.9)	438 (6.0)	12 (1.6)	462 (7.2)

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

Background data provided by students.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) 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.

	Asian/ Pacific Islander		American Indian/ Alaskan Native		Other	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
States						
Connecticut	2 (0.4)	~ ~	0 (0.2)	~ ~	4 (0.6)	514 (16.1)
Idaho	2 (0.5)	~ ~	2 (0.5)	~ ~	2 (0.3)	~ ~
Illinois	4 (0.9)	539 (10.2)	0 (0.2)	~ ~	2 (0.4)	~ ~
Indiana	2 (0.4)	~ ~	1 (0.3)	~ ~	2 (0.4)	~ ~
Maryland	5 (0.6)	539 (12.3)	1 (0.2)	~ ~	5 (0.6)	517 (11.1)
Massachusetts	5 (0.8)	552 (26.5)	1 (0.2)	~ ~	5 (0.8)	503 (14.5)
Michigan	2 (0.3)	~ ~	1 (0.2)	~ ~	3 (0.3)	509 (16.5)
Missouri	1 (0.3)	~ ~	1 (0.4)	~ ~	3 (0.4)	475 (14.4)
North Carolina	1 (0.3)	~ ~	1 (0.4)	~ ~	2 (0.4)	~ ~
Oregon	4 (0.7)	530 (11.7)	3 (0.5)	498 (17.8)	4 (0.5)	548 (15.3)
Pennsylvania	3 (1.4)	524 (24.8)	1 (0.2)	~ ~	3 (0.5)	517 (17.8)
South Carolina	1 (0.2)	~ ~	1 (0.2)	~ ~	2 (0.3)	~ ~
Texas	4 (1.4)	548 (18.5)	1 (0.1)	~ ~	3 (0.4)	513 (18.4)
Districts and Consortia						
Academy School Dist. #20, CO	4 (0.6)	559 (9.6)	1 (0.3)	~ ~	4 (0.5)	543 (16.0)
Chicago Public Schools, IL	2 (1.0)	~ ~	1 (0.2)	~ ~	2 (0.5)	~ ~
Delaware Science Coalition, DE	2 (0.6)	~ ~	1 (0.2)	~ ~	5 (0.9)	490 (17.1)
First in the World Consort., IL	15 (1.7)	580 (6.5)	1 (0.4)	~ ~	2 (0.8)	~ ~
Fremont/Lincoln/WestSide PS, NE	3 (0.5)	470 (20.7)	2 (0.4)	~ ~	5 (0.9)	481 (13.3)
Guilford County, NC	4 (0.4)	505 (10.2)	1 (0.2)	~ ~	2 (0.5)	~ ~
Jersey City Public Schools, NJ	16 (1.7)	471 (21.8)	0 (0.2)	~ ~	7 (0.8)	457 (20.2)
Miami-Dade County PS, FL	2 (0.6)	~ ~	1 (0.1)	~ ~	5 (1.1)	438 (28.5)
Michigan Invitational Group, MI	3 (0.5)	587 (26.1)	0 (0.2)	~ ~	3 (0.3)	580 (19.2)
Montgomery County, MD	15 (1.4)	538 (7.8)	1 (0.2)	~ ~	6 (0.8)	524 (11.5)
Naperville Sch. Dist. #203, IL	12 (0.8)	593 (7.8)	0 (0.1)	~ ~	3 (0.5)	592 (17.0)
Project SMART Consortium, OH	3 (0.5)	541 (24.5)	1 (0.2)	~ ~	3 (0.7)	550 (25.3)
Rochester City Sch. Dist., NY	3 (0.5)	497 (19.2)	2 (0.5)	~ ~	7 (1.0)	478 (13.8)
SW Math/Sci. Collaborative, PA	1 (0.4)	~ ~	0 (0.1)	~ ~	2 (0.4)	~ ~
United States	5 (1.3)	527 (8.7)	1 (0.2)	~ ~	4 (0.3)	502 (12.4)

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

Exhibit 4.5 Students' Expectations for Finishing School*

8th Grade Science

	Finish University[1]		Some Vocational/ Technical Education or University Only[2]		Finish Secondary School Only[3]		Some Secondary School Only		Don't 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
Countries										
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)
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)
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)
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)
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	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –
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)
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)
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)
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)
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)
States										
Connecticut	80 (1.6)	540 (11.0)	8 (1.0)	491 (15.9)	4 (0.5)	464 (13.4)	1 (0.2)	~ ~	7 (0.8)	501 (10.2)
Idaho	72 (2.0)	541 (5.7)	11 (0.9)	521 (7.7)	7 (0.9)	459 (11.5)	1 (0.2)	~ ~	9 (0.9)	486 (9.6)
Illinois	81 (1.2)	531 (7.0)	9 (0.8)	487 (8.5)	4 (0.7)	441 (12.7)	0 (0.1)	~ ~	6 (0.6)	496 (14.4)
Indiana	79 (1.6)	547 (6.7)	9 (0.9)	490 (9.3)	4 (0.6)	472 (12.0)	1 (0.2)	~ ~	7 (0.7)	502 (13.4)
Maryland	80 (1.2)	516 (7.3)	9 (0.7)	483 (13.0)	4 (0.5)	431 (21.1)	1 (0.2)	~ ~	6 (0.6)	487 (9.4)
Massachusetts	78 (1.5)	545 (7.2)	10 (0.6)	493 (10.4)	5 (0.7)	457 (14.8)	1 (0.1)	~ ~	6 (0.7)	518 (9.2)
Michigan	83 (1.1)	554 (8.4)	7 (0.7)	501 (11.1)	3 (0.4)	486 (15.7)	1 (0.1)	~ ~	6 (0.5)	512 (16.7)
Missouri	72 (1.5)	536 (7.5)	12 (0.9)	504 (9.1)	8 (0.8)	463 (9.4)	1 (0.2)	~ ~	7 (0.6)	507 (12.0)
North Carolina	79 (1.5)	519 (6.7)	9 (0.7)	480 (9.2)	6 (0.7)	439 (10.8)	1 (0.1)	~ ~	4 (0.4)	483 (11.5)
Oregon	76 (1.9)	549 (5.3)	10 (0.9)	516 (8.1)	5 (0.8)	458 (15.4)	1 (0.2)	~ ~	9 (0.9)	510 (11.9)
Pennsylvania	77 (1.4)	538 (6.5)	9 (0.7)	514 (13.1)	5 (0.6)	471 (12.4)	1 (0.1)	~ ~	7 (0.6)	505 (9.5)
South Carolina	80 (1.3)	526 (7.0)	9 (0.8)	452 (11.5)	6 (0.6)	436 (11.5)	0 (0.1)	~ ~	5 (0.5)	474 (10.0)
Texas	80 (2.0)	528 (8.9)	7 (0.8)	456 (14.8)	6 (1.3)	404 (25.6)	1 (0.3)	~ ~	6 (0.7)	476 (20.9)
Districts and Consortia										
Academy School Dist. #20, CO	83 (1.1)	568 (2.4)	5 (0.6)	500 (11.0)	3 (0.4)	489 (19.1)	1 (0.3)	~ ~	8 (0.9)	539 (9.2)
Chicago Public Schools, IL	74 (1.8)	460 (10.1)	11 (0.8)	432 (12.5)	8 (1.2)	399 (14.5)	1 (0.3)	~ ~	6 (0.9)	436 (16.7)
Delaware Science Coalition, DE	74 (2.2)	519 (8.4)	11 (0.8)	461 (9.1)	7 (1.1)	432 (13.4)	1 (0.4)	~ ~	7 (1.0)	470 (10.3)
First in the World Consort., IL	92 (1.1)	570 (5.1)	3 (0.8)	507 (17.5)	1 (0.5)	~ ~	0 (0.2)	~ ~	4 (0.8)	536 (19.2)
Fremont/Lincoln/WestSide PS, NE	74 (2.3)	529 (5.8)	7 (1.1)	472 (14.1)	5 (1.3)	432 (14.7)	1 (0.2)	~ ~	12 (1.4)	483 (15.5)
Guilford County, NC	89 (1.5)	541 (6.9)	5 (0.9)	485 (14.8)	3 (0.8)	436 (18.0)	0 (0.3)	~ ~	3 (0.6)	518 (19.4)
Jersey City Public Schools, NJ	80 (1.6)	450 (11.2)	8 (0.9)	415 (10.3)	6 (0.8)	405 (16.9)	0 (0.0)	~ ~	6 (0.8)	401 (16.0)
Miami-Dade County PS, FL	76 (2.4)	445 (9.8)	10 (1.3)	376 (17.0)	6 (0.7)	364 (17.4)	1 (0.2)	~ ~	7 (1.0)	381 (18.4)
Michigan Invitational Group, MI	80 (2.1)	574 (6.5)	9 (1.6)	550 (8.3)	5 (0.7)	503 (18.2)	1 (0.3)	~ ~	5 (0.8)	519 (15.8)
Montgomery County, MD	85 (1.0)	541 (4.2)	6 (0.9)	477 (18.2)	2 (0.3)	~ ~	1 (0.3)	~ ~	7 (0.6)	516 (9.3)
Naperville Sch. Dist. #203, IL	94 (0.8)	586 (4.0)	3 (0.5)	538 (14.3)	1 (0.3)	~ ~	0 (0.1)	~ ~	3 (0.5)	548 (24.6)
Project SMART Consortium, OH	81 (2.1)	550 (9.0)	8 (1.1)	501 (8.2)	4 (0.8)	499 (15.7)	1 (0.3)	~ ~	7 (0.8)	493 (11.8)
Rochester City Sch. Dist., NY	76 (1.6)	464 (7.5)	9 (1.1)	427 (15.9)	7 (0.9)	393 (15.9)	1 (0.3)	~ ~	8 (1.0)	440 (14.6)
SW Math/Sci. Collaborative, PA	80 (2.1)	552 (6.8)	8 (0.8)	519 (11.6)	5 (0.5)	471 (17.6)	0 (0.1)	~ ~	7 (1.2)	516 (10.7)
International Avg (All Countries)	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 R1.4 for country 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. For the United States, includes community college, college, or university.

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).

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) 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.

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

One of the main ways for students to consolidate and extend classroom learning is to spend time out of school studying or doing homework. 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 and Benchmarking jurisdiction, TIMSS constructed an index of out-of-school study time (OST) that assigns students to a high, medium, or low level based on 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.

Exhibit 4.6 shows the percentages of students at each level of this index, and their average science achievement, for Benchmarking participants and comparison countries. On average across all the TIMSS 1999 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. The United States was one of the countries with relatively little emphasis on homework, with just 22 percent of students at the high level and 23 percent at the low level. Among Benchmarking participants, the jurisdictions that reported the greatest amount of out-of-school study time included the Jersey City and Chicago Public Schools, and the Academy School District, which each had more than one-third of their students at the high level of the index.

On average internationally, and in many of the Benchmarking entities, students at the low index level 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 necessarily associated with higher achievement. In many of the Benchmarking entities, students at the medium level of the study index had average achievement that was as high as or higher than that of students at the high level. This pattern suggests that, compared with their higher-achieving counterparts, the lower-performing students may do less homework, either because they simply do not do it or because their teachers do not assign it, or more homework, perhaps in an effort to keep up academically.

More detailed information on the amount of time students reported spending on science homework is presented in Exhibit 4.7. The results reveal that while students on average across all the TIMSS 1999 countries spent one hour per day doing science homework, students in the Benchmarking jurisdictions and the United States spent less. 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. On average across all countries, 36 percent of students reported spending one hour or more per day doing science homework. None of the Benchmarking entities reported this much homework. The highest levels of science homework were reported in Massachusetts, the Academy School District, and the public school systems in Chicago, Jersey City, Miami-Dade, and Rochester, where more than 20 percent of students reported spending one hour or more. The lowest levels were reported in Idaho, Indiana, Missouri, Oregon, Texas, the Delaware Science Coalition, the Fremont/Lincoln/Westside Public Schools, and the Project SMART Consortium, where at least one-fourth of the students reported spending no time at all doing science homework on a normal school day.

Further detail on the student data that underlie the out-of-school study time index appears in Exhibit R1.9 in the reference section. In comparison with the one hour each day spent on science homework, the TIMSS 1999 countries on average reported 2.8 hours of homework in total. None of the Benchmarking jurisdictions reached this level, the highest being 2.7 hours in Chicago and Jersey City, and the lowest 1.8 hours in Texas, the Fremont/Lincoln/Westside Public Schools, and Project SMART. To provide a fuller picture of how students spend their out-of-school time on a school day, Exhibit R1.10, also in the reference section, gives students' reports on how they spend their daily leisure time. The two most popular activities internationally were watching television or videos and playing or talking with friends (each about two hours per day). Among Benchmarking participants, students generally reported spending a little more time on these activities and on sports, and less time reading for enjoyment. For example, in the four jurisdictions with the lowest average science achievement – the public school systems of Rochester, Chicago, Jersey City, and Miami-Dade – students reported watching television or videos for about three to three and one-half hours (as well as playing computer games for about one hour).

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 R1.9). 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.

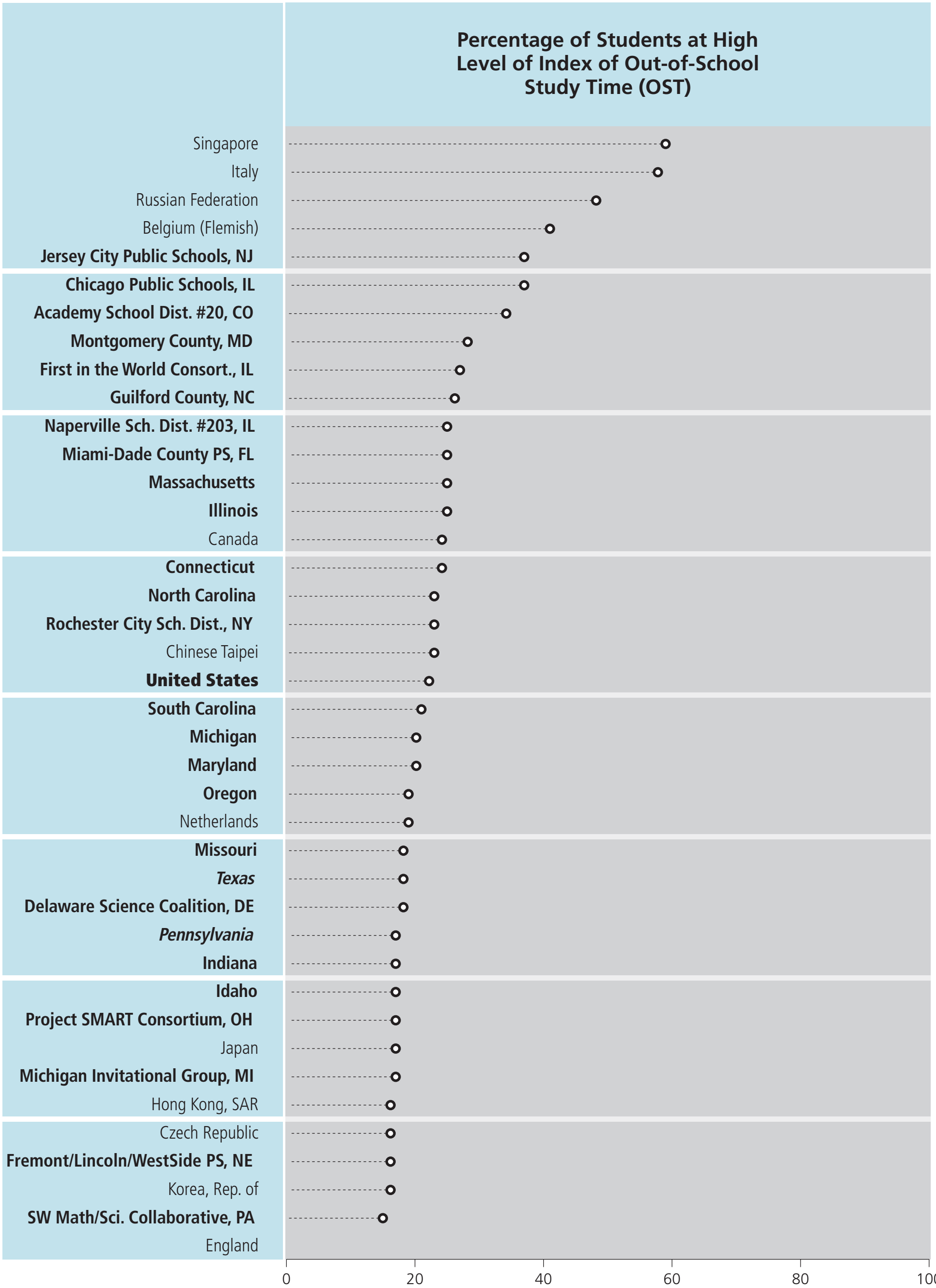
	High OST		Medium OST		Low OST	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Singapore	59 (1.2)	573 (7.2)	35 (0.9)	571 (9.8)	7 (0.6)	514 (13.3)
Italy	58 (1.3)	504 (4.4)	36 (1.2)	497 (5.0)	6 (0.6)	419 (8.6)
Russian Federation	48 (1.3)	541 (6.3)	46 (1.2)	536 (7.0)	6 (0.6)	493 (9.7)
Belgium (Flemish)	41 (1.3)	529 (3.0)	52 (1.1)	545 (3.6)	7 (1.0)	514 (14.4)
Jersey City Public Schools, NJ	37 (2.4)	451 (12.3)	47 (1.8)	449 (9.2)	16 (1.7)	418 (9.0)
Chicago Public Schools, IL	37 (2.1)	458 (10.4)	51 (1.6)	452 (9.6)	12 (1.2)	445 (13.2)
Academy School Dist. #20, CO	34 (1.3)	567 (3.4)	55 (1.4)	565 (3.4)	11 (0.9)	526 (9.9)
Montgomery County, MD	28 (1.4)	547 (7.1)	57 (2.3)	541 (5.0)	15 (1.5)	491 (10.4)
First in the World Consort., IL	27 (2.4)	565 (7.2)	61 (2.2)	567 (6.7)	12 (1.1)	557 (11.2)
Guilford County, NC	26 (1.6)	527 (6.1)	62 (1.9)	540 (8.6)	12 (1.0)	526 (11.3)
Naperville Sch. Dist. #203, IL	25 (1.4)	584 (6.2)	63 (1.7)	588 (4.8)	12 (0.9)	571 (10.4)
Miami-Dade County PS, FL	25 (1.5)	435 (15.5)	51 (1.3)	439 (9.7)	24 (2.4)	416 (11.3)
Massachusetts	25 (1.7)	535 (8.3)	62 (1.6)	546 (7.5)	13 (1.2)	487 (9.1)
Illinois	25 (1.6)	509 (7.7)	58 (1.2)	530 (7.2)	17 (1.4)	517 (6.5)
Canada	24 (0.8)	519 (3.3)	59 (1.0)	542 (2.3)	18 (0.8)	531 (4.6)
Connecticut	24 (1.1)	524 (12.5)	62 (1.7)	543 (10.0)	15 (1.5)	494 (11.1)
North Carolina	23 (1.2)	507 (8.6)	57 (1.3)	521 (5.8)	19 (1.6)	483 (7.5)
Rochester City Sch. Dist., NY	23 (1.8)	455 (9.9)	56 (2.3)	468 (8.4)	21 (2.2)	429 (8.8)
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)
South Carolina	21 (1.3)	502 (9.2)	57 (1.1)	526 (6.6)	22 (1.4)	499 (8.6)
Michigan	20 (1.1)	549 (9.5)	59 (1.0)	553 (8.0)	20 (1.3)	528 (10.4)
Maryland	20 (1.0)	511 (9.6)	60 (1.3)	522 (6.5)	20 (1.3)	472 (11.4)
Oregon	19 (1.1)	548 (7.6)	55 (1.5)	545 (5.6)	25 (1.7)	522 (8.7)
Netherlands	19 (1.4)	519 (12.8)	74 (1.3)	553 (6.9)	7 (1.0)	543 (11.4)
Missouri	18 (1.5)	516 (7.5)	54 (1.5)	533 (6.7)	28 (1.6)	514 (8.4)
Texas	18 (1.4)	521 (11.2)	49 (2.2)	524 (9.4)	33 (2.6)	502 (11.9)
Delaware Science Coalition, DE	18 (1.0)	490 (10.8)	58 (2.1)	524 (9.0)	24 (1.9)	472 (8.9)
Pennsylvania	17 (1.9)	520 (8.1)	59 (2.0)	540 (5.8)	24 (1.9)	516 (9.0)
Indiana	17 (1.3)	530 (8.1)	58 (1.5)	544 (6.8)	25 (2.0)	524 (8.5)
Idaho	17 (1.3)	527 (9.0)	55 (1.9)	536 (5.8)	28 (2.1)	514 (9.2)
Project SMART Consortium, OH	17 (1.0)	534 (11.1)	58 (1.2)	550 (8.6)	26 (1.6)	522 (9.9)
Japan	17 (0.9)	558 (5.9)	49 (0.9)	558 (2.7)	35 (1.3)	535 (3.7)
Michigan Invitational Group, MI	17 (1.1)	570 (14.3)	63 (1.8)	571 (4.6)	20 (1.9)	543 (9.1)
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)
Fremont/Lincoln/WestSide PS, NE	16 (1.8)	509 (7.1)	54 (1.6)	533 (5.6)	30 (2.2)	486 (8.6)
Korea, Rep. of	16 (0.7)	574 (4.6)	43 (0.7)	561 (3.7)	41 (1.0)	527 (2.9)
SW Math/Sci. Collaborative, PA	15 (1.1)	531 (8.3)	61 (1.6)	555 (7.2)	24 (1.9)	525 (10.0)
England	– –	– –	– –	– –	– –	– –
International Avg. (All Countries)	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.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

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.



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

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

	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	
Countries							
United States	16 (0.8)	502 (5.9)	60 (1.3)	532 (4.6)	24 (1.4)	495 (6.4)	0.6 (0.01)
Belgium (Flemish)	31 (1.4)	520 (3.7)	55 (1.2)	543 (3.9)	14 (1.1)	538 (8.8)	0.8 (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)
Chinese Taipei	20 (0.9)	607 (4.7)	42 (0.9)	588 (4.4)	38 (1.3)	530 (5.7)	0.6 (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	– –	– –	– –	– –	– –	– –	– –
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)
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)
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)
Netherlands	15 (1.3)	507 (12.9)	80 (1.5)	555 (6.4)	6 (0.8)	530 (11.6)	0.6 (0.02)
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)
States							
Connecticut	18 (1.0)	516 (12.2)	68 (1.8)	542 (10.3)	14 (1.5)	493 (11.5)	0.7 (0.02)
Idaho	14 (1.3)	521 (9.8)	57 (2.2)	536 (5.7)	29 (2.4)	514 (8.9)	0.6 (0.02)
Illinois	17 (1.1)	495 (8.3)	64 (1.5)	531 (7.5)	20 (1.6)	511 (6.0)	0.6 (0.02)
Indiana	12 (0.8)	519 (9.6)	61 (1.8)	543 (6.8)	26 (2.0)	526 (8.4)	0.5 (0.02)
Maryland	17 (1.1)	495 (9.7)	65 (1.3)	519 (6.8)	18 (1.1)	480 (11.8)	0.6 (0.02)
Massachusetts	21 (1.4)	521 (9.9)	67 (1.5)	546 (7.0)	12 (1.0)	490 (9.8)	0.7 (0.02)
Michigan	13 (1.0)	530 (11.7)	65 (1.4)	552 (7.6)	21 (1.6)	536 (11.5)	0.6 (0.02)
Missouri	16 (1.2)	507 (6.2)	54 (1.9)	537 (6.7)	30 (2.0)	509 (9.6)	0.5 (0.02)
North Carolina	18 (1.1)	489 (6.1)	60 (1.8)	522 (6.3)	22 (1.9)	488 (10.1)	0.6 (0.02)
Oregon	13 (1.4)	536 (7.6)	59 (2.2)	547 (5.8)	28 (2.2)	523 (8.7)	0.5 (0.03)
Pennsylvania	14 (2.1)	506 (7.1)	62 (2.6)	540 (5.6)	24 (1.8)	518 (10.5)	0.6 (0.02)
South Carolina	16 (1.5)	487 (8.9)	61 (1.6)	526 (6.5)	23 (1.6)	495 (10.9)	0.6 (0.02)
Texas	13 (1.0)	489 (13.5)	51 (1.9)	525 (8.9)	36 (2.1)	507 (13.4)	0.5 (0.03)
Districts and Consortia							
Academy School Dist. #20, CO	24 (1.4)	550 (4.8)	64 (1.4)	570 (3.1)	12 (0.8)	526 (9.4)	0.8 (0.03)
Chicago Public Schools, IL	27 (1.8)	461 (12.4)	55 (1.6)	452 (9.7)	17 (1.8)	434 (10.3)	0.8 (0.03)
Delaware Science Coalition, DE	15 (1.3)	476 (10.0)	60 (2.1)	522 (8.9)	25 (2.2)	475 (8.3)	0.6 (0.03)
First in the World Consort., IL	16 (2.1)	556 (11.1)	69 (2.7)	570 (6.3)	15 (1.8)	557 (10.8)	0.6 (0.03)
Fremont/Lincoln/WestSide PS, NE	10 (1.2)	488 (10.8)	57 (1.6)	531 (5.0)	33 (1.4)	490 (7.1)	0.5 (0.03)
Guilford County, NC	17 (1.6)	518 (9.0)	68 (2.1)	542 (8.2)	15 (1.7)	520 (10.6)	0.6 (0.02)
Jersey City Public Schools, NJ	29 (1.9)	447 (13.0)	53 (1.9)	450 (8.9)	18 (2.0)	413 (10.0)	0.8 (0.03)
Miami-Dade County PS, FL	24 (2.1)	427 (12.0)	55 (1.5)	439 (10.6)	21 (2.3)	411 (14.5)	0.7 (0.04)
Michigan Invitational Group, MI	14 (0.8)	555 (10.7)	67 (1.2)	573 (5.8)	19 (1.3)	545 (10.2)	0.6 (0.01)
Montgomery County, MD	18 (1.5)	526 (8.6)	67 (2.1)	541 (4.7)	15 (1.3)	504 (8.4)	0.7 (0.03)
Naperville Sch. Dist. #203, IL	17 (1.4)	570 (6.4)	69 (1.8)	592 (4.5)	14 (1.4)	564 (10.6)	0.6 (0.02)
Project SMART Consortium, OH	13 (0.9)	516 (12.8)	62 (1.5)	551 (8.9)	25 (1.7)	523 (10.5)	0.5 (0.02)
Rochester City Sch. Dist., NY	23 (2.0)	449 (10.8)	57 (2.5)	468 (8.1)	20 (2.4)	425 (8.5)	0.7 (0.04)
SW Math/Sci. Collaborative, PA	10 (1.1)	513 (12.1)	66 (1.9)	554 (6.9)	24 (1.8)	527 (9.8)	0.5 (0.02)
International Avg. (All Countries)	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.

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) 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.

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). It 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 combinations of responses. (As an example of one of the components of the index, Exhibit R1.11 in the reference section shows the percentages of agreement for the statement "science is not one of my strengths.")

The percentages of eighth-grade students at each index level, 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 (including all the Benchmarking participants), and in separate panels for earth science, biology, physics, and chemistry for countries that teach the sciences separately. Among all the single-science countries, the United States had the greatest percentage of students at the high level of the self-concept index: 45 percent compared with 26 percent on average across all countries. Several of the Benchmarking participants had even greater percentages at the high level, notably the First in the World Consortium and North Carolina, with more than 50 percent of students at this level.

Although there was a clear positive association between self-concept and science achievement within every country and within every Benchmarking jurisdiction, the relationship across entities was more complex. Several countries with high average science achievement, including Singapore, Japan, Hong Kong, Chinese Taipei, and Korea, had relatively low percentages of students (21 percent or less) 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. 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[4] in all subjects. 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 TIMSS 1995 data by gender[5] 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 than in language, and to doing well in science in order to get a good job. Not surprisingly, therefore, many countries, including the United States, showed differences in science self-concept between girls and boys. Exhibit 4.9 presents the percentages of girls and boys in the Benchmarking entities and in the reference countries at the high, medium, and low levels of the science self-concept index. Despite the gender differences in the United States as a whole, there were few significant differences among Benchmarking participants. There were greater percentages of boys at the high index level in Massachusetts, Missouri, Naperville, and the Southwest Pennsylvania Math and Science Collaborative. Naperville had a greater percentage of girls at the low level. Greater percentages of girls at the medium level were found in Massachusetts, Oregon, and Rochester.

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

5 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.

Exhibits 4.8-4.9

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.

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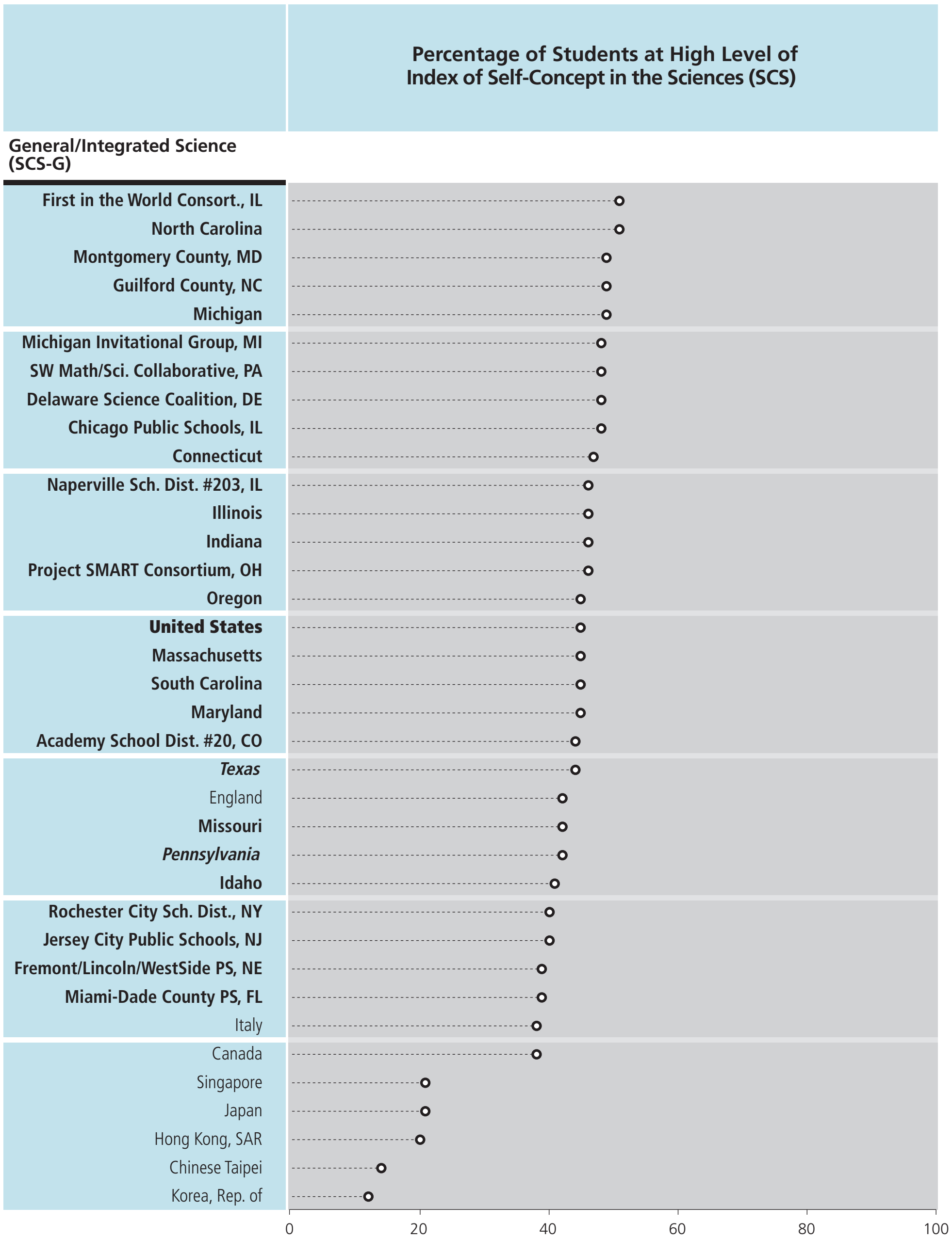
	High SCS		Medium SCS		Low SCS	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
General/Integrated Science (SCS-G)						
First in the World Consort., IL	51 (1.8)	587 (6.3)	36 (1.8)	553 (5.6)	13 (1.3)	515 (8.7)
North Carolina	51 (2.2)	533 (6.8)	37 (1.5)	494 (7.3)	13 (1.1)	457 (8.5)
Montgomery County, MD	49 (2.1)	565 (4.8)	35 (1.2)	517 (7.0)	15 (1.8)	462 (9.0)
Guilford County, NC	49 (2.2)	566 (5.9)	40 (1.6)	515 (8.7)	11 (1.6)	469 (8.0)
Michigan	49 (1.7)	572 (8.9)	37 (1.3)	531 (8.6)	13 (1.0)	498 (9.7)
Michigan Invitational Group, MI	48 (2.9)	587 (7.1)	40 (2.2)	556 (5.2)	11 (1.2)	508 (9.8)
SW Math/Sci. Collaborative, PA	48 (2.3)	568 (8.9)	37 (1.3)	532 (8.1)	15 (1.9)	500 (10.5)
Delaware Science Coalition, DE	48 (2.6)	533 (7.7)	37 (1.6)	491 (8.6)	15 (1.6)	455 (8.3)
Chicago Public Schools, IL	48 (2.7)	470 (10.0)	41 (1.9)	440 (9.6)	11 (1.7)	407 (11.6)
Connecticut	47 (2.3)	557 (10.4)	38 (1.7)	519 (10.4)	15 (1.3)	477 (10.8)
Naperville Sch. Dist. #203, IL	46 (2.2)	613 (5.9)	40 (1.9)	572 (4.5)	14 (1.2)	523 (7.1)
Illinois	46 (1.6)	551 (7.0)	40 (1.0)	502 (7.6)	14 (0.9)	473 (6.0)
Indiana	46 (2.2)	564 (6.2)	41 (1.7)	523 (7.7)	14 (1.4)	479 (8.0)
Project SMART Consortium, OH	46 (2.9)	571 (8.9)	39 (1.8)	524 (7.6)	15 (1.9)	486 (7.8)
Oregon	45 (1.9)	567 (6.5)	39 (1.6)	527 (6.8)	16 (1.3)	486 (10.5)
United States	45 (1.2)	550 (4.5)	40 (0.8)	505 (4.4)	15 (0.7)	459 (6.2)
Massachusetts	45 (2.0)	565 (7.3)	40 (1.3)	522 (6.4)	16 (1.3)	475 (9.1)
South Carolina	45 (2.4)	542 (8.8)	41 (1.9)	496 (7.2)	14 (1.0)	467 (8.2)
Maryland	45 (1.7)	541 (6.9)	39 (1.1)	492 (8.2)	16 (1.2)	460 (7.7)
Academy School Dist. #20, CO	44 (1.2)	584 (4.0)	40 (1.4)	552 (3.1)	16 (1.0)	509 (6.7)
Texas	44 (2.7)	554 (7.8)	41 (1.8)	497 (11.7)	16 (1.5)	442 (12.0)
England	42 (1.3)	573 (5.8)	45 (1.2)	528 (4.6)	13 (0.8)	486 (8.6)
Missouri	42 (1.5)	553 (7.7)	39 (1.0)	514 (6.5)	19 (1.5)	479 (8.3)
Pennsylvania	42 (1.2)	556 (6.5)	42 (0.8)	521 (6.5)	16 (1.2)	489 (10.6)
Idaho	41 (1.7)	559 (6.5)	40 (1.1)	516 (7.0)	19 (1.3)	486 (6.3)
Rochester City Sch. Dist., NY	40 (2.2)	473 (7.8)	39 (1.8)	460 (9.2)	21 (1.6)	427 (10.5)
Jersey City Public Schools, NJ	40 (1.7)	461 (11.2)	45 (1.8)	440 (11.4)	16 (1.6)	399 (9.7)
Fremont/Lincoln/WestSide PS, NE	39 (2.9)	551 (4.8)	40 (2.3)	503 (7.3)	21 (2.2)	461 (11.4)
Miami-Dade County PS, FL	39 (2.1)	469 (10.5)	41 (1.3)	414 (8.6)	20 (2.1)	381 (13.6)
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)
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)
Korea, Rep. of	12 (0.5)	601 (5.0)	80 (0.6)	547 (2.6)	8 (0.4)	490 (4.5)
International Avg. (All General Science Countries)	26 (0.2)	521 (1.4)	56 (0.2)	475 (1.0)	18 (0.2)	439 (1.3)

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

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

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

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



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

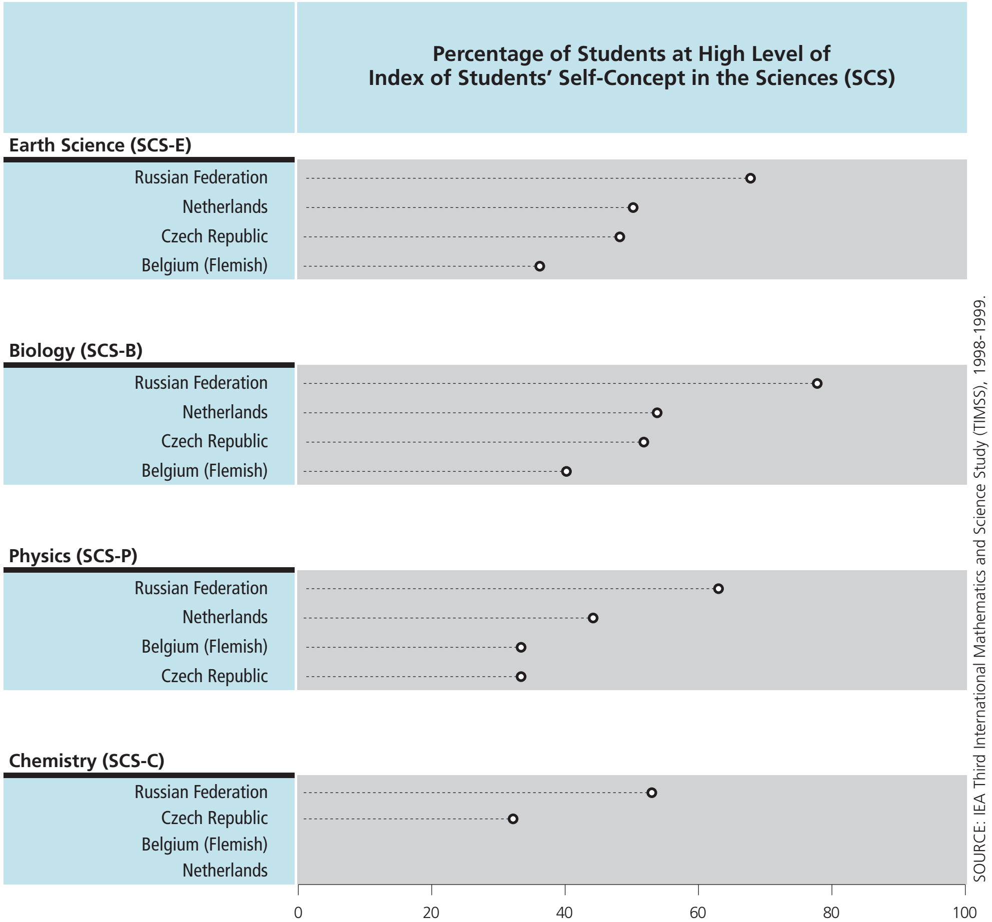
	High SCS		Medium SCS		Low SCS	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Earth Science (SCS-E)						
Russian Federation	68 (1.2)	545 (6.4)	22 (0.9)	519 (7.2)	10 (0.6)	488 (8.1)
Netherlands	50 (1.7)	555 (7.3)	43 (1.4)	538 (8.3)	7 (0.6)	527 (9.8)
Czech Republic	48 (1.5)	552 (4.8)	43 (1.2)	533 (4.6)	9 (0.7)	506 (8.2)
Belgium (Flemish)	36 (1.1)	555 (4.5)	49 (1.3)	535 (3.5)	15 (0.9)	511 (5.3)
International Avg. (All Separate Science Countries)	42 (0.4)	522 (1.5)	43 (0.3)	496 (1.5)	15 (0.3)	467 (2.0)
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)
Czech Republic	52 (1.5)	551 (4.8)	40 (1.2)	532 (4.8)	8 (0.8)	506 (7.3)
Belgium (Flemish)	40 (1.2)	557 (3.9)	48 (1.2)	529 (2.9)	12 (0.8)	496 (6.3)
International Avg. (All Separate Science Countries)	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 [b]	44 (2.4)	563 (8.2)	45 (1.8)	533 (6.9)	11 (1.2)	526 (8.4)
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)
International Avg. (All Separate Science Countries)	32 (0.4)	530 (1.6)	46 (0.3)	501 (1.4)	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)
Czech Republic	32 (1.7)	561 (5.6)	48 (1.3)	537 (3.8)	20 (1.4)	511 (5.9)
Belgium (Flemish)	– –	– –	– –	– –	– –	– –
Netherlands	– –	– –	– –	– –	– –	– –
International Avg. (All Separate Science Countries)	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.

b 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.



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*

8th Grade Science

General/Integrated Science (SCS-G)

G

		High SCS Percent of Students		Medium SCS Percent of Students		Low SCS Percent of Students	
		Girls	Boys	Girls	Boys	Girls	Boys
Countries	United States	42 (1.2)	48 (1.6) ▲	42 (1.0) ▲	38 (1.1)	16 (0.7)	14 (0.9)
	Canada	35 (1.3)	41 (1.3)	49 (1.4) ▲	42 (1.1)	16 (0.7)	17 (0.8)
	Chinese Taipei [a]	10 (0.6)	18 (0.9) ▲	60 (0.9)	62 (1.1)	30 (1.0) ▲	20 (1.1)
	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)
	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)
	Korea, Rep. of	8 (0.5)	15 (0.8) ▲	83 (0.7) ▲	78 (0.9)	9 (0.6)	7 (0.5)
	Singapore	17 (1.0)	26 (1.5) ▲	61 (1.0)	58 (1.2)	23 (1.1) ▲	16 (1.0)
States	Connecticut	44 (2.9)	51 (2.4)	40 (2.1)	37 (2.1)	17 (1.6)	13 (1.5)
	Idaho	40 (2.0)	42 (2.2)	41 (1.3)	39 (1.7)	20 (1.6)	18 (1.6)
	Illinois	42 (1.8)	50 (2.4)	42 (1.7)	37 (1.7)	15 (1.2)	12 (1.2)
	Indiana	44 (2.5)	47 (2.6)	41 (1.7)	40 (2.7)	15 (1.8)	12 (1.6)
	Maryland	43 (2.1)	47 (1.8)	42 (1.3)	37 (1.5)	16 (1.2)	16 (1.3)
	Massachusetts	42 (1.9)	48 (2.6) ▲	43 (1.3) ▲	36 (2.0)	16 (1.7)	16 (1.4)
	Michigan	47 (2.3)	52 (2.0)	38 (2.2)	37 (1.6)	15 (1.6)	11 (1.1)
	Missouri	38 (1.7)	46 (2.3) ▲	42 (1.7)	35 (1.6)	19 (1.5)	19 (1.8)
	North Carolina	51 (2.3)	50 (2.6)	35 (1.6)	38 (2.0)	13 (1.6)	12 (1.1)
	Oregon	41 (2.4)	48 (2.1)	44 (2.1) ▲	35 (1.8)	15 (1.8)	17 (2.0)
	Pennsylvania	40 (1.6)	43 (1.9)	43 (1.4)	41 (1.0)	17 (1.5)	16 (1.4)
	South Carolina	42 (3.3)	48 (2.3)	44 (2.7)	38 (1.9)	15 (1.6)	15 (1.1)
	Texas	41 (3.0)	47 (2.8)	42 (2.2)	39 (1.8)	17 (1.7)	14 (1.8)
Districts	Academy School Dist. #20, CO	40 (2.2)	48 (1.7)	44 (2.5)	36 (1.9)	16 (1.5)	16 (1.2)
	Chicago Public Schools, IL	45 (3.1)	51 (3.6)	42 (2.2)	40 (3.2)	13 (2.5)	10 (1.2)
	Delaware Science Coalition, DE	46 (2.8)	49 (3.5)	38 (2.3)	36 (2.1)	15 (1.6)	15 (2.1)
	First in the World Consort., IL	46 (3.0)	56 (2.1)	39 (2.9)	32 (2.0)	14 (1.7)	12 (1.6)
	Fremont/Lincoln/WestSide PS, NE	35 (3.3)	44 (3.4)	43 (3.4)	38 (3.3)	23 (3.3)	19 (2.0)
	Guilford County, NC	47 (3.0)	52 (2.3)	40 (2.4)	39 (2.2)	12 (1.5)	10 (2.3)
	Jersey City Public Schools, NJ	38 (2.4)	42 (2.5)	46 (2.3)	43 (2.6)	16 (1.8)	16 (2.6)
	Miami-Dade County PS, FL	40 (3.1)	39 (1.9)	42 (2.0)	40 (1.8)	19 (2.5)	21 (2.7)
	Michigan Invitational Group, MI	48 (5.1)	48 (3.1)	41 (4.1)	40 (2.4)	11 (1.6)	12 (1.7)
	Montgomery County, MD	47 (2.7)	52 (2.4)	36 (2.1)	34 (2.0)	17 (1.8)	14 (2.3)
	Naperville Sch. Dist. #203, IL	40 (2.1)	53 (3.0) ▲	42 (1.9)	37 (2.9)	17 (1.8) ▲	10 (1.4)
	Project SMART Consortium, OH	43 (3.3)	48 (3.4)	40 (2.5)	38 (2.2)	17 (2.2)	14 (2.3)
	Rochester City Sch. Dist., NY	36 (2.3)	45 (3.0)	43 (1.8) ▲	34 (2.2)	21 (1.6)	21 (2.3)
	SW Math/Sci. Collaborative, PA	43 (2.8)	53 (2.5) ▲	39 (1.4)	34 (1.8)	18 (2.7)	12 (1.6)
	International Avg. (All General Science Countries)	25 (0.3)	28 (0.3) ▲	57 (0.3) ▲	55 (0.2)	19 (0.2) ▲	18 (0.2)

▲ Significantly higher than other gender

Significance tests adjusted for multiple comparisons

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

Background data provided by students.

* 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.

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

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

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) 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 SCS Percent of Students		Medium SCS Percent of Students		Low SCS Percent of Students	
	Girls	Boys	Girls	Boys	Girls	Boys
Earth Science (SCS-E)						
Belgium (Flemish)	33 (1.6)	38 (1.8)	50 (1.2)	48 (1.8)	17 (1.5)	14 (0.7)
Czech Republic	48 (2.1)	48 (1.9)	43 (1.8)	43 (1.4)	9 (0.8)	9 (1.1)
Netherlands	43 (2.3)	57 (2.3) ▲	48 (2.0) ▲	37 (1.8)	9 (0.9)	6 (1.0)
Russian Federation	70 (1.7)	66 (1.1)	21 (1.3)	23 (0.9)	9 (0.8)	11 (0.8)
International Avg. (All Separate Science Countries)	42 (0.5)	43 (0.5) ▲	43 (0.5) ▲	42 (0.4)	15 (0.3)	16 (0.3) ▲
Biology (SCS-B)						
Belgium (Flemish)	42 (2.1)	39 (1.6)	47 (2.3)	49 (1.6)	10 (1.4)	13 (1.3)
Czech Republic	57 (1.9) ▲	47 (1.5)	38 (1.7)	43 (1.3)	6 (0.9)	10 (1.1) ▲
Netherlands	56 (1.7)	52 (1.9)	39 (1.5)	40 (1.9)	5 (0.8)	8 (1.1)
Russian Federation	82 (1.3) ▲	73 (1.5)	16 (1.0)	19 (1.1)	2 (0.4)	8 (0.8) ▲
International Avg. (All Separate Science Countries)	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)
Czech Republic	26 (1.8)	40 (1.8) ▲	51 (1.7) ▲	43 (1.4)	23 (1.4)	17 (1.8)
Netherlands [b]	35 (3.4)	53 (3.1) ▲	52 (2.4) ▲	38 (2.6)	13 (1.6)	9 (1.6)
Russian Federation	62 (1.2)	64 (1.3)	25 (1.0)	24 (1.0)	14 (0.9)	13 (0.9)
International Avg. (All Separate Science Countries)	27 (0.5)	36 (0.5) ▲	48 (0.4) ▲	44 (0.4)	25 (0.4) ▲	19 (0.3)
Chemistry (SCS-C)						
Belgium (Flemish)	– –	– –	– –	– –	– –	– –
Czech Republic	31 (2.1)	32 (1.8)	49 (1.6)	47 (1.7)	20 (1.5)	21 (1.7)
Netherlands	– –	– –	– –	– –	– –	– –
Russian Federation	53 (1.7)	52 (2.0)	29 (1.1)	28 (1.1)	18 (1.3)	20 (1.4)
International Avg. (All Separate Science Countries)	27 (0.4)	29 (0.4) ▲	48 (0.4) ▲	47 (0.4)	25 (0.4) ▲	24 (0.4)

▲ Significantly higher than other gender

Significance tests adjusted for multiple comparisons

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 jurisdictions. To gain some understanding of eighth-graders' views 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 boring[6]
- 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. 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 (this panel includes the Benchmarking participants) and in separate panels for earth science, biology, physics, and chemistry for countries that teach the sciences separately. (Additional information on students' liking science, one of the components of the index, is provided in Exhibit R1.12 in the reference section.)

In countries where science is taught as a single subject, students generally had positive attitudes towards the sciences, with 40 percent on average across all TIMSS 1999 countries in the high category and a further 49 percent in the medium category. Only 10 percent of students were in the low category. Percentages for the United States did not vary much from the international averages. Benchmarking jurisdictions with large percentages of students at the high level included the Rochester City School District and North Carolina (40 percent). Jurisdictions with somewhat less favorable attitudes included Idaho, the Delaware Science Coalition,

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

Massachusetts, the Fremont/Lincoln/Westside Public Schools, Pennsylvania, Oregon, and the Chicago Public Schools, where less than 30 percent of the students were at the high level. The comparison countries with the least positive attitudes were Chinese Taipei, Hong Kong, Japan, and Korea. Since these are all countries with high average science achievement, it may be that the students follow a demanding science curriculum 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 across all the TIMSS 1999 countries and in many of the Benchmarking entities.

Attitudes towards the science subject areas were somewhat less positive among the separate-science countries. The most positive were towards biology (32 percent in the high category, on average) and earth science (27 percent), and the least positive towards physics and chemistry (19 and 23 percent, respectively). Among the four separate-science comparison countries, the Russian Federation and the Czech Republic had the greatest percentage of students at the high level in all of the subject areas. 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 on average across all the TIMSS 1999 countries, but this was not the case for earth science and biology.

Exhibit 4.11 shows the percentages of girls and boys in each of the comparison countries and Benchmarking jurisdictions at each level of the index of positive attitudes towards the sciences. Although the United States, like many of the other countries, had significantly different percentages of girls and boys at the index levels, there were few significant differences among the Benchmarking participants. North Carolina was the only state to show a difference, with a greater percentage of boys at the high level and of girls at the medium level. The Delaware Science Coalition and Naperville had greater percentages of boys at the high level. For the separate-science countries on average, 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.

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)						
Singapore	46 (1.4)	594 (8.1)	49 (1.2)	549 (7.8)	5 (0.6)	509 (12.3)
Rochester City Sch. Dist., NY s	40 (2.0)	475 (10.8)	50 (2.3)	469 (8.8)	10 (1.6)	454 (14.7)
North Carolina	40 (1.4)	526 (6.8)	50 (1.4)	501 (6.8)	10 (0.8)	486 (12.8)
England	39 (1.1)	559 (5.5)	53 (1.1)	532 (5.6)	8 (0.6)	514 (10.2)
Miami-Dade County PS, FL	38 (3.4)	443 (13.5)	53 (2.5)	428 (9.7)	10 (1.5)	420 (12.2)
Jersey City Public Schools, NJ	35 (2.2)	461 (13.8)	51 (1.9)	437 (8.3)	13 (1.0)	432 (11.9)
First in the World Consort., IL	34 (2.0)	584 (7.5)	50 (2.1)	561 (5.9)	15 (1.5)	539 (12.7)
South Carolina	33 (1.9)	539 (9.0)	50 (1.1)	503 (7.4)	17 (1.5)	490 (7.2)
Guilford County, NC	33 (1.7)	556 (7.0)	54 (1.7)	530 (8.8)	12 (1.5)	513 (8.7)
Maryland	33 (1.6)	534 (7.6)	49 (1.2)	507 (7.9)	18 (1.4)	487 (8.7)
United States	32 (0.9)	543 (5.9)	51 (0.8)	515 (4.5)	16 (0.6)	489 (4.3)
Indiana	32 (2.1)	561 (7.8)	52 (1.3)	531 (6.8)	16 (1.4)	508 (7.8)
Academy School Dist. #20, CO	32 (1.4)	592 (4.2)	51 (1.4)	550 (3.0)	17 (1.2)	530 (6.6)
Texas	32 (1.2)	536 (11.2)	54 (1.2)	507 (10.6)	15 (0.9)	497 (13.6)
Connecticut	31 (1.6)	554 (12.8)	51 (1.3)	530 (10.4)	18 (1.6)	505 (6.0)
Montgomery County, MD	31 (2.0)	562 (5.1)	51 (1.4)	529 (6.4)	18 (2.1)	495 (8.1)
SW Math/Sci. Collaborative, PA	31 (2.1)	572 (9.3)	52 (1.4)	536 (6.4)	18 (1.5)	520 (10.3)
Missouri	31 (1.6)	548 (8.4)	50 (0.9)	519 (7.0)	19 (1.5)	498 (6.5)
Michigan Invitational Group, MI	30 (1.7)	589 (9.1)	54 (2.0)	557 (6.4)	16 (1.4)	550 (10.0)
Michigan	30 (1.4)	570 (7.9)	54 (1.3)	545 (8.4)	16 (1.0)	517 (8.8)
Illinois	30 (1.5)	544 (9.6)	53 (1.6)	515 (6.7)	17 (1.1)	503 (6.0)
Naperville Sch. Dist. #203, IL	30 (1.8)	618 (7.3)	52 (2.0)	578 (3.9)	18 (1.2)	546 (7.0)
Canada	30 (0.8)	556 (2.8)	52 (0.8)	530 (2.6)	18 (0.8)	511 (4.0)
Project SMART Consortium, OH	30 (1.5)	557 (9.5)	54 (1.3)	540 (9.5)	16 (1.4)	508 (7.7)
Italy	29 (1.2)	514 (4.9)	58 (1.1)	489 (4.2)	13 (0.9)	475 (6.1)
Idaho	29 (2.1)	563 (6.4)	51 (1.4)	523 (7.0)	20 (1.6)	490 (7.8)
Delaware Science Coalition, DE	29 (1.9)	538 (10.1)	53 (1.4)	504 (8.4)	18 (2.1)	477 (10.7)
Massachusetts	29 (1.6)	565 (9.6)	55 (1.0)	530 (5.7)	17 (1.4)	496 (10.0)
Fremont/Lincoln/WestSide PS, NE	28 (2.2)	541 (6.8)	53 (2.2)	513 (5.3)	18 (1.7)	479 (12.5)
Pennsylvania	28 (1.7)	555 (7.3)	53 (1.6)	529 (6.8)	18 (1.1)	501 (8.0)
Oregon	28 (2.1)	562 (8.1)	52 (1.1)	537 (6.2)	20 (1.8)	516 (9.8)
Chinese Taipei [a]	27 (0.8)	607 (4.7)	64 (0.7)	561 (4.4)	10 (0.6)	528 (6.7)
Chicago Public Schools, IL	26 (2.6)	482 (10.0)	60 (2.1)	442 (9.2)	14 (1.9)	443 (13.3)
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. (All General Science Countries)	40 (0.2)	499 (1.1)	49 (0.2)	473 (1.0)	10 (0.1)	467 (2.4)

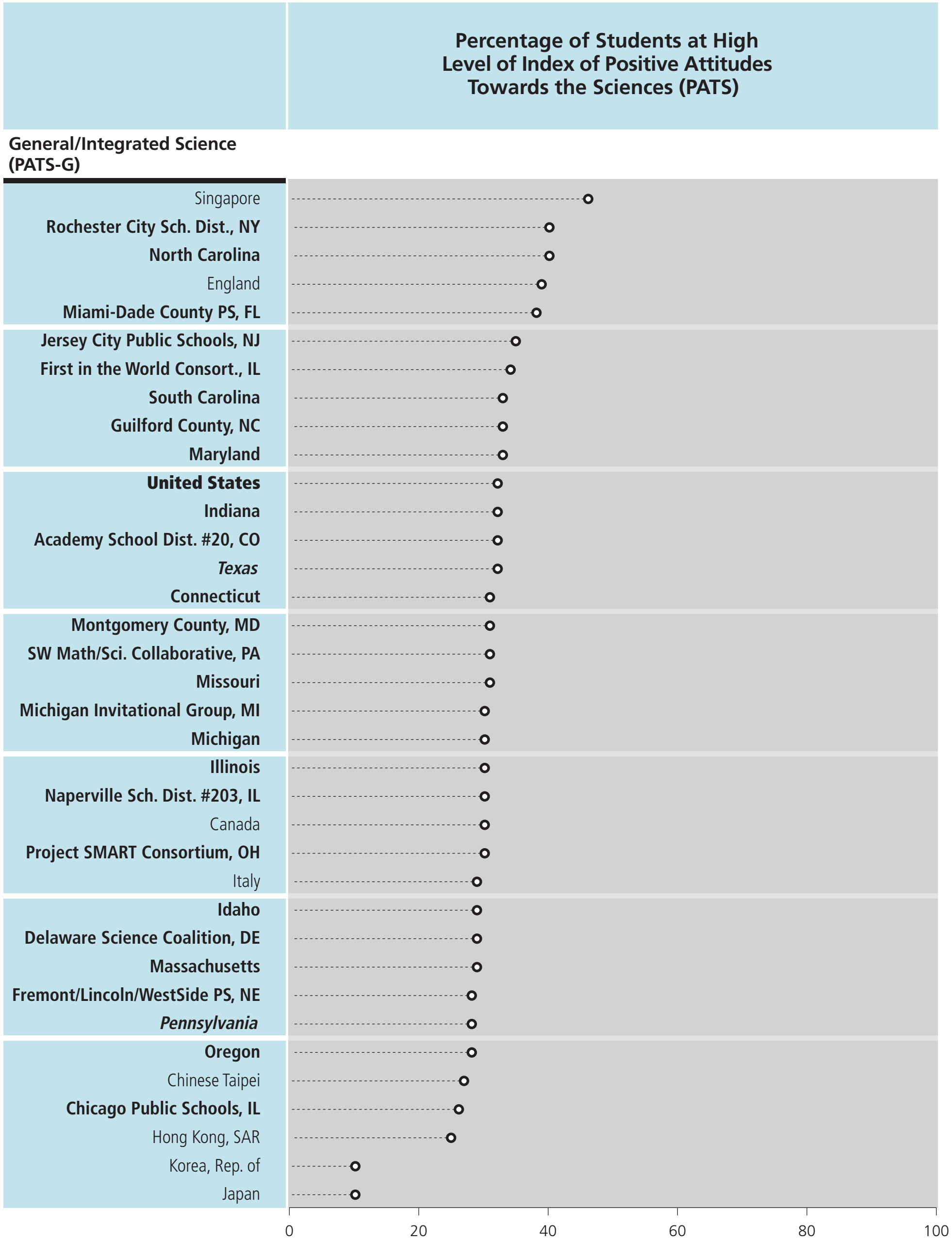
SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

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

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

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

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



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

Exhibit 4.10
(Continued 2)

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

8th Grade Science

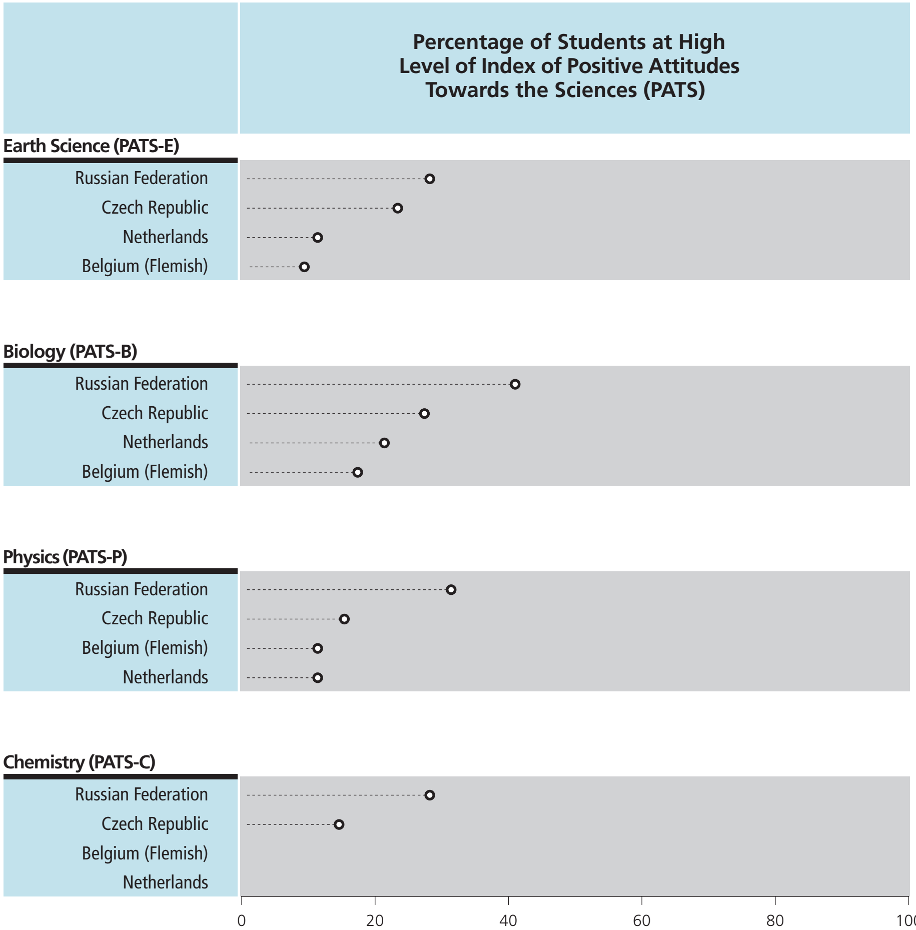
	High PATS		Medium PATS		Low PATS	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Earth Science (PATS-E)						
Russian Federation	28 (1.8)	542 (10.2)	65 (1.6)	529 (6.2)	7 (0.6)	526 (8.7)
Czech Republic	23 (1.4)	544 (6.1)	64 (1.2)	538 (4.4)	13 (1.0)	547 (7.6)
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)
International Avg. (All Separate Science Countries)	27 (0.4)	524 (2.1)	60 (0.4)	517 (1.4)	13 (0.4)	525 (3.3)
Biology (PATS-B)						
Russian Federation	41 (1.6)	536 (7.6)	55 (1.5)	529 (6.6)	4 (0.3)	530 (11.9)
Czech Republic	27 (1.5)	546 (5.1)	60 (1.1)	537 (4.5)	12 (1.2)	541 (7.3)
Netherlands	21 (1.8)	543 (11.7)	63 (1.4)	541 (9.1)	16 (1.3)	550 (8.3)
Belgium (Flemish)	17 (0.9)	555 (3.4)	61 (1.2)	541 (3.6)	23 (1.1)	518 (4.5)
International Avg. (All Separate Science Countries)	32 (0.3)	509 (1.7)	58 (0.3)	502 (1.2)	10 (0.2)	505 (3.0)
Physics (PATS-P)						
Russian Federation	31 (1.4)	551 (8.0)	63 (1.3)	526 (6.7)	6 (0.6)	516 (9.3)
Czech Republic	15 (1.3)	565 (9.2)	59 (1.5)	539 (4.6)	26 (1.8)	533 (4.5)
Belgium (Flemish)	11 (0.9)	564 (7.9)	58 (1.5)	548 (5.1)	31 (1.9)	533 (6.8)
Netherlands [b]	11 (0.8)	564 (12.8)	59 (1.7)	550 (7.9)	30 (2.0)	532 (7.2)
International Avg. (All Separate Science Countries)	19 (0.3)	532 (2.2)	61 (0.3)	516 (1.3)	20 (0.4)	512 (2.3)
Chemistry (PATS-C)						
Russian Federation	28 (1.2)	546 (8.4)	62 (1.0)	528 (6.5)	10 (0.9)	522 (8.2)
Czech Republic	14 (1.0)	560 (8.5)	60 (1.5)	538 (4.2)	25 (1.7)	533 (5.1)
Belgium (Flemish)	– –	– –	– –	– –	– –	– –
Netherlands	– –	– –	– –	– –	– –	– –
International Avg. (All Separate Science Countries)	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.

b 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.



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

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

8th Grade Science

General/Integrated Science (PATS-G)	High PATS Percent of Students		Medium PATS Percent of Students		Low PATS Percent of Students	
	Girls	Boys	Girls	Boys	Girls	Boys
Countries						
United States	29 (1.1)	35 (1.2) ▲	54 (0.9) ▲	49 (1.0)	17 (0.8)	15 (0.9)
Canada	28 (1.1)	32 (1.1)	55 (1.3) ▲	49 (0.9)	17 (0.9)	19 (1.2)
Chinese Taipei [a]	19 (0.9)	34 (1.2) ▲	69 (0.8) ▲	59 (1.1)	12 (0.8) ▲	7 (0.6)
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)
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)
Korea, Rep. of	7 (0.6)	14 (0.7) ▲	65 (1.0)	67 (0.9)	28 (1.1) ▲	19 (0.9)
Singapore	39 (1.7)	52 (1.5) ▲	55 (1.4) ▲	44 (1.3)	6 (0.7)	4 (0.6)
States						
Connecticut	30 (1.7)	34 (2.0)	53 (1.5)	48 (2.3)	17 (1.7)	19 (2.5)
Idaho	26 (2.3)	32 (2.5)	52 (2.0)	49 (1.8)	21 (2.0)	19 (1.9)
Illinois	28 (1.6)	31 (1.9)	54 (1.9)	53 (1.9)	18 (1.4)	16 (1.6)
Indiana	30 (2.9)	34 (2.4)	54 (2.2)	50 (1.7)	15 (2.1)	16 (1.9)
Maryland	30 (1.8)	35 (2.0)	51 (1.6)	48 (1.5)	19 (1.7)	17 (1.6)
Massachusetts	27 (1.8)	31 (2.1)	56 (1.4)	54 (1.7)	18 (2.0)	16 (1.6)
Michigan	28 (2.0)	33 (1.5)	56 (1.6)	52 (1.8)	16 (1.4)	15 (1.2)
Missouri	28 (1.8)	34 (2.4)	53 (1.4)	47 (1.5)	20 (1.6)	19 (2.1)
North Carolina	37 (1.8)	42 (2.3)	53 (1.9)	47 (1.9)	10 (1.0)	11 (1.2)
Oregon	25 (2.3)	31 (2.9)	56 (2.1)	48 (2.3)	20 (1.8)	20 (2.7)
Pennsylvania	28 (2.0)	29 (2.0)	54 (1.9)	54 (1.7)	19 (1.5)	18 (1.0)
South Carolina	31 (2.3)	35 (2.2)	52 (1.4)	48 (1.9)	17 (1.7)	16 (1.9)
Texas	30 (2.0)	33 (1.5)	54 (2.0)	53 (1.7)	16 (1.3)	14 (1.2)
Districts						
Academy School Dist. #20, CO	29 (1.8)	35 (2.1)	53 (2.1)	48 (1.8)	18 (1.6)	17 (1.7)
Chicago Public Schools, IL	23 (3.0)	30 (2.8)	61 (2.6)	58 (2.4)	16 (2.8)	12 (1.6)
Delaware Science Coalition, DE	23 (2.0)	36 (2.6) ▲	57 (2.0)	49 (1.9)	20 (2.6)	15 (1.9)
First in the World Consort., IL	32 (4.0)	37 (1.9)	50 (3.9)	50 (2.1)	17 (1.9)	13 (1.4)
Fremont/Lincoln/WestSide PS, NE	26 (3.3)	31 (2.4)	54 (3.0)	53 (2.1)	21 (2.6)	16 (2.4)
Guilford County, NC	31 (2.3)	36 (1.8)	57 (2.0)	52 (1.8)	13 (1.6)	12 (2.1)
Jersey City Public Schools, NJ	35 (2.5)	36 (3.1)	52 (2.1)	51 (3.4)	13 (1.7)	13 (1.5)
Miami-Dade County PS, FL	37 (3.7)	38 (4.0)	53 (3.0)	53 (2.8)	10 (1.9)	9 (1.5)
Michigan Invitational Group, MI	29 (2.4)	31 (2.7)	57 (3.1)	51 (2.3)	14 (1.8)	18 (2.0)
Montgomery County, MD	28 (2.3)	34 (3.1)	52 (2.3)	49 (1.9)	20 (2.5)	17 (1.9)
Naperville Sch. Dist. #203, IL	24 (1.7)	35 (2.6) ▲	55 (2.3)	50 (2.7)	20 (1.7)	15 (1.6)
Project SMART Consortium, OH	27 (2.1)	33 (1.8)	55 (2.0)	54 (1.8)	18 (1.6)	14 (2.0)
Rochester City Sch. Dist., NY s	39 (2.5)	42 (3.5)	49 (2.9)	51 (3.8)	12 (2.3)	8 (1.5)
SW Math/Sci. Collaborative, PA	26 (2.6)	36 (3.1)	56 (2.1)	47 (2.5)	18 (1.8)	17 (1.9)
International Avg. (All General Science Countries)	38 (0.3)	42 (0.3) ▲	50 (0.3) ▲	48 (0.3)	11 (0.2) ▲	9 (0.2)

▲ Significantly higher than other gender

Significance tests adjusted for multiple comparisons

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

Background data provided by students.

* 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.

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

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

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details).

( ) 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.

	High PATS Percent of Students		Medium PATS Percent of Students		Low PATS Percent of Students	
	Girls	Boys	Girls	Boys	Girls	Boys
Earth Science (PATS-E)						
Belgium (Flemish)	7 (0.7)	11 (0.9) ▲	53 (1.7)	59 (1.4)	40 (2.0) ▲	30 (1.6)
Czech Republic	21 (1.9)	26 (2.0)	64 (1.5)	63 (2.0)	14 (1.3)	12 (1.1)
Netherlands	8 (1.0)	15 (1.8) ▲	64 (2.0)	66 (1.9)	28 (2.3) ▲	18 (1.8)
Russian Federation	24 (1.9)	33 (2.0) ▲	69 (1.8) ▲	61 (1.9)	7 (0.8)	7 (0.8)
International Avg. (All Separate Science Countries)	24 (0.5)	30 (0.5) ▲	62 (0.5) ▲	59 (0.5)	14 (0.4) ▲	12 (0.4)
Biology (PATS-B)						
Belgium (Flemish)	19 (1.4) ▲	14 (0.9)	61 (1.3)	60 (1.6)	20 (1.3)	25 (1.6)
Czech Republic	34 (2.0) ▲	20 (1.8)	57 (1.6)	64 (1.5)	9 (1.3)	16 (1.4) ▲
Netherlands	27 (2.6) ▲	14 (1.6)	61 (2.0)	66 (1.7)	12 (1.5)	20 (1.8) ▲
Russian Federation	44 (1.9)	39 (1.7)	53 (1.9)	57 (1.5)	3 (0.4)	4 (0.5)
International Avg. (All Separate Science Countries)	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)
Czech Republic	8 (1.4)	22 (1.6) ▲	58 (1.8)	60 (1.9)	34 (2.2) ▲	18 (1.8)
Netherlands [b]	5 (1.1)	17 (1.4) ▲	56 (2.4)	62 (1.7)	38 (2.6) ▲	21 (2.0)
Russian Federation	24 (1.7)	39 (1.6) ▲	68 (1.5) ▲	57 (1.6)	8 (0.9) ▲	4 (0.5)
International Avg. (All Separate Science Countries)	14 (0.3)	29 (0.4) ▲	61 (0.5) ▲	58 (0.4)	25 (0.5) ▲	14 (0.4)
Chemistry (PATS-C)						
Belgium (Flemish)	– –	– –	– –	– –	– –	– –
Czech Republic	15 (1.4)	14 (1.3)	61 (2.2)	60 (1.9)	24 (2.2)	27 (1.8)
Netherlands	– –	– –	– –	– –	– –	– –
Russian Federation	28 (1.5)	28 (1.3)	63 (1.3)	61 (1.2)	9 (1.2)	10 (0.9)
International Avg. (All Separate Science Countries)	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.

▲ Significantly higher than other gender

Significance tests adjusted for multiple comparisons