CHAPTER 4

Students' Backgrounds and Attitudes Towards Mathematics

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

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 mathematics. 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 mathematics and their feelings towards mathematics.

In an effort to summarize this information concisely and focus attention on educationally relevant support and practice, TIMSS sometimes has combined information from individual questions to form an index that was more global and reliable than the component questions (e.g., home educational resources). According to their responses, students were placed in a "high," "medium," or "low" category. Cutoff points were established so that the high level of an index corresponds to conditions or activities generally associated with good educational practice and high academic achievement. For each index, the percentages of students in each category are presented in relation to their mathematics achievement. The data 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 mathematics 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 mathematics.[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., Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., Kelly, D.L., and Smith, T.A. (1996), *Mathematics Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study*, Chestnut Hill, MA: Boston College.

2 Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., Gregory, K.D., Garden, R.A., O'Connor, K.M., Chrostowski, S.J., and Smith, T.A. (2000), *TIMSS 1999 International Mathematics 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 mathematics 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 mathematics 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 (559) and the low level (431) amounted to 128 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). Together with the Michigan Invitational Group (29 percent), these were also among the top-performing jurisdictions in mathematics. The four urban Benchmarking school districts that had the lowest student achievement in mathematics – the Jersey City Public Schools, the Chicago Public Schools, the Rochester City School District, 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 mathematics 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. These effects can be found even when children begin school. For example, kindergartners whose mothers have higher levels of education are more likely to be able pass through four levels of mathematics proficiency that involve such tasks as reading numerals, counting, and sequencing numbers. Similarly, first-time kindergartners whose families have not received or are not receiving welfare services are more likely than kindergartners from families receiving welfare to pass through the mathematics proficiency levels.[3]

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 mathematics 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.[4]

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 mathematics 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 mathematics achievement. In most jurisdictions, the more books students reported in the home, the higher their mathematics achievement.

The percentages of students in each of five categories of parents' educational level are shown in Exhibit R1.3, together with their average mathematics 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

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3 West, J., Denton, K., and Germino-Hausken, E. (2000), *America's Kindergartners: Findings from the Early Childhood Longitudinal Study, Kindergarten Class of 1998-99,* NCES 2000-070, Washington, DC: National Center for Education Statistics.

4 *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.

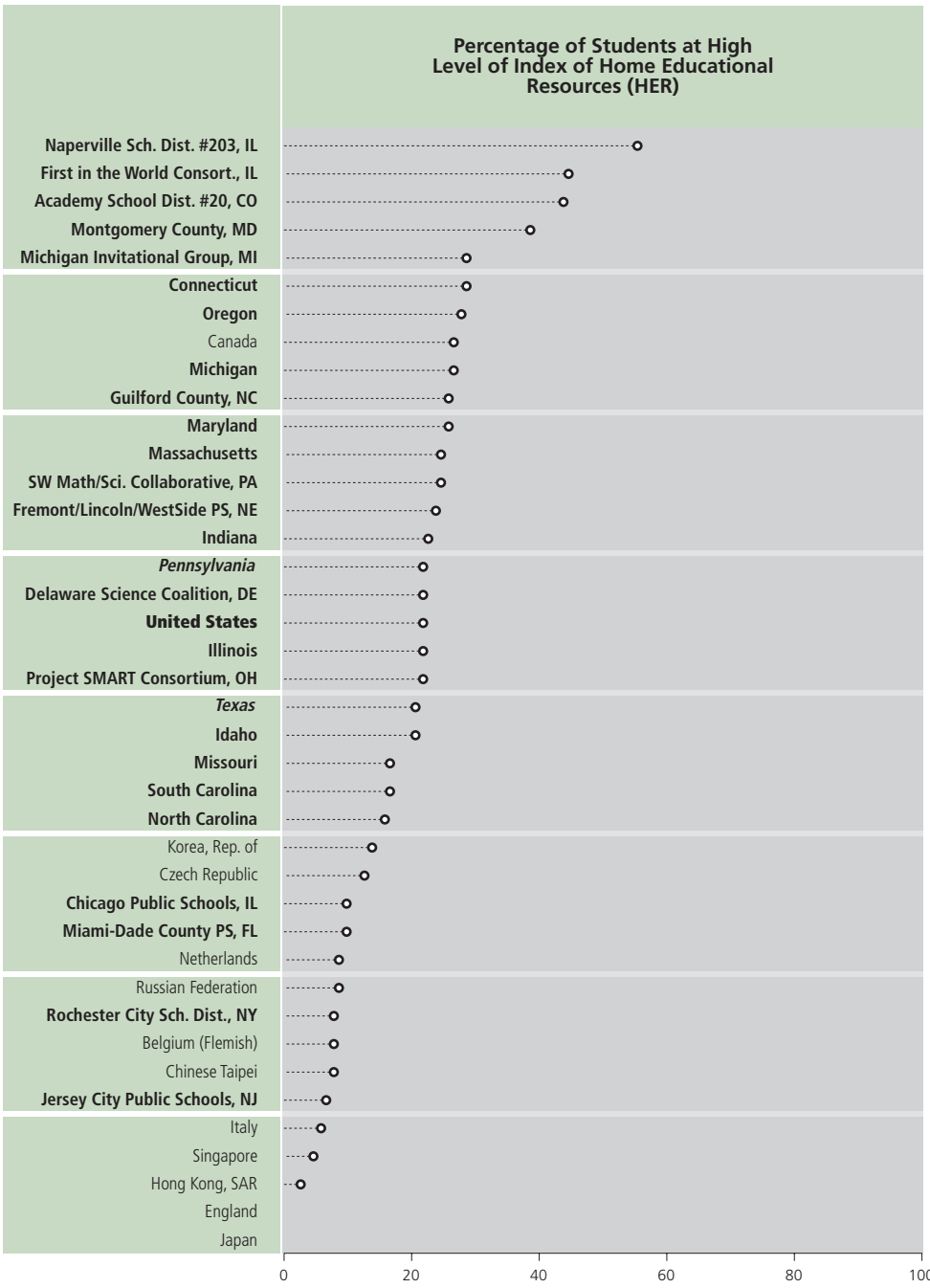
	High HER		Medium HER		Low HER	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Naperville Sch. Dist. #203, IL	56 (1.3)	583 (3.5)	43 (1.3)	553 (3.3)	0 (0.2)	~ ~
First in the World Consort., IL	45 (2.5)	580 (7.2)	53 (2.5)	546 (6.1)	2 (0.3)	~ ~
Academy School Dist. #20, CO	44 (1.6)	550 (3.1)	55 (1.6)	513 (2.6)	1 (0.3)	~ ~
Montgomery County, MD	39 (2.5)	578 (5.8)	59 (2.4)	515 (3.9)	2 (0.8)	~ ~
Michigan Invitational Group, MI	29 (2.6)	557 (8.5)	70 (2.6)	523 (5.8)	1 (0.3)	~ ~
Connecticut	29 (2.8)	554 (9.4)	68 (2.5)	499 (8.0)	3 (0.8)	426 (10.2)
Oregon	28 (2.6)	556 (5.9)	68 (2.6)	502 (5.5)	3 (0.6)	421 (15.4)
Canada	27 (1.0)	552 (4.1)	71 (1.0)	525 (2.2)	2 (0.2)	~ ~
Michigan	27 (2.9)	557 (7.8)	71 (2.7)	505 (6.3)	2 (0.5)	~ ~
Guilford County, NC	26 (2.0)	558 (9.2)	72 (1.7)	499 (7.6)	3 (0.4)	451 (16.0)
Maryland	26 (2.0)	544 (6.4)	71 (1.8)	481 (5.9)	3 (0.5)	415 (13.2)
Massachusetts	25 (2.1)	555 (6.6)	72 (1.8)	502 (5.8)	3 (0.6)	449 (14.0)
SW Math/Sci. Collaborative, PA	25 (2.8)	560 (9.5)	72 (2.9)	505 (6.8)	3 (0.8)	441 (16.2)
Fremont/Lincoln/WestSide PS, NE	24 (1.7)	528 (11.1)	72 (1.7)	477 (8.7)	3 (0.4)	424 (15.7)
Indiana	23 (2.6)	553 (7.9)	74 (2.4)	506 (6.3)	3 (0.5)	442 (9.2)
Pennsylvania	22 (2.7)	549 (9.7)	75 (2.6)	498 (4.8)	2 (0.4)	~ ~
Delaware Science Coalition, DE	22 (2.6)	538 (10.2)	75 (2.4)	466 (7.1)	3 (0.9)	406 (16.2)
United States	22 (1.5)	555 (5.1)	73 (1.4)	492 (3.1)	4 (0.5)	427 (6.4)
Illinois	22 (2.7)	562 (6.5)	74 (2.6)	498 (6.0)	4 (0.7)	438 (7.6)
Project SMART Consortium, OH	22 (2.3)	557 (11.0)	76 (2.1)	513 (6.5)	2 (0.5)	~ ~
Texas	21 (2.8)	581 (6.6)	70 (2.1)	512 (8.0)	9 (1.6)	432 (11.4)
Idaho	21 (1.8)	532 (6.7)	74 (1.6)	492 (6.5)	5 (1.1)	403 (13.2)
Missouri	17 (1.4)	527 (8.5)	79 (1.4)	485 (5.0)	4 (0.5)	434 (7.9)
South Carolina	17 (1.6)	560 (8.4)	79 (1.6)	493 (7.3)	4 (0.6)	439 (7.1)
North Carolina	16 (1.9)	546 (9.4)	81 (1.6)	489 (5.9)	4 (0.6)	422 (10.8)
Korea, Rep. of	14 (0.8)	637 (2.8)	80 (0.8)	583 (1.9)	5 (0.3)	513 (5.0)
Czech Republic	13 (0.8)	560 (6.8)	83 (0.8)	517 (3.9)	4 (0.5)	460 (11.3)
Chicago Public Schools, IL	10 (2.4)	489 (12.0)	81 (1.8)	463 (5.3)	9 (1.4)	432 (9.4)
Miami-Dade County PS, FL	10 (2.2)	505 (16.5)	80 (2.3)	419 (8.4)	11 (1.4)	367 (12.8)
Netherlands	9 (1.1)	575 (10.4)	89 (1.1)	538 (7.1)	2 (0.8)	~ ~
Russian Federation	9 (0.8)	560 (8.3)	86 (0.7)	527 (5.9)	6 (0.5)	474 (12.6)
Rochester City Sch. Dist., NY	8 (1.5)	497 (18.8)	82 (1.4)	445 (5.5)	10 (0.9)	416 (7.9)
Belgium (Flemish)	8 (0.7)	599 (6.5)	86 (1.3)	559 (3.9)	6 (1.3)	490 (11.7)
Chinese Taipei	8 (0.7)	666 (7.2)	84 (0.7)	586 (3.6)	8 (0.6)	502 (6.6)
Jersey City Public Schools, NJ	7 (1.2)	514 (18.6)	82 (1.3)	477 (8.5)	11 (1.0)	440 (8.9)
Italy	6 (0.6)	528 (7.3)	81 (0.8)	484 (3.7)	14 (0.8)	434 (6.4)
Singapore	5 (0.7)	663 (10.0)	87 (0.6)	605 (6.0)	8 (0.7)	552 (7.3)
Hong Kong, SAR	3 (0.3)	612 (8.8)	78 (0.8)	586 (4.2)	19 (0.9)	566 (5.2)
England	– –	– –	– –	– –	– –	– –
Japan	– –	– –	– –	– –	– –	– –
International Avg. (All Countries)	9 (0.1)	559 (2.3)	72 (0.2)	487 (0.8)	19 (0.2)	431 (1.2)

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

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

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.



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

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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' mathematics achievement. The pattern across countries was that eighth-grade students whose parents had more education were also those who had higher achievement in mathematics. 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, together with their average mathematics 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 mathematics 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 mathematics achievement. Students from homes where the language of the test is always or almost always spoken had higher average achievement than those who spoke it less frequently. 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 mathematics achievement, with Asian/Pacific Islander students having the highest average achievement, followed by white, Hispanic, and black students. This pattern was found for many of the Benchmarking participants. 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 mathematics 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

Exhibit 4.2 Students Having a Computer at Home

8th Grade Mathematics

	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)	515 (3.8)	20 (1.2)	459 (4.7)
Belgium (Flemish)	86 (1.0)	564 (3.5)	14 (1.0)	523 (7.4)
Canada	85 (0.8)	536 (2.5)	15 (0.8)	505 (4.5)
Chinese Taipei	63 (1.0)	605 (3.9)	37 (1.0)	552 (4.4)
Czech Republic	47 (1.2)	536 (4.8)	53 (1.2)	506 (4.7)
England	85 (0.8)	503 (4.1)	15 (0.8)	466 (6.2)
Hong Kong, SAR	72 (1.3)	589 (4.0)	28 (1.3)	566 (5.8)
Italy	63 (1.0)	488 (4.1)	37 (1.0)	465 (4.2)
Japan	52 (0.9)	592 (2.3)	48 (0.9)	566 (2.3)
Korea, Rep. of	67 (0.9)	600 (1.8)	33 (0.9)	561 (3.0)
Netherlands	96 (1.0)	542 (7.3)	4 (1.0)	513 (11.1)
Russian Federation	22 (1.2)	531 (6.5)	78 (1.2)	525 (6.4)
Singapore	80 (1.3)	614 (6.1)	20 (1.3)	567 (7.3)
States				
Connecticut	88 (1.7)	521 (8.4)	12 (1.7)	449 (9.3)
Idaho	82 (2.1)	505 (6.6)	18 (2.1)	452 (9.2)
Illinois	80 (2.1)	521 (6.7)	20 (2.1)	464 (6.4)
Indiana	81 (1.5)	523 (7.2)	19 (1.5)	479 (7.2)
Maryland	86 (1.4)	504 (5.9)	14 (1.4)	442 (7.4)
Massachusetts	87 (1.6)	520 (5.7)	13 (1.6)	469 (8.0)
Michigan	85 (1.7)	526 (6.6)	15 (1.7)	468 (9.9)
Missouri	76 (1.8)	501 (5.2)	24 (1.8)	456 (6.7)
North Carolina	74 (1.8)	507 (7.2)	26 (1.8)	461 (6.3)
Oregon	86 (1.7)	524 (5.4)	14 (1.7)	457 (7.0)
Pennsylvania	83 (2.0)	516 (6.0)	17 (2.0)	466 (7.4)
South Carolina	75 (2.2)	514 (7.2)	25 (2.2)	465 (8.3)
Texas	73 (3.3)	540 (7.5)	27 (3.3)	464 (9.3)
Districts and Consortia				
Academy School Dist. #20, CO	96 (0.5)	531 (1.9)	4 (0.5)	484 (10.8)
Chicago Public Schools, IL	61 (1.7)	471 (7.0)	39 (1.7)	450 (5.9)
Delaware Science Coalition, DE	82 (1.6)	489 (9.3)	18 (1.6)	438 (9.2)
First in the World Consort., IL	96 (0.6)	563 (5.7)	4 (0.6)	476 (14.5)
Fremont/Lincoln/WestSide PS, NE	81 (1.6)	500 (8.8)	19 (1.6)	435 (12.1)
Guilford County, NC	81 (1.6)	524 (7.5)	19 (1.6)	469 (9.6)
Jersey City Public Schools, NJ	58 (2.3)	488 (11.8)	42 (2.3)	459 (5.4)
Miami-Dade County PS, FL	66 (2.8)	438 (10.7)	34 (2.8)	391 (8.0)
Michigan Invitational Group, MI	89 (1.6)	538 (5.6)	11 (1.6)	486 (10.4)
Montgomery County, MD	91 (1.4)	546 (3.8)	9 (1.4)	458 (7.1)
Naperville Sch. Dist. #203, IL	98 (0.4)	570 (2.8)	2 (0.4)	~ ~
Project SMART Consortium, OH	83 (1.2)	527 (8.3)	17 (1.2)	489 (6.6)
Rochester City Sch. Dist., NY	61 (2.3)	451 (8.0)	39 (2.3)	440 (6.6)
SW Math/Sci. Collaborative, PA	82 (1.9)	528 (6.6)	18 (1.9)	468 (10.5)
International Avg. (All Countries)	45 (0.2)	509 (1.1)	55 (0.2)	470 (0.8)

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.

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

8th Grade Mathematics

	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)	509 (3.8)	9 (1.0)	456 (8.2)	1 (0.1)	~ ~
Belgium (Flemish)	86 (1.3)	566 (3.2)	8 (0.7)	531 (8.0)	6 (0.9)	522 (13.5)
Canada	91 (0.6)	532 (2.5)	8 (0.5)	523 (6.6)	2 (0.2)	~ ~
Chinese Taipei	67 (1.4)	606 (3.9)	31 (1.3)	545 (5.3)	2 (0.2)	~ ~
Czech Republic	98 (0.5)	523 (4.0)	1 (0.3)	~ ~	1 (0.2)	~ ~
England	95 (0.9)	500 (4.2)	5 (0.8)	471 (12.1)	0 (0.1)	~ ~
Hong Kong, SAR r	80 (2.4)	571 (4.5)	17 (1.9)	600 (8.5)	3 (0.5)	609 (12.2)
Italy	77 (1.1)	493 (3.5)	20 (1.0)	434 (5.6)	4 (0.5)	442 (11.8)
Japan	97 (0.3)	581 (1.8)	3 (0.3)	532 (11.5)	0 (0.1)	~ ~
Korea, Rep. of	96 (0.3)	589 (2.0)	4 (0.3)	545 (4.9)	0 (0.0)	~ ~
Netherlands	86 (2.4)	544 (7.8)	8 (1.2)	529 (9.0)	6 (1.8)	531 (13.7)
Russian Federation	94 (2.3)	527 (5.9)	5 (2.3)	527 (36.9)	1 (0.2)	~ ~
Singapore	27 (1.8)	629 (7.1)	63 (1.6)	595 (6.4)	10 (0.5)	601 (8.2)
States						
Connecticut	90 (1.4)	517 (8.8)	8 (1.4)	472 (13.4)	2 (0.3)	~ ~
Idaho	92 (1.4)	501 (6.7)	7 (1.3)	430 (13.3)	1 (0.3)	~ ~
Illinois	91 (1.3)	515 (6.6)	8 (1.2)	471 (10.1)	1 (0.2)	~ ~
Indiana	96 (0.6)	518 (7.1)	3 (0.5)	477 (15.8)	1 (0.3)	~ ~
Maryland	91 (0.8)	497 (5.9)	8 (0.7)	493 (10.2)	1 (0.3)	~ ~
Massachusetts	88 (1.6)	518 (5.7)	10 (1.4)	493 (11.7)	2 (0.3)	~ ~
Michigan	96 (0.6)	520 (7.2)	3 (0.4)	484 (13.2)	1 (0.2)	~ ~
Missouri	95 (0.6)	494 (5.5)	4 (0.5)	453 (11.5)	1 (0.2)	~ ~
North Carolina	96 (0.5)	498 (7.0)	3 (0.4)	471 (13.2)	1 (0.2)	~ ~
Oregon	92 (1.1)	520 (5.9)	7 (0.9)	456 (12.0)	1 (0.4)	~ ~
Pennsylvania	95 (1.1)	510 (6.3)	5 (0.9)	472 (13.7)	1 (0.3)	~ ~
South Carolina	97 (0.4)	504 (7.7)	2 (0.4)	~ ~	0 (0.2)	~ ~
Texas	82 (2.9)	532 (8.4)	17 (2.8)	464 (10.6)	1 (0.4)	~ ~
Districts and Consortia						
Academy School Dist. #20, CO	93 (0.8)	531 (2.0)	6 (0.7)	507 (12.5)	1 (0.3)	~ ~
Chicago Public Schools, IL	77 (4.7)	464 (6.5)	21 (4.6)	461 (8.8)	2 (0.7)	~ ~
Delaware Science Coalition, DE	91 (0.9)	485 (9.0)	6 (0.9)	454 (13.7)	3 (0.5)	434 (24.6)
First in the World Consort., IL	85 (1.3)	564 (5.9)	14 (1.3)	531 (7.8)	1 (0.3)	~ ~
Fremont/Lincoln/WestSide PS, NE	92 (1.1)	493 (8.9)	7 (0.9)	447 (10.0)	1 (0.3)	~ ~
Guilford County, NC	95 (0.7)	516 (7.3)	4 (0.7)	500 (16.4)	1 (0.5)	~ ~
Jersey City Public Schools, NJ	74 (1.5)	474 (9.3)	26 (1.4)	485 (9.1)	1 (0.3)	~ ~
Miami-Dade County PS, FL	59 (4.1)	428 (9.2)	36 (3.6)	420 (11.4)	5 (0.8)	394 (17.6)
Michigan Invitational Group, MI	96 (0.6)	535 (6.1)	3 (0.5)	509 (22.7)	1 (0.3)	~ ~
Montgomery County, MD	83 (1.9)	544 (4.0)	15 (2.0)	512 (10.4)	2 (0.6)	~ ~
Naperville Sch. Dist. #203, IL	93 (0.5)	570 (2.9)	6 (0.6)	573 (7.6)	1 (0.2)	~ ~
Project SMART Consortium, OH	95 (0.9)	523 (7.7)	4 (0.7)	485 (11.4)	1 (0.3)	~ ~
Rochester City Sch. Dist., NY	86 (1.3)	450 (6.7)	13 (1.1)	437 (8.2)	2 (0.6)	~ ~
SW Math/Sci. Collaborative, PA	98 (0.4)	518 (7.2)	1 (0.3)	~ ~	1 (0.2)	~ ~
International Avg. (All Countries)	79 (0.3)	493 (0.8)	17 (0.2)	466 (2.3)	5 (0.1)	455 (4.1)

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

Background data provided by students.

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.

	White		Black		Hispanic	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
States						
Connecticut	74 (4.5)	533 (6.8)	10 (3.0)	432 (12.5)	9 (2.2)	451 (13.5)
Idaho	83 (2.0)	506 (6.5)	1 (0.3)	~ ~	10 (1.7)	432 (8.9)
Illinois	65 (3.4)	533 (5.3)	17 (2.9)	449 (7.8)	12 (2.3)	462 (10.3)
Indiana	83 (2.3)	525 (7.2)	10 (2.2)	438 (6.5)	3 (0.6)	493 (11.9)
Maryland	55 (4.2)	521 (4.7)	30 (3.9)	438 (7.0)	4 (0.6)	487 (12.8)
Massachusetts	74 (3.4)	524 (5.1)	7 (1.6)	464 (20.4)	8 (1.4)	464 (11.0)
Michigan	82 (3.4)	532 (5.9)	10 (3.4)	418 (9.5)	3 (0.6)	481 (15.6)
Missouri	78 (3.2)	505 (4.9)	15 (3.1)	426 (12.3)	2 (0.4)	~ ~
North Carolina	62 (3.5)	521 (6.7)	31 (3.2)	447 (7.9)	3 (0.5)	474 (14.1)
Oregon	80 (1.9)	523 (5.4)	1 (0.5)	~ ~	8 (1.1)	452 (13.6)
Pennsylvania	78 (4.5)	519 (5.6)	12 (3.7)	446 (16.8)	3 (1.3)	476 (7.1)
South Carolina	63 (4.0)	533 (6.0)	32 (4.0)	446 (7.0)	1 (0.4)	~ ~
Texas	47 (5.2)	562 (5.0)	13 (2.5)	464 (16.7)	32 (4.7)	476 (8.6)
Districts and Consortia						
Academy School Dist. #20, CO	82 (1.0)	535 (2.4)	3 (0.5)	484 (15.7)	7 (0.6)	496 (8.7)
Chicago Public Schools, IL	11 (3.2)	499 (12.5)	47 (10.6)	447 (8.4)	37 (8.9)	468 (10.0)
Delaware Science Coalition, DE	63 (2.3)	501 (9.3)	24 (2.0)	435 (6.2)	5 (0.7)	465 (12.4)
First in the World Consort., IL	74 (1.8)	564 (5.6)	1 (0.3)	~ ~	7 (0.8)	478 (5.0)
Fremont/Lincoln/WestSide PS, NE	83 (1.6)	498 (8.1)	3 (0.8)	437 (28.6)	4 (0.7)	404 (14.6)
Guilford County, NC	57 (2.1)	544 (6.8)	35 (2.3)	463 (8.6)	2 (0.5)	~ ~
Jersey City Public Schools, NJ	7 (0.9)	513 (14.7)	35 (1.7)	442 (7.7)	35 (1.1)	474 (6.4)
Miami-Dade County PS, FL	7 (2.5)	501 (24.8)	31 (5.6)	381 (11.5)	55 (6.8)	438 (8.5)
Michigan Invitational Group, MI	88 (1.2)	534 (6.0)	4 (1.0)	473 (14.5)	1 (0.5)	~ ~
Montgomery County, MD	50 (2.7)	564 (6.2)	16 (1.3)	482 (9.3)	12 (1.8)	480 (13.0)
Naperville Sch. Dist. #203, IL	82 (1.0)	569 (2.6)	1 (0.4)	~ ~	2 (0.5)	~ ~
Project SMART Consortium, OH	79 (1.9)	530 (8.4)	10 (1.5)	476 (5.5)	4 (0.7)	475 (12.5)
Rochester City Sch. Dist., NY	16 (2.2)	504 (12.0)	56 (2.6)	428 (6.1)	16 (1.7)	443 (6.5)
SW Math/Sci. Collaborative, PA	87 (2.9)	526 (6.9)	10 (2.6)	440 (11.9)	1 (0.3)	~ ~
United States	63 (2.4)	525 (4.6)	15 (1.9)	444 (5.5)	12 (1.6)	457 (6.4)

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)	481 (13.8)
Idaho	2 (0.5)	~ ~	2 (0.5)	~ ~	2 (0.3)	~ ~
Illinois	4 (0.9)	544 (11.9)	0 (0.2)	~ ~	2 (0.4)	~ ~
Indiana	2 (0.4)	~ ~	1 (0.3)	~ ~	2 (0.4)	~ ~
Maryland	5 (0.6)	551 (7.0)	1 (0.2)	~ ~	5 (0.6)	511 (12.5)
Massachusetts	5 (0.8)	559 (19.8)	1 (0.2)	~ ~	5 (0.8)	490 (13.4)
Michigan	2 (0.3)	~ ~	1 (0.2)	~ ~	3 (0.3)	490 (14.1)
Missouri	1 (0.3)	~ ~	1 (0.4)	~ ~	3 (0.4)	450 (15.3)
North Carolina	1 (0.3)	~ ~	1 (0.4)	~ ~	2 (0.4)	~ ~
Oregon	4 (0.7)	531 (10.0)	3 (0.5)	482 (11.7)	4 (0.5)	517 (10.0)
Pennsylvania	3 (1.4)	526 (17.1)	1 (0.2)	~ ~	3 (0.5)	512 (12.1)
South Carolina	1 (0.2)	~ ~	1 (0.2)	~ ~	2 (0.3)	~ ~
Texas	4 (1.4)	569 (24.1)	1 (0.1)	~ ~	3 (0.4)	515 (16.7)
Districts and Consortia						
Academy School Dist. #20, CO	4 (0.6)	527 (10.7)	1 (0.3)	~ ~	4 (0.5)	511 (12.1)
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)	475 (13.6)
First in the World Consort., IL	15 (1.7)	591 (11.4)	1 (0.4)	~ ~	2 (0.8)	~ ~
Fremont/Lincoln/WestSide PS, NE	3 (0.5)	476 (17.6)	2 (0.4)	~ ~	5 (0.9)	475 (19.3)
Guilford County, NC	4 (0.4)	529 (14.2)	1 (0.2)	~ ~	2 (0.5)	~ ~
Jersey City Public Schools, NJ	16 (1.7)	533 (16.2)	0 (0.2)	~ ~	7 (0.8)	504 (16.5)
Miami-Dade County PS, FL	2 (0.6)	~ ~	1 (0.1)	~ ~	5 (1.1)	426 (24.1)
Michigan Invitational Group, MI	3 (0.5)	580 (16.4)	0 (0.2)	~ ~	3 (0.3)	533 (19.2)
Montgomery County, MD	15 (1.4)	564 (6.7)	1 (0.2)	~ ~	6 (0.8)	535 (14.3)
Naperville Sch. Dist. #203, IL	12 (0.8)	599 (5.9)	0 (0.1)	~ ~	3 (0.5)	549 (8.6)
Project SMART Consortium, OH	3 (0.5)	550 (23.1)	1 (0.2)	~ ~	3 (0.7)	519 (15.8)
Rochester City Sch. Dist., NY	3 (0.5)	500 (22.4)	2 (0.5)	~ ~	7 (1.0)	465 (13.3)
SW Math/Sci. Collaborative, PA	1 (0.4)	~ ~	0 (0.1)	~ ~	2 (0.4)	~ ~
United States	5 (1.3)	539 (10.7)	1 (0.2)	~ ~	4 (0.3)	496 (9.5)

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

Exhibit 4.5 Students' Expectations for Finishing School*

8th Grade Mathematics

	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)	516 (3.8)	9 (0.6)	466 (5.1)	5 (0.4)	426 (6.2)	1 (0.1)	~ ~	7 (0.5)	474 (5.9)
Belgium (Flemish)	26 (1.1)	605 (6.4)	30 (0.9)	563 (3.8)	16 (0.9)	509 (4.5)	0 (0.0)	~ ~	29 (1.0)	544 (2.9)
Canada	76 (0.9)	539 (2.6)	13 (0.6)	522 (4.7)	4 (0.3)	482 (7.7)	1 (0.1)	~ ~	7 (0.6)	497 (6.0)
Chinese Taipei	62 (1.4)	624 (3.7)	24 (1.0)	527 (3.0)	2 (0.3)	~ ~	0 (0.1)	~ ~	11 (0.6)	534 (7.2)
Czech Republic	38 (1.8)	564 (4.1)	5 (0.6)	542 (7.1)	39 (1.5)	496 (3.3)	8 (1.0)	452 (7.1)	10 (0.8)	493 (7.6)
England	– –	– –	– –	– –	– –	– –	– –	– –	– –	– –
Hong Kong, SAR	63 (1.7)	601 (3.8)	20 (0.9)	562 (4.9)	10 (0.8)	529 (7.7)	1 (0.2)	~ ~	6 (0.4)	562 (6.8)
Italy	33 (1.3)	517 (4.1)	19 (0.9)	487 (4.4)	31 (1.1)	463 (4.0)	7 (0.6)	396 (10.4)	9 (0.7)	461 (8.7)
Japan	38 (0.9)	614 (2.7)	18 (0.6)	564 (2.6)	18 (0.7)	532 (3.0)	1 (0.1)	~ ~	25 (0.7)	572 (3.1)
Korea, Rep. of	77 (0.7)	605 (1.9)	8 (0.4)	521 (4.2)	4 (0.3)	500 (6.3)	0 (0.1)	~ ~	11 (0.5)	551 (4.3)
Netherlands	22 (2.8)	582 (9.6)	30 (1.8)	549 (5.7)	29 (2.6)	507 (9.0)	1 (0.2)	~ ~	18 (0.9)	533 (8.1)
Russian Federation	61 (1.5)	547 (5.4)	19 (1.0)	505 (6.1)	7 (0.5)	481 (10.4)	2 (0.5)	~ ~	11 (0.7)	496 (7.8)
Singapore	57 (2.1)	625 (6.1)	26 (1.6)	576 (5.5)	2 (0.3)	~ ~	0 (0.0)	~ ~	15 (0.7)	587 (8.2)
States										
Connecticut	80 (1.6)	524 (9.5)	8 (1.0)	468 (10.8)	4 (0.5)	441 (8.8)	1 (0.2)	~ ~	7 (0.8)	483 (8.9)
Idaho	72 (2.0)	511 (6.3)	11 (0.9)	480 (8.5)	7 (0.9)	425 (8.9)	1 (0.2)	~ ~	9 (0.9)	458 (10.9)
Illinois	81 (1.2)	521 (7.1)	9 (0.8)	465 (7.6)	4 (0.7)	443 (9.3)	0 (0.1)	~ ~	6 (0.6)	487 (9.1)
Indiana	79 (1.6)	527 (6.6)	9 (0.9)	471 (8.1)	4 (0.6)	449 (13.1)	1 (0.2)	~ ~	7 (0.7)	486 (13.3)
Maryland	80 (1.2)	506 (6.6)	9 (0.7)	456 (8.4)	4 (0.5)	415 (9.6)	1 (0.2)	~ ~	6 (0.6)	481 (7.4)
Massachusetts	78 (1.5)	526 (5.9)	10 (0.6)	477 (8.3)	5 (0.7)	429 (11.3)	1 (0.1)	~ ~	6 (0.7)	493 (7.7)
Michigan	83 (1.1)	527 (7.4)	7 (0.7)	473 (9.3)	3 (0.4)	454 (11.0)	1 (0.1)	~ ~	6 (0.5)	483 (14.0)
Missouri	72 (1.5)	504 (5.8)	12 (0.9)	468 (6.5)	8 (0.8)	426 (8.2)	1 (0.2)	~ ~	7 (0.6)	468 (7.6)
North Carolina	79 (1.5)	508 (7.4)	9 (0.7)	455 (6.5)	6 (0.7)	432 (8.8)	1 (0.1)	~ ~	4 (0.4)	461 (10.4)
Oregon	76 (1.9)	529 (5.9)	10 (0.9)	485 (9.1)	5 (0.8)	439 (7.8)	1 (0.2)	~ ~	9 (0.9)	472 (10.5)
Pennsylvania	77 (1.4)	518 (6.8)	9 (0.7)	478 (8.6)	5 (0.6)	448 (10.2)	1 (0.1)	~ ~	7 (0.6)	481 (9.6)
South Carolina	80 (1.3)	519 (8.1)	9 (0.8)	437 (7.8)	6 (0.6)	415 (8.6)	0 (0.1)	~ ~	5 (0.5)	458 (9.8)
Texas	80 (2.0)	534 (7.9)	7 (0.8)	459 (10.8)	6 (1.3)	427 (16.4)	1 (0.3)	~ ~	6 (0.7)	492 (15.7)
Districts and Consortia										
Academy School Dist. #20, CO	83 (1.1)	537 (2.1)	5 (0.6)	482 (11.4)	3 (0.4)	463 (12.5)	1 (0.3)	~ ~	8 (0.9)	512 (8.5)
Chicago Public Schools, IL	74 (1.8)	474 (6.7)	11 (0.8)	434 (10.1)	8 (1.2)	414 (8.4)	1 (0.3)	~ ~	6 (0.9)	456 (14.7)
Delaware Science Coalition, DE	74 (2.2)	498 (9.0)	11 (0.8)	444 (8.6)	7 (1.1)	417 (12.5)	1 (0.4)	~ ~	7 (1.0)	431 (8.9)
First in the World Consort., IL	92 (1.1)	564 (5.4)	3 (0.8)	494 (12.1)	1 (0.5)	~ ~	0 (0.2)	~ ~	4 (0.8)	540 (19.3)
Fremont/Lincoln/WestSide PS, NE	74 (2.3)	506 (8.8)	7 (1.1)	442 (19.1)	5 (1.3)	404 (9.7)	1 (0.2)	~ ~	12 (1.4)	458 (12.4)
Guilford County, NC	89 (1.5)	521 (7.4)	5 (0.9)	460 (13.4)	3 (0.8)	419 (15.2)	0 (0.3)	~ ~	3 (0.6)	481 (16.3)
Jersey City Public Schools, NJ	80 (1.6)	485 (9.7)	8 (0.9)	443 (10.4)	6 (0.8)	442 (13.4)	0 (0.0)	~ ~	6 (0.8)	439 (17.1)
Miami-Dade County PS, FL	76 (2.4)	440 (8.8)	10 (1.3)	372 (11.6)	6 (0.7)	361 (13.1)	1 (0.2)	~ ~	7 (1.0)	365 (18.8)
Michigan Invitational Group, MI	80 (2.1)	543 (5.2)	9 (1.6)	503 (9.0)	5 (0.7)	459 (11.0)	1 (0.3)	~ ~	5 (0.8)	495 (16.8)
Montgomery County, MD	85 (1.0)	547 (4.1)	6 (0.9)	472 (12.7)	2 (0.3)	~ ~	1 (0.3)	~ ~	7 (0.6)	521 (9.5)
Naperville Sch. Dist. #203, IL	94 (0.8)	572 (2.8)	3 (0.5)	532 (10.8)	1 (0.3)	~ ~	0 (0.1)	~ ~	3 (0.5)	519 (17.4)
Project SMART Consortium, OH	81 (2.1)	533 (7.9)	8 (1.1)	468 (9.1)	4 (0.8)	469 (11.2)	1 (0.3)	~ ~	7 (0.8)	479 (9.3)
Rochester City Sch. Dist., NY	76 (1.6)	455 (6.5)	9 (1.1)	421 (14.6)	7 (0.9)	392 (16.1)	1 (0.3)	~ ~	8 (1.0)	436 (13.0)
SW Math/Sci. Collaborative, PA	80 (2.1)	528 (6.6)	8 (0.8)	476 (10.0)	5 (0.5)	450 (12.5)	0 (0.1)	~ ~	7 (1.2)	478 (12.4)
International Avg. (All Countries)	52 (0.3)	517 (0.8)	17 (0.1)	469 (1.0)	15 (0.2)	442 (1.0)	3 (0.1)	390 (3.1)	14 (0.1)	462 (1.1)

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

Background data provided by students.

* Response categories were defined by each country to conform to their own educational system and may not be strictly comparable across countries. See Reference Exhibit R1.4 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).

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 mathematics, science, and other subjects. Students at the high level reported spending more than three hours each day out of school studying all subjects combined. Students at the medium level reported spending more than one hour but not more than three, while those at the low level reported one hour or less per day.

Exhibit 4.6 shows the percentages of students at each level of this index, and their average mathematics 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 mathematics 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

Exhibits 4.6-4.7

Index of Out-of-School Study Time

Index based on students' responses to three questions about out-of-school study time: time spent after school studying mathematics or doing mathematics homework; time spent after school studying science or doing science homework; time spent after school studying or doing homework in school subjects other than mathematics and science (see reference exhibit R1.9). 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.

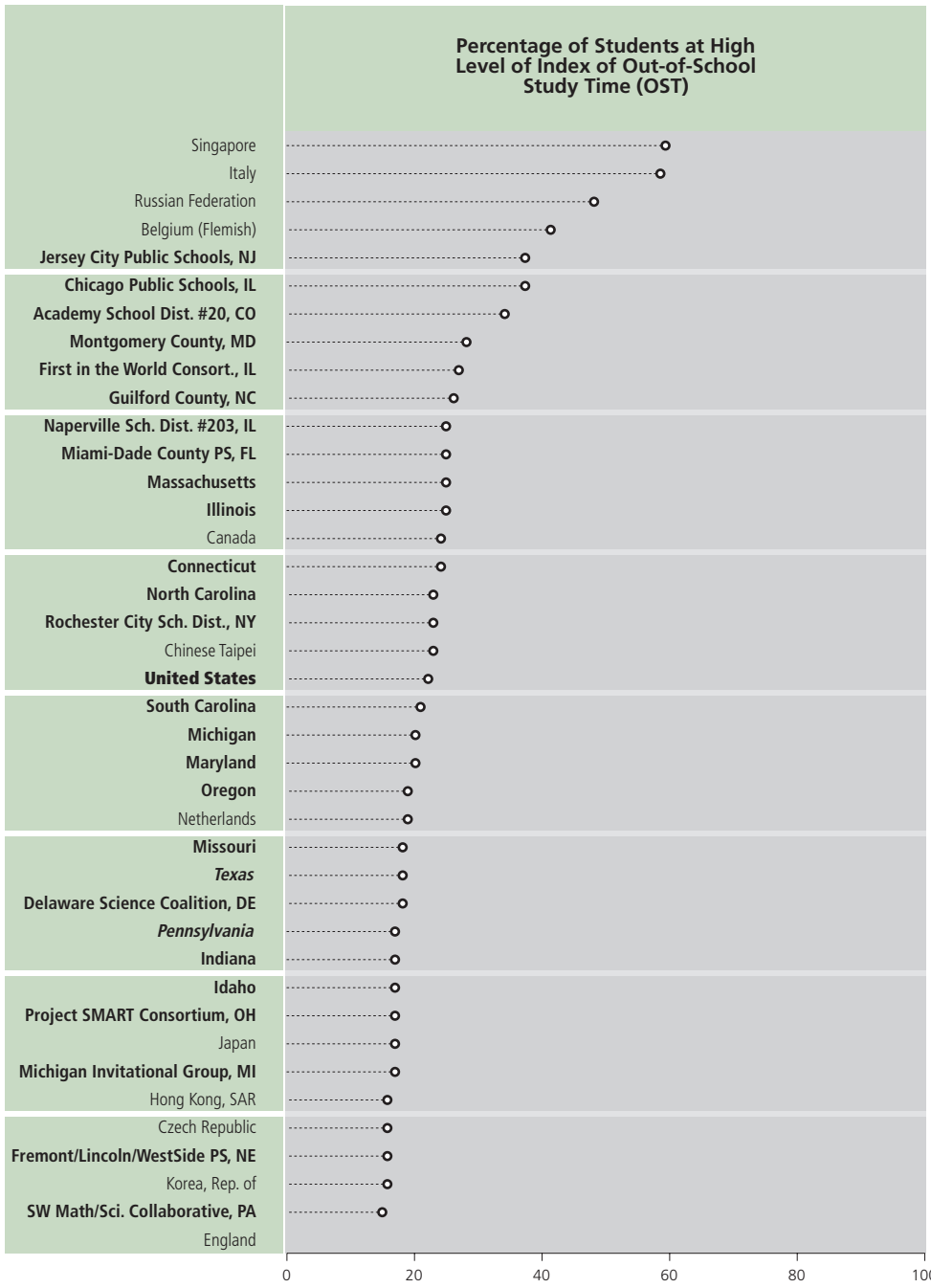
	High OST		Medium OST		Low OST	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Singapore	59 (1.2)	608 (5.8)	35 (0.9)	609 (7.4)	7 (0.6)	559 (10.2)
Italy	58 (1.3)	489 (4.1)	36 (1.2)	487 (4.6)	6 (0.6)	405 (9.1)
Russian Federation	48 (1.3)	540 (4.7)	46 (1.2)	532 (7.0)	6 (0.6)	479 (9.3)
Belgium (Flemish)	41 (1.3)	554 (3.3)	52 (1.1)	571 (3.8)	7 (1.0)	517 (16.4)
Jersey City Public Schools, NJ	37 (2.4)	489 (10.5)	47 (1.8)	479 (8.9)	16 (1.7)	452 (8.7)
Chicago Public Schools, IL	37 (2.1)	469 (7.2)	51 (1.6)	468 (6.1)	12 (1.2)	451 (11.6)
Academy School Dist. #20, CO	34 (1.3)	538 (3.2)	55 (1.4)	533 (3.0)	11 (0.9)	501 (6.4)
Montgomery County, MD	28 (1.4)	551 (8.5)	57 (2.3)	547 (4.3)	15 (1.5)	496 (6.7)
First in the World Consort., IL	27 (2.4)	551 (7.6)	61 (2.2)	566 (6.5)	12 (1.1)	549 (11.7)
Guilford County, NC	26 (1.6)	507 (7.4)	62 (1.9)	522 (8.7)	12 (1.0)	498 (14.3)
Naperville Sch. Dist. #203, IL	25 (1.4)	568 (5.2)	63 (1.7)	574 (3.4)	12 (0.9)	560 (7.9)
Miami-Dade County PS, FL	25 (1.5)	429 (12.7)	51 (1.3)	436 (9.6)	24 (2.4)	405 (8.0)
Massachusetts	25 (1.7)	515 (6.8)	62 (1.6)	526 (5.9)	13 (1.2)	469 (8.2)
Illinois	25 (1.6)	505 (8.7)	58 (1.2)	518 (7.1)	17 (1.4)	501 (6.1)
Canada	24 (0.8)	516 (3.5)	59 (1.0)	540 (2.8)	18 (0.8)	528 (4.1)
Connecticut	24 (1.1)	506 (9.8)	62 (1.7)	528 (8.9)	15 (1.5)	474 (7.9)
North Carolina	23 (1.2)	490 (7.9)	57 (1.3)	510 (7.1)	19 (1.6)	469 (8.0)
Rochester City Sch. Dist., NY	23 (1.8)	450 (8.9)	56 (2.3)	458 (6.9)	21 (2.2)	422 (9.2)
Chinese Taipei	23 (1.0)	625 (4.5)	42 (0.8)	602 (3.9)	35 (1.3)	542 (4.4)
United States	22 (0.8)	508 (4.8)	56 (0.9)	517 (4.1)	23 (1.3)	477 (3.9)
South Carolina	21 (1.3)	488 (9.3)	57 (1.1)	518 (7.6)	22 (1.4)	490 (8.7)
Michigan	20 (1.1)	516 (8.3)	59 (1.0)	527 (7.1)	20 (1.3)	499 (8.7)
Maryland	20 (1.0)	501 (8.2)	60 (1.3)	506 (5.6)	20 (1.3)	466 (7.6)
Oregon	19 (1.1)	524 (8.1)	55 (1.5)	526 (5.6)	25 (1.7)	491 (5.5)
Netherlands	19 (1.4)	521 (11.5)	74 (1.3)	548 (6.5)	7 (1.0)	529 (12.8)
Missouri	18 (1.5)	485 (7.0)	54 (1.5)	499 (6.0)	28 (1.6)	480 (6.3)
Texas	18 (1.4)	527 (12.0)	49 (2.2)	532 (7.4)	33 (2.6)	506 (10.6)
Delaware Science Coalition, DE	18 (1.0)	474 (10.9)	58 (2.1)	500 (9.3)	24 (1.9)	450 (7.9)
Pennsylvania	17 (1.9)	496 (8.4)	59 (2.0)	521 (5.1)	24 (1.9)	490 (8.1)
Indiana	17 (1.3)	510 (8.3)	58 (1.5)	526 (7.1)	25 (2.0)	500 (8.4)
Idaho	17 (1.3)	490 (8.6)	55 (1.9)	509 (6.4)	28 (2.1)	479 (9.6)
Project SMART Consortium, OH	17 (1.0)	515 (9.2)	58 (1.2)	532 (7.8)	26 (1.6)	503 (9.0)
Japan	17 (0.9)	586 (2.9)	49 (0.9)	587 (2.1)	35 (1.3)	564 (3.1)
Michigan Invitational Group, MI	17 (1.1)	535 (11.9)	63 (1.8)	539 (4.1)	20 (1.9)	512 (10.0)
Hong Kong, SAR	16 (0.8)	600 (5.3)	42 (0.9)	595 (3.9)	42 (1.4)	564 (5.0)
Czech Republic	16 (1.1)	500 (5.7)	62 (1.4)	527 (4.7)	22 (1.3)	519 (6.5)
Fremont/Lincoln/WestSide PS, NE	16 (1.8)	480 (10.1)	54 (1.6)	510 (7.7)	30 (2.2)	464 (11.4)
Korea, Rep. of	16 (0.7)	612 (4.3)	43 (0.7)	601 (2.5)	41 (1.0)	565 (2.5)
SW Math/Sci. Collaborative, PA	15 (1.1)	506 (6.9)	61 (1.6)	528 (7.0)	24 (1.9)	499 (10.7)
England	– –	– –	– –	– –	– –	– –
International Avg. (All Countries)	38 (0.2)	492 (0.9)	48 (0.2)	497 (0.8)	14 (0.1)	463 (1.6)

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

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.

	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	27 (1.1)	505 (4.5)	58 (0.7)	514 (4.0)	15 (1.1)	466 (4.8)	0.8 (0.02)
Belgium (Flemish)	47 (1.2)	550 (3.1)	50 (1.0)	573 (3.7)	3 (0.8)	476 (21.2)	1.1 (0.03)
Canada	28 (1.0)	510 (3.3)	61 (1.0)	542 (2.8)	11 (0.8)	527 (5.2)	0.8 (0.02)
Chinese Taipei	25 (1.0)	627 (4.7)	44 (0.8)	604 (3.5)	31 (1.3)	529 (4.8)	0.7 (0.02)
Czech Republic	20 (1.1)	493 (5.2)	68 (1.3)	528 (4.6)	12 (1.0)	525 (9.2)	0.7 (0.02)
England	– –	– –	– –	– –	– –	– –	– –
Hong Kong, SAR	24 (1.1)	600 (4.8)	51 (0.9)	591 (3.9)	25 (1.2)	552 (6.1)	0.7 (0.02)
Italy	57 (1.3)	482 (4.0)	39 (1.2)	488 (4.5)	5 (0.5)	400 (9.5)	1.3 (0.03)
Japan	20 (0.9)	585 (2.5)	54 (0.9)	586 (2.0)	26 (1.2)	558 (3.8)	0.6 (0.01)
Korea, Rep. of	21 (0.9)	610 (4.1)	45 (0.7)	598 (2.0)	34 (1.0)	560 (2.6)	0.6 (0.02)
Netherlands	14 (1.5)	507 (12.2)	78 (1.3)	546 (6.7)	8 (1.1)	559 (14.0)	0.6 (0.02)
Russian Federation	45 (1.5)	530 (5.2)	49 (1.3)	537 (6.7)	6 (0.5)	483 (10.0)	1.1 (0.03)
Singapore	61 (1.1)	604 (5.7)	34 (1.0)	612 (7.6)	5 (0.5)	562 (10.7)	1.3 (0.02)
States							
Connecticut	27 (1.1)	504 (9.6)	61 (1.5)	526 (9.1)	12 (1.2)	468 (9.2)	0.8 (0.02)
Idaho	25 (1.6)	494 (9.4)	56 (2.0)	508 (6.3)	19 (1.8)	464 (9.9)	0.7 (0.02)
Illinois	32 (1.5)	501 (9.9)	56 (1.2)	520 (6.7)	12 (1.0)	487 (5.5)	0.8 (0.02)
Indiana	24 (1.8)	512 (8.9)	58 (1.5)	526 (6.8)	17 (1.7)	485 (8.4)	0.7 (0.03)
Maryland	25 (1.1)	496 (7.8)	61 (1.6)	503 (6.2)	14 (1.3)	460 (8.6)	0.8 (0.02)
Massachusetts	27 (1.4)	507 (6.2)	62 (1.4)	525 (5.7)	10 (1.0)	466 (9.8)	0.8 (0.02)
Michigan	26 (1.6)	521 (8.2)	60 (1.2)	525 (7.5)	13 (1.4)	478 (7.9)	0.8 (0.03)
Missouri	23 (2.1)	489 (9.0)	55 (1.9)	500 (5.5)	22 (1.4)	468 (5.8)	0.7 (0.03)
North Carolina	30 (1.6)	494 (8.8)	59 (1.3)	506 (6.6)	11 (1.0)	449 (8.8)	0.8 (0.02)
Oregon	26 (1.5)	526 (7.2)	59 (1.2)	520 (5.6)	15 (1.1)	480 (6.9)	0.8 (0.02)
Pennsylvania	21 (1.9)	500 (10.6)	64 (1.4)	518 (5.5)	16 (1.5)	479 (7.2)	0.7 (0.03)
South Carolina	28 (1.3)	495 (8.8)	58 (1.0)	517 (7.6)	14 (1.2)	463 (8.8)	0.8 (0.02)
Texas	27 (2.0)	534 (10.3)	51 (1.5)	530 (8.0)	22 (2.3)	486 (11.3)	0.8 (0.04)
Districts and Consortia							
Academy School Dist. #20, CO	41 (1.6)	536 (3.5)	50 (1.4)	533 (3.2)	9 (0.7)	483 (7.0)	1.0 (0.03)
Chicago Public Schools, IL	48 (2.5)	460 (6.0)	44 (1.7)	472 (6.7)	8 (1.5)	439 (10.9)	1.2 (0.06)
Delaware Science Coalition, DE	21 (1.0)	473 (10.4)	61 (2.1)	497 (9.0)	17 (1.7)	437 (11.6)	0.7 (0.03)
First in the World Consort., IL	29 (1.5)	553 (6.9)	65 (1.7)	566 (6.9)	6 (1.1)	526 (17.6)	0.8 (0.02)
Fremont/Lincoln/WestSide PS, NE	20 (2.7)	474 (10.0)	61 (3.2)	508 (8.2)	19 (1.7)	444 (8.8)	0.7 (0.05)
Guilford County, NC	35 (1.4)	508 (7.0)	58 (1.7)	523 (9.0)	7 (0.9)	475 (13.4)	0.9 (0.03)
Jersey City Public Schools, NJ	44 (2.0)	475 (10.6)	46 (1.8)	485 (8.5)	10 (1.5)	450 (8.2)	1.1 (0.05)
Miami-Dade County PS, FL	32 (1.2)	417 (12.3)	51 (1.6)	436 (9.7)	17 (2.0)	400 (6.7)	0.9 (0.03)
Michigan Invitational Group, MI	25 (2.0)	537 (10.8)	60 (1.5)	539 (4.5)	15 (1.6)	501 (9.9)	0.7 (0.03)
Montgomery County, MD	35 (2.4)	544 (7.6)	56 (2.3)	545 (4.0)	9 (1.1)	474 (7.6)	0.9 (0.04)
Naperville Sch. Dist. #203, IL	28 (1.4)	562 (5.4)	66 (1.4)	576 (3.7)	6 (0.8)	536 (12.7)	0.8 (0.02)
Project SMART Consortium, OH	21 (1.0)	517 (8.7)	59 (1.4)	531 (8.1)	20 (1.5)	494 (8.2)	0.6 (0.02)
Rochester City Sch. Dist., NY	29 (2.2)	441 (9.3)	56 (2.1)	459 (7.0)	15 (1.9)	415 (8.1)	0.8 (0.05)
SW Math/Sci. Collaborative, PA	20 (2.0)	516 (7.5)	67 (1.6)	524 (7.5)	13 (1.3)	484 (11.4)	0.7 (0.03)
International Avg. (All Countries)	40 (0.2)	486 (0.9)	50 (0.2)	495 (0.8)	10 (0.1)	455 (1.7)	1.1 (0.00)

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

Background data provided by students.

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

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 Mathematics?

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

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

Students who disagreed or strongly disagreed with all five statements were assigned to the high level of the index, while students who agreed or strongly agreed with all five were assigned to the low level. The medium level includes all other 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 "mathematics is not one of my strengths.")

The percentages of eighth-grade students at each index level, and their average mathematics achievement, are presented in Exhibit 4.8. Across participating countries, the United States was among those with the greatest percentages of students at the high level of the self-concept index: 31 percent compared with 18 percent on average across all countries. Several of the Benchmarking participants had even greater percentages at the high level, notably the Naperville School District and the First in the World Consortium, with 40 percent or more of students at this level.

Although there was a clear positive association between self-concept and mathematics achievement within every country and within every Benchmarking jurisdiction, the relationship across entitiess was more complex. Several countries with high average mathematics achievement, including Singapore, Hong Kong, Chinese Taipei, Korea, and Japan, had relatively low percentages of students (15 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.

text continued on page 132

Index of Students' Self-Concept in Mathematics

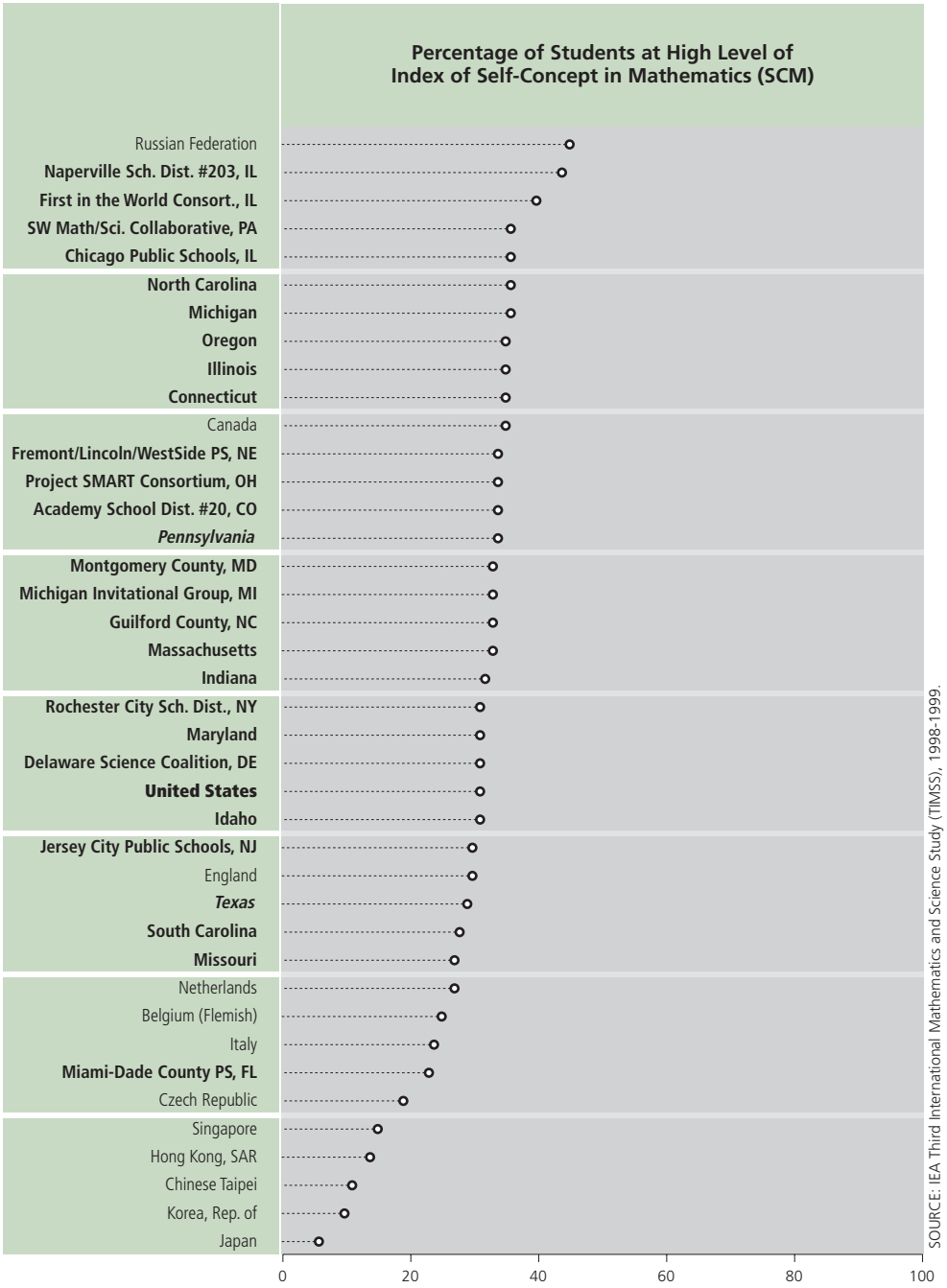
Index based on students' responses to five statements about their mathematics ability: 1) I would like mathematics much more if it were not so difficult; 2) although I do my best, mathematics is more difficult for me than for many of my classmates; 3) nobody can be good in every subject, and I am just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

	High SCM		Medium SCM		Low SCM	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Russian Federation	45 (1.5)	568 (4.7)	44 (1.1)	510 (6.5)	11 (0.8)	470 (10.9)
Naperville Sch. Dist. #203, IL	44 (1.4)	597 (3.9)	49 (1.7)	554 (3.1)	7 (0.8)	507 (7.6)
First in the World Consort., IL	40 (2.5)	590 (6.9)	55 (3.1)	545 (6.1)	5 (1.1)	481 (9.0)
SW Math/Sci. Collaborative, PA	36 (1.9)	553 (7.8)	56 (1.6)	504 (7.6)	8 (0.7)	447 (11.7)
Chicago Public Schools, IL	36 (2.8)	505 (6.7)	56 (2.7)	445 (6.0)	8 (1.2)	404 (9.1)
North Carolina	36 (1.7)	533 (7.5)	54 (1.4)	484 (6.7)	10 (0.8)	430 (8.7)
Michigan	36 (1.6)	554 (7.4)	53 (1.7)	508 (6.7)	11 (0.8)	452 (6.4)
Oregon	35 (1.6)	552 (5.8)	55 (1.3)	505 (5.6)	9 (0.9)	444 (7.5)
Illinois	35 (1.8)	549 (6.9)	56 (1.5)	495 (7.0)	9 (0.9)	448 (7.5)
Connecticut	35 (2.0)	547 (10.0)	56 (1.8)	502 (8.5)	9 (1.0)	448 (9.5)
Canada	35 (1.0)	573 (2.9)	56 (1.0)	517 (2.4)	9 (0.5)	459 (6.1)
Fremont/Lincoln/WestSide PS, NE	34 (2.1)	539 (9.7)	51 (1.7)	479 (9.1)	14 (1.5)	406 (8.6)
Project SMART Consortium, OH	34 (2.2)	562 (8.4)	56 (2.0)	509 (7.1)	10 (1.2)	448 (7.5)
Academy School Dist. #20, CO	34 (1.4)	560 (3.4)	58 (1.5)	521 (2.8)	8 (0.8)	460 (8.5)
Pennsylvania	34 (1.7)	543 (8.3)	56 (1.3)	499 (5.5)	10 (0.9)	443 (6.3)
Montgomery County, MD	33 (1.7)	572 (6.1)	58 (1.5)	529 (3.4)	9 (1.1)	473 (9.8)
Michigan Invitational Group, MI	33 (2.3)	568 (6.1)	55 (2.2)	527 (4.7)	12 (1.0)	465 (13.0)
Guilford County, NC	33 (2.7)	535 (7.7)	60 (2.7)	508 (8.0)	8 (1.1)	469 (13.5)
Massachusetts	33 (1.9)	553 (6.4)	58 (1.5)	503 (5.5)	10 (1.0)	446 (8.1)
Indiana	32 (1.9)	557 (6.9)	57 (1.5)	504 (6.5)	12 (1.1)	457 (9.6)
Rochester City Sch. Dist., NY	31 (1.6)	486 (6.6)	54 (1.6)	440 (8.0)	15 (1.2)	402 (8.1)
Maryland	31 (1.4)	535 (5.7)	58 (1.0)	487 (6.2)	11 (0.9)	432 (7.6)
Delaware Science Coalition, DE	31 (1.5)	528 (9.7)	57 (1.8)	472 (7.9)	12 (1.1)	418 (12.6)
United States	31 (1.0)	551 (4.6)	58 (0.8)	493 (3.9)	11 (0.6)	435 (5.6)
Idaho	31 (1.9)	534 (7.6)	58 (1.5)	488 (6.4)	11 (0.9)	429 (9.7)
Jersey City Public Schools, NJ	30 (2.8)	531 (8.9)	60 (2.4)	459 (6.8)	9 (1.2)	413 (9.3)
England	30 (1.3)	543 (5.0)	61 (1.2)	487 (3.9)	9 (0.6)	430 (6.5)
Texas	29 (1.5)	565 (9.0)	60 (1.3)	513 (9.1)	11 (1.1)	447 (10.6)
South Carolina	28 (1.8)	548 (6.9)	61 (1.4)	492 (7.7)	11 (0.9)	441 (8.0)
Missouri	27 (1.6)	527 (7.0)	60 (1.6)	484 (5.1)	12 (0.8)	441 (8.6)
Netherland	27 (2.0)	578 (7.0)	65 (1.8)	532 (7.7)	8 (0.9)	490 (9.8)
Belgium (Flemish)	25 (0.8)	600 (5.4)	62 (0.8)	554 (3.3)	13 (1.1)	506 (7.8)
Italy	24 (0.9)	539 (3.8)	63 (0.9)	474 (3.8)	13 (0.8)	412 (5.4)
Miami-Dade County PS, FL	23 (2.2)	478 (13.0)	60 (1.8)	420 (9.2)	17 (2.1)	364 (8.2)
Czech Republic	19 (1.2)	585 (5.7)	66 (1.0)	515 (4.0)	15 (1.0)	461 (5.5)
Singapore	15 (1.0)	656 (8.8)	74 (0.8)	603 (5.7)	11 (0.7)	547 (7.1)
Hong Kong, SAR	14 (0.7)	624 (4.6)	71 (0.8)	585 (3.8)	14 (0.8)	531 (6.3)
Chinese Taipei	11 (0.5)	660 (6.0)	75 (0.7)	591 (3.9)	14 (0.7)	506 (4.2)
Korea, Rep. of	10 (0.5)	646 (4.0)	85 (0.5)	585 (1.8)	5 (0.3)	515 (5.7)
Japan	6 (0.4)	634 (6.2)	82 (0.5)	581 (1.8)	12 (0.5)	536 (3.8)
International Avg. (All Countries)	18 (0.2)	547 (1.1)	67 (0.2)	486 (0.7)	15 (0.1)	436 (0.9)

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

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.

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

8th Grade Mathematics

	High SCM Percent of Students		Medium SCM Percent of Students		Low SCM Percent of Students	
	Girls	Boys	Girls	Boys	Girls	Boys
Countries						
United States	28 (1.3)	34 (1.2) ▲	61 (1.2) ▲	54 (1.0)	11 (0.7)	11 (0.7)
Belgium (Flemish)	24 (1.3)	26 (1.2)	61 (1.5)	63 (1.2)	16 (1.4) ▲	11 (1.1)
Canada	31 (1.4)	39 (1.1) ▲	59 (1.6) ▲	52 (1.0)	9 (0.7)	9 (0.5)
Chinese Taipei	7 (0.5)	14 (0.8) ▲	79 (0.8) ▲	72 (1.0)	14 (0.8)	14 (0.9)
Czech Republic	16 (1.3)	22 (1.5) ▲	69 (1.3)	63 (1.3)	15 (1.0)	15 (1.5)
England	24 (1.5)	36 (1.8) ▲	65 (1.5) ▲	57 (1.7)	11 (1.0)	7 (0.7)
Hong Kong, SAR	11 (0.9)	18 (0.9) ▲	74 (1.2) ▲	69 (1.0)	15 (1.1)	14 (1.1)
Italy	22 (1.1)	25 (1.3)	64 (1.3)	63 (1.3)	14 (1.0)	13 (1.0)
Japan	3 (0.4)	8 (0.7) ▲	80 (0.9)	83 (0.9)	17 (0.8) ▲	8 (0.5)
Korea, Rep. of	7 (0.6)	12 (0.7) ▲	87 (0.6) ▲	84 (0.7)	6 (0.4)	4 (0.4)
Netherlands	21 (2.1)	33 (2.6) ▲	69 (1.8)	61 (2.7)	10 (1.2)	6 (1.0)
Russian Federation	48 (1.8)	42 (1.8)	42 (1.5)	45 (1.4)	10 (0.9)	13 (1.0)
Singapore	13 (0.9)	17 (1.4)	77 (0.9) ▲	72 (1.0)	11 (0.8)	12 (0.9)
States						
Connecticut	31 (2.2)	40 (2.5) ▲	59 (2.2)	52 (2.1)	10 (1.1)	8 (1.1)
Idaho	29 (2.2)	33 (2.2)	61 (2.0)	56 (1.9)	10 (1.2)	11 (1.0)
Illinois	32 (2.3)	38 (2.1)	59 (1.9)	52 (1.8)	8 (1.0)	9 (1.2)
Indiana	27 (1.8)	36 (2.5) ▲	61 (1.7) ▲	52 (2.2)	11 (1.3)	12 (1.0)
Maryland	30 (1.8)	33 (1.8)	59 (1.3)	57 (1.7)	11 (0.9)	10 (1.1)
Massachusetts	28 (2.3)	37 (1.9) ▲	62 (1.9) ▲	53 (1.8)	9 (1.2)	10 (1.2)
Michigan	33 (1.6)	39 (2.3)	56 (1.8) ▲	49 (2.1)	11 (1.0)	11 (1.1)
Missouri	27 (1.4)	28 (2.3)	61 (1.6)	60 (2.2)	12 (1.2)	12 (1.0)
North Carolina	37 (1.9)	35 (2.0)	54 (1.6)	54 (2.0)	8 (0.9)	11 (1.3)
Oregon	33 (2.3)	38 (1.8)	59 (2.2)	52 (2.0)	8 (1.3)	11 (1.2)
Pennsylvania	31 (2.3)	37 (2.0)	59 (1.8)	53 (1.5)	11 (1.3)	10 (1.2)
South Carolina	24 (2.1)	32 (2.5)	64 (1.6)	57 (2.3)	12 (1.1)	10 (1.3)
Texas	26 (2.3)	32 (1.7)	64 (1.9)	57 (1.9)	10 (1.4)	12 (1.4)
Districts and Consortia						
Academy School Dist. #20, CO	30 (1.9)	38 (1.9)	63 (1.8) ▲	53 (1.9)	7 (1.2)	9 (1.2)
Chicago Public Schools, IL	35 (2.9)	37 (3.1)	56 (2.6)	56 (3.3)	9 (1.4)	7 (1.2)
Delaware Science Coalition, DE	26 (2.1)	37 (1.8) ▲	63 (2.1) ▲	51 (2.3)	11 (1.2)	12 (1.9)
First in the World Consort., IL	38 (2.7)	41 (4.0)	56 (2.8)	55 (4.4)	6 (1.4)	4 (0.9)
Fremont/Lincoln/WestSide PS, NE	31 (3.9)	38 (1.4)	54 (2.9)	49 (2.5)	16 (2.2)	13 (1.9)
Guilford County, NC	31 (3.0)	35 (3.3)	62 (3.0)	57 (3.3)	7 (1.1)	8 (1.6)
Jersey City Public Schools, NJ	27 (2.2)	34 (4.1)	62 (2.4)	58 (3.8)	11 (1.5)	8 (1.6)
Miami-Dade County PS, FL	23 (2.6)	24 (2.9)	60 (2.3)	59 (2.0)	17 (2.0)	17 (3.0)
Michigan Invitational Group, MI	30 (3.8)	37 (3.3)	60 (3.2)	49 (2.9)	10 (1.5)	14 (1.8)
Montgomery County, MD	33 (2.7)	34 (1.6)	56 (2.1)	59 (1.8)	11 (1.3) ▲	7 (1.2)
Naperville Sch. Dist. #203, IL	41 (1.9)	47 (2.2)	51 (2.3)	46 (2.1)	8 (1.2)	6 (0.9)
Project SMART Consortium, OH	31 (2.8)	38 (2.1)	58 (2.7)	53 (2.4)	11 (1.5)	9 (1.3)
Rochester City Sch. Dist., NY	31 (1.6)	32 (2.9)	56 (2.2)	51 (3.0)	13 (2.1)	16 (1.7)
SW Math/Sci. Collaborative, PA	32 (2.4)	41 (2.6)	59 (2.0)	52 (2.8)	9 (1.1)	7 (0.7)
International Avg. (All Countries)	17 (0.2)	20 (0.2) ▲	68 (0.2) ▲	66 (0.2)	16 (0.2) ▲	15 (0.2)

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.

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.

What Are Students' Attitudes Towards Mathematics?

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

- I like mathematics
- I enjoy learning mathematics
- Mathematics is boring[5]
- Mathematics is important to everyone's life
- I would like a job that involved using mathematics.

For each statement, students responded on a four-point scale indicating whether their feelings about mathematics were strongly positive, positive, negative, or strongly negative. The responses were averaged, with students being placed in the high category if their average indicated a positive or strongly positive attitude. 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. (Additional information on students' liking mathematics, one of the components of the index, is provided in Exhibit R1.12 in the reference section.)

Internationally, eighth graders generally had positive attitudes towards mathematics, with 37 percent on average across all TIMSS 1999 countries in the high category and a further 52 percent in the medium category. Only 11 percent of students were in the low category. The percentage for the United States did not vary much from the international average for the high category, but was greater in the low category (16 percent). Benchmarking jurisdictions with large percentages of students at the high level included Jersey City, Chicago, and North Carolina (44 percent or more). Jurisdictions with students having somewhat less favorable attitudes included Massachusetts, Oregon, and the Academy School District, where 28 to 29 percent of the students were at the high level. The reference countries with the least positive attitudes were Japan and Korea (9 percent in the high category). Since these are countries with high average mathematics achievement, it may be that the students follow a demanding mathematics curriculum that leads to high achievement but little enthu-

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

siasm for the subject matter. However, there was a clear positive association between attitudes towards mathematics and mathematics achievement on average across all the TIMSS 1999 countries and in many of the Benchmarking entities.

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 mathematics. Although the United States, like many of the other countries, had significantly different percentages of girls and boys at the index levels, there were essentially no significant differences among the Benchmarking participants. The only significant difference was in Massachusetts, with a greater percentage of girls at the medium level.

Index of Students' Positive Attitudes Towards Mathematics

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

	High PATM		Medium PATM		Low PATM	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Jersey City Public Schools, NJ	51 (2.4)	499 (8.4)	41 (1.8)	462 (9.5)	8 (1.2)	409 (9.3)
Chicago Public Schools, IL	47 (3.0)	478 (7.9)	45 (2.6)	453 (6.5)	8 (1.7)	437 (10.6)
Singapore	45 (1.0)	620 (6.4)	48 (0.9)	595 (6.7)	7 (0.5)	568 (9.1)
North Carolina	44 (1.4)	509 (7.7)	46 (1.2)	489 (7.5)	9 (0.8)	466 (8.0)
England	41 (1.3)	506 (5.4)	51 (1.2)	495 (4.5)	8 (0.5)	478 (8.1)
Guilford County, NC	40 (2.0)	513 (10.0)	49 (1.6)	516 (8.2)	10 (0.9)	510 (10.8)
Rochester City Sch. Dist., NY r	39 (2.1)	467 (7.0)	49 (1.9)	449 (7.9)	12 (1.5)	414 (11.7)
Illinois	39 (1.5)	526 (8.7)	50 (1.3)	503 (6.3)	12 (0.7)	484 (8.2)
Miami-Dade County PS, FL	38 (2.6)	440 (10.6)	48 (2.3)	413 (10.1)	14 (1.7)	414 (9.0)
South Carolina	38 (1.4)	510 (8.7)	49 (0.9)	501 (8.2)	13 (1.1)	490 (7.0)
Texas	37 (1.4)	537 (10.7)	50 (1.1)	513 (9.2)	13 (1.0)	504 (11.5)
Russian Federation	36 (1.3)	555 (5.3)	58 (1.2)	518 (6.3)	5 (0.4)	496 (8.3)
SW Math/Sci. Collaborative, PA	36 (1.7)	536 (7.6)	49 (1.5)	509 (7.9)	14 (1.3)	496 (10.9)
Naperville Sch. Dist. #203, IL	36 (1.4)	595 (3.7)	50 (1.8)	562 (3.4)	14 (1.3)	530 (6.7)
Fremont/Lincoln/WestSide PS, NE	36 (1.5)	513 (12.0)	51 (1.8)	488 (9.0)	14 (1.0)	437 (8.4)
Italy	35 (1.2)	512 (4.2)	51 (1.1)	469 (4.3)	14 (0.8)	449 (5.1)
Canada	35 (0.9)	552 (3.4)	51 (1.0)	526 (2.7)	14 (0.7)	500 (4.6)
Maryland	35 (1.5)	514 (5.9)	50 (1.0)	490 (6.4)	15 (1.2)	480 (7.6)
United States	35 (1.1)	522 (4.5)	49 (0.7)	500 (3.9)	16 (0.7)	481 (4.7)
Indiana	35 (2.1)	537 (7.0)	49 (1.7)	508 (7.5)	16 (0.9)	495 (10.5)
Delaware Science Coalition, DE	35 (1.8)	506 (9.9)	50 (1.5)	476 (9.3)	16 (1.5)	466 (10.7)
Pennsylvania	34 (1.6)	527 (8.6)	51 (1.0)	503 (5.8)	15 (1.5)	480 (9.5)
Connecticut	34 (1.7)	528 (11.6)	51 (1.3)	509 (8.4)	15 (1.4)	497 (9.1)
Michigan	33 (1.5)	538 (9.3)	51 (1.3)	516 (6.8)	16 (1.1)	486 (5.6)
Michigan Invitational Group, MI	33 (1.2)	560 (7.1)	50 (1.3)	528 (6.0)	17 (1.9)	497 (10.9)
First in the World Consort., IL	33 (1.4)	576 (6.5)	52 (1.8)	559 (6.5)	15 (1.6)	525 (10.5)
Project SMART Consortium, OH	31 (2.1)	552 (8.1)	52 (1.8)	517 (7.1)	17 (1.4)	482 (9.9)
Idaho	31 (2.1)	518 (7.5)	51 (1.5)	492 (7.5)	18 (1.5)	468 (8.0)
Missouri	31 (1.9)	508 (7.3)	52 (1.2)	488 (4.8)	17 (1.2)	468 (7.5)
Montgomery County, MD	30 (1.8)	553 (5.8)	53 (1.7)	535 (3.6)	18 (1.6)	523 (6.9)
Massachusetts	29 (1.8)	534 (7.0)	52 (1.1)	511 (6.0)	19 (1.4)	491 (7.4)
Oregon	29 (1.8)	536 (6.9)	55 (1.6)	513 (6.7)	15 (1.6)	489 (7.7)
Hong Kong, SAR	28 (0.9)	613 (4.1)	61 (0.8)	578 (4.1)	11 (0.6)	533 (4.8)
Academy School Dist. #20, CO	28 (1.2)	549 (4.1)	52 (1.4)	527 (2.9)	21 (1.4)	509 (5.4)
Belgium (Flemish)	25 (0.9)	598 (4.7)	53 (0.9)	555 (3.5)	22 (1.1)	523 (4.5)
Chinese Taipei	23 (0.8)	643 (5.1)	59 (0.8)	582 (4.1)	18 (0.7)	529 (5.4)
Czech Republic	19 (1.2)	559 (6.2)	63 (1.2)	515 (4.9)	18 (1.0)	500 (5.8)
Netherland	17 (1.4)	555 (11.7)	63 (1.0)	543 (7.1)	20 (1.4)	522 (8.4)
Japan	9 (0.5)	619 (5.4)	61 (0.7)	585 (2.0)	29 (0.9)	554 (2.9)
Korea, Rep. of	9 (0.4)	647 (4.2)	65 (0.8)	591 (2.1)	26 (0.8)	560 (2.6)
International Avg. (All Countries)	37 (0.2)	512 (0.9)	52 (0.2)	481 (0.8)	11 (0.1)	473 (1.2)

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

States in *italics* did not fully satisfy guidelines for sample participation rates (see Appendix A for details). An "r" indicates a 70-84% student response rate.

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

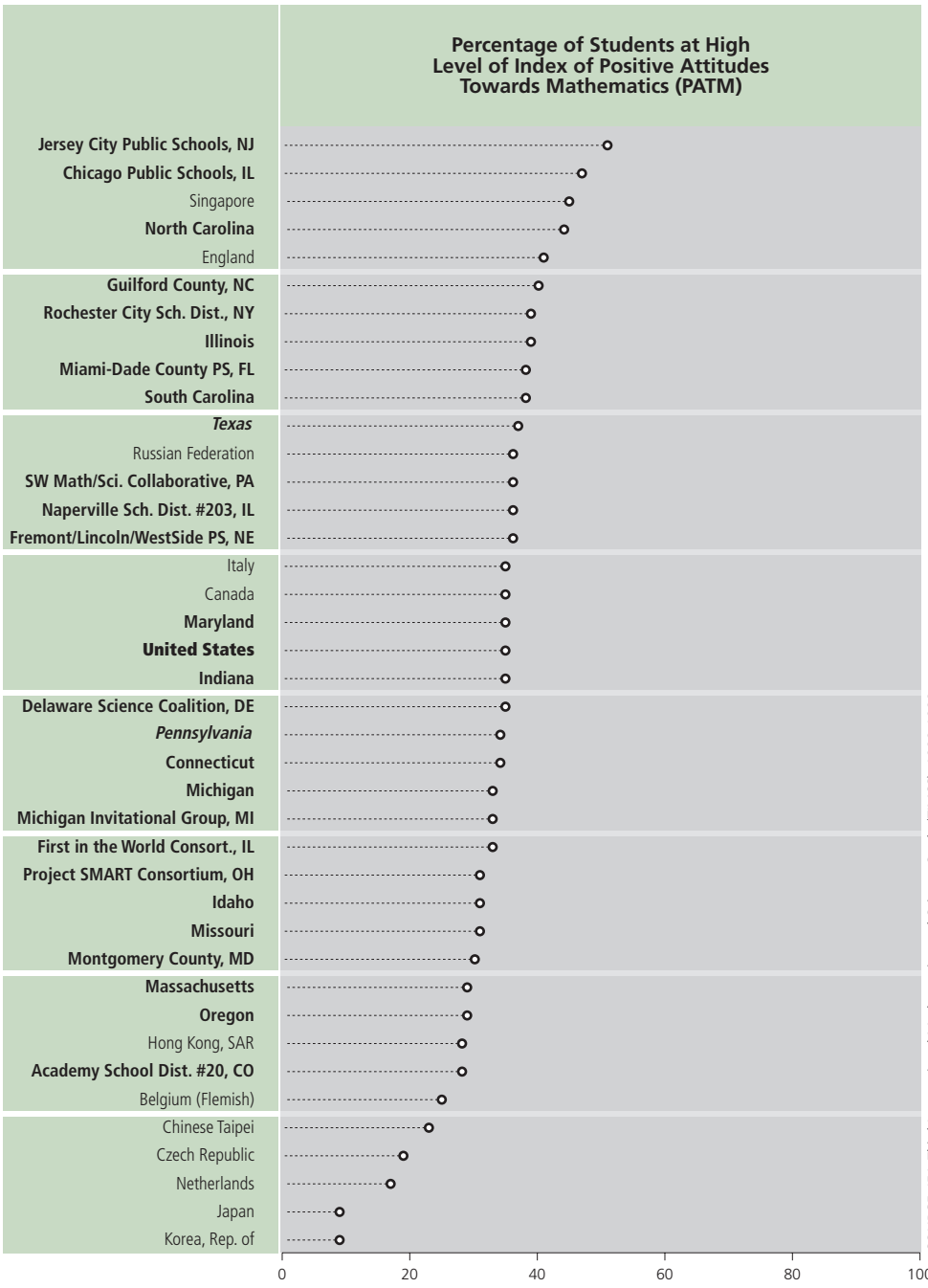

Percentage of Students at High Level of Index of Positive Attitudes Towards Mathematics (PATM)
Jersey City Public Schools, NJ
Chicago Public Schools, IL
Singapore
North Carolina
England
Guilford County, NC
Rochester City Sch. Dist., NY
Illinois
Miami-Dade County PS, FL
South Carolina
Texas
Russian Federation
SW Math/Sci. Collaborative, PA
Naperville Sch. Dist. #203, IL
Fremont/Lincoln/WestSide PS, NE
Italy
Canada
Maryland
United States
Indiana
Delaware Science Coalition, DE
Pennsylvania
Connecticut
Michigan
Michigan Invitational Group, MI
First in the World Consort., IL
Project SMART Consortium, OH
Idaho
Missouri
Montgomery County, MD
Massachusetts
Oregon
Hong Kong, SAR
Academy School Dist. #20, CO
Belgium (Flemish)
Chinese Taipei
Czech Republic
Netherlands
Japan
Korea, Rep. of
0
20
40
60
80
100
SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

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

8th Grade Mathematics

	High PATM Percent of Students		Medium PATM Percent of Students		Low PATM Percent of Students	
	Girls	Boys	Girls	Boys	Girls	Boys
Countries						
United States	32 (1.3)	37 (1.2) ▲	52 (1.1) ▲	46 (0.9)	16 (0.7)	16 (1.1)
Belgium (Flemish)	24 (1.4)	26 (1.7)	53 (1.8)	53 (1.4)	23 (1.6)	21 (1.3)
Canada	31 (1.1)	38 (1.2) ▲	53 (1.4) ▲	48 (1.1)	15 (0.9)	13 (0.9)
Chinese Taipei	18 (0.9)	27 (1.1) ▲	61 (1.0)	58 (1.0)	21 (0.9) ▲	15 (0.8)
Czech Republic	16 (1.5)	22 (1.7)	64 (1.7)	61 (1.4)	20 (1.4)	17 (1.3)
England	35 (1.7)	48 (1.7) ▲	55 (1.5) ▲	47 (1.5)	10 (0.8) ▲	6 (0.7)
Hong Kong, SAR	22 (1.1)	34 (1.2) ▲	65 (1.0) ▲	57 (1.1)	13 (0.8) ▲	8 (0.6)
Italy	33 (1.6)	38 (1.4)	52 (1.5)	49 (1.4)	15 (1.0)	13 (1.0)
Japan	6 (0.5)	13 (0.7) ▲	59 (1.0)	64 (1.0) ▲	36 (1.2) ▲	23 (0.9)
Korea, Rep. of	8 (0.6)	10 (0.6)	64 (1.2)	66 (1.0)	28 (1.3)	25 (0.9)
Netherlands	12 (1.5)	23 (1.8) ▲	62 (1.4)	63 (1.9)	26 (1.9) ▲	14 (1.4)
Russian Federation	37 (1.6)	36 (1.6)	58 (1.5)	59 (1.4)	5 (0.5)	5 (0.6)
Singapore	41 (1.4)	48 (1.4) ▲	52 (1.1) ▲	45 (1.3)	7 (0.7)	7 (0.7)
States						
Connecticut	33 (2.1)	34 (2.0)	52 (1.7)	49 (1.9)	15 (1.8)	16 (1.5)
Idaho	30 (2.1)	32 (3.0)	55 (2.1)	47 (2.1)	15 (1.7)	21 (1.9)
Illinois	38 (2.3)	39 (1.3)	51 (2.0)	48 (1.4)	10 (0.9)	13 (1.0)
Indiana	31 (2.2)	38 (2.5)	53 (1.8)	45 (2.4)	16 (1.2)	17 (1.3)
Maryland	32 (2.0)	38 (1.5)	52 (1.5)	48 (1.1)	16 (1.4)	15 (1.4)
Massachusetts	26 (2.0)	32 (2.2)	56 (1.6) ▲	48 (1.6)	18 (1.7)	19 (1.8)
Michigan	30 (2.0)	36 (2.0)	54 (1.9)	48 (1.8)	16 (1.3)	16 (1.5)
Missouri	32 (2.4)	30 (1.8)	53 (1.9)	50 (1.7)	15 (1.2)	20 (1.8)
North Carolina	44 (2.2)	44 (1.9)	48 (2.1)	45 (1.6)	8 (0.9)	11 (1.1)
Oregon	26 (2.5)	32 (2.1)	57 (1.6)	54 (2.5)	17 (2.0)	13 (1.5)
Pennsylvania	32 (2.0)	37 (1.8)	52 (1.5)	49 (2.1)	15 (1.5)	14 (1.7)
South Carolina	35 (2.1)	40 (2.2)	52 (2.2)	47 (1.8)	13 (1.5)	13 (1.2)
Texas	35 (2.3)	38 (1.2)	53 (2.0)	48 (1.3)	11 (1.4)	15 (1.0)
Districts and Consortia						
Academy School Dist. #20, CO	24 (2.1)	32 (1.7)	54 (2.2)	50 (2.1)	22 (2.1)	19 (1.7)
Chicago Public Schools, IL	46 (3.1)	48 (3.7)	46 (3.0)	45 (2.9)	8 (1.5)	8 (2.1)
Delaware Science Coalition, DE	31 (2.3)	39 (2.1)	52 (1.8)	47 (2.4)	17 (2.1)	14 (1.8)
First in the World Consort., IL	32 (3.0)	33 (3.1)	54 (3.0)	50 (2.1)	15 (2.1)	16 (2.4)
Fremont/Lincoln/WestSide PS, NE	32 (2.1)	39 (3.1)	53 (2.1)	48 (2.7)	14 (2.5)	13 (1.2)
Guilford County, NC	40 (2.6)	41 (2.1)	51 (2.4)	47 (2.1)	9 (0.9)	12 (1.6)
Jersey City Public Schools, NJ	50 (2.7)	52 (3.5)	42 (2.5)	40 (2.8)	8 (1.2)	8 (2.1)
Miami-Dade County PS, FL	37 (3.0)	40 (2.9)	49 (3.0)	47 (2.3)	14 (2.5)	14 (1.5)
Michigan Invitational Group, MI	33 (2.5)	33 (2.1)	51 (2.3)	49 (2.2)	16 (3.4)	19 (2.1)
Montgomery County, MD	29 (2.1)	30 (2.0)	52 (2.0)	54 (2.1)	19 (2.0)	16 (1.7)
Naperville Sch. Dist. #203, IL	34 (2.1)	38 (2.0)	53 (2.4)	48 (2.2)	14 (1.7)	14 (1.7)
Project SMART Consortium, OH	28 (2.6)	34 (2.3)	53 (2.8)	50 (1.9)	19 (1.7)	16 (1.8)
Rochester City Sch. Dist., NY r	35 (2.9)	44 (2.4)	53 (2.7)	45 (2.2)	13 (1.7)	11 (2.2)
SW Math/Sci. Collaborative, PA	35 (2.3)	38 (2.5)	51 (2.3)	48 (2.2)	14 (1.3)	15 (2.0)
International Avg. (All Countries)	35 (0.2)	39 (0.2) ▲	53 (0.2) ▲	51 (0.2)	12 (0.2) ▲	10 (0.1)

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

▲ Significantly higher than other gender

Significance tests adjusted for multiple comparisons

Background data provided by students.

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