CHAPTER 6

Teachers and Instruction

Chapter 6 presents information about science teachers and instruction. Teachers' reports are given on their educational background, teaching preparation, and instructional practices. Information is also provided about how teachers spend their time related to teaching tasks, the materials used in instruction, the activities students do in class, the use of computers in science lessons, the role of homework, and the reliance on different types of assessment.

Teachers of science design and manage the learning environments that provide students with the opportunity needed to learn science. They structure the content and pace of lessons, introducing new material, selecting various instructional activities, and monitoring students' developing understanding of the concepts studied. Teachers may help students use technology and tools to investigate scientific ideas, analyze students' work for misconceptions, and promote positive attitudes towards science. They may also assign homework and conduct formal and informal assessments to evaluate achievement. To collect information about science instruction, TIMSS administered a questionnaire to teachers asking them about some of these issues.

Because the sampling for the teacher questionnaires was based on participating students, teachers' responses do not necessarily represent all eighth-grade science teachers in each participating entity. Rather, they represent teachers of the representative samples of students assessed. It is important to note that when information from the teacher questionnaire is reported, the student is always the unit of analysis. That is, the data shown are the percentages of *students* whose teachers reported on various characteristics or instructional strategies. Using the student as the unit of analysis makes it possible to describe the science instruction received by representative samples of students. Although this perspective may differ from that obtained by simply collecting information from teachers, it is consistent with the TIMSS goals of examining the educational contexts and performance of students.

The teachers who completed the questionnaires were the science teachers of the students who took the TIMSS 1999 test. The general sampling procedure was to sample a mathematics class from each participating school, administer the test to those students, and ask both their mathematics and science teachers to complete a background questionnaire. Thus, the information about instruction is tied directly to the students tested and the specific science classes in which they were taught. In countries where students had separate teachers for the science subjects, all science teachers of the students in the sampled mathematics classes were asked to complete questionnaires. Sometimes, however, teachers did not complete the questionnaire assigned to them, so most entities had some percentage of students for whom no teacher questionnaire information is available. The exhibits in this chapter have special notations on this point. For a TIMSS 1999 participating entity (country, state, district, or consortium) where teacher responses are available for 70 to 84 percent of the students, an "r" is included next to the data. Where teacher responses are available for 50 to 69 percent of students, an "s" is included; where they are available for less than 50 percent, an "x" replaces the data.

What Preparation Do Teachers Have for Teaching Science?

This section provides information about background characteristics of science teachers, including age and gender, major area of study, and certification. Teachers' confidence in teaching various science topics is also discussed.

As shown by the international average at the bottom of Exhibit 6.1, 61 percent of eighth-grade students internationally were taught by teachers between the ages of 30 and 49, 21 percent by teachers age 50 or older, and only 19 percent by teachers younger than age 30. In comparison, the United States had a relatively older teaching force, with 32 percent of students taught by teachers age 50 or older.

Most Benchmarking participants did not differ substantially from the international profile. However, Idaho, Oregon, the Chicago Public Schools, the First in the World Consortium, the Fremont/Lincoln/Westside Public Schools, and the Michigan Invitational Group had less than 10 percent of their students taught by teachers in their 20s. Similarly, Connecticut, Idaho, Massachusetts, Oregon, Chicago, the Fremont/Lincoln/Westside Public Schools, the Jersey City Public Schools, the Michigan Invitational Group, and the Southwest Pennsylvania Math and Science Collaborative had 65 percent or more of their students taught by teachers age 40 or older, compared with 51 percent internationally and 61 percent in the United States. On the other hand, the teachers in the Delaware Science Coalition were younger than the international average – 69 percent of the students had teachers under age 40 compared with 50 percent internationally.

Internationally on average, 58 percent of eighth-grade students had female science teachers, and 42 percent had male. However, in the United States and in Canada, Chinese Taipei, England, Hong Kong, Japan, and the Netherlands, the majority of students were taught science by male teachers. The Benchmarking participants varied quite considerably, with South Carolina, Chicago, and Jersey City having more than three-fourths of their students taught by female science teachers, and Oregon, the Fremont/Lincoln/Westside Public Schools, the Project SMART Consortium, and the Southwest Pennsylvania Math and Science Collaborative having more than 60 percent of their students taught by male science teachers.

Exhibit 6.2 presents teachers' reports about their major areas of study during their post-secondary teacher preparation programs. Teachers' undergraduate and graduate studies give some indication of their preparation to teach science. Also, research shows that higher achievement in science is associated with teachers having a bachelor's and/or master's degree in science.[1] According to their teachers, however, U.S. eighth-grade students were less likely than those in other countries to be taught science by teachers with a major area of study in science.

In countries such as the United States that offer eighth-grade science as a single general subject, 42 percent of students on average internationally were in a science class taught by a teacher whose major area of study was biology, 23 percent physics, 30 percent chemistry, 44 percent science education, 25 percent mathematics or mathematics education, and 30 percent general education. (Note that teachers can have dual majors, or different majors at the undergraduate and graduate level.) The United States was similar to the international profile, although with somewhat fewer students taught by physics and chemistry teachers and considerably more taught by teachers with a major in general education or some other area.

Among Benchmarking participants, in almost every jurisdiction the majority of students were in science classes in which the teacher's major area was science education or general education. In addition, in eight of the jurisdictions – Connecticut, Idaho, Illinois, Missouri, the Academy School District, the Delaware Science Coalition, the First in the World Consortium, the Miami-Dade County Public Schools, and the Michigan Invitational Group – the majority of students had science teachers with a major in some other non-science subject. More than half the students in Maryland, Massachusetts, Missouri, Oregon, Texas, the Academy School District, First in the World, the Fremont/Lincoln/Westside Public Schools, Naperville, and Rochester were taught science by teachers with a major in biology. Teachers with a major in physics or chemistry were rare; only in the Academy School District, Naperville, and Project SMART were more than 30 percent of students taught by such teachers.

In countries such as Belgium (Flemish), Chinese Taipei, the Czech Republic, the Netherlands, and the Russian Federation, where the science subjects are taught as separate courses, typically greater percentages of students were taught science by teachers with a major in the area they were teaching. On average across all the TIMSS 1999 separate-science countries, 85 percent of students were taught biology by teachers with a major in biology, 75 percent were taught physics by a physics major, and 87 percent were taught chemistry by a chemistry major.

1 Goldhaber, D.D. and Brewer, D.J. (1997), "Evaluating the Effect of Teacher Degree Level on Educational Performance" in W. Fowler (ed.), *Developments in School Finance, 1996*, NCES 97-535, Washington DC: National Center for Education Statistics; Darling-Hammond, L. (2000), *Teacher Quality and Student Achievement: A Review of State Policy Evidence*, Education Policy Analysis Archives, 8(1).

To gauge teachers' confidence in their ability to teach science topics, TIMSS constructed an index of teachers' confidence in their preparation to teach science (CPTS), presented in Exhibit 6.3. Teachers were asked how well prepared they felt to teach each of 10 science topics (e.g., earth's features and physical processes, chemical reactivity and transformation). There were three possible responses: very well prepared was assigned a value of three, somewhat prepared two, and not well prepared one. Students were assigned to the high level of the index if their teachers reported feeling very well prepared, on average, across the 10 topics (2.75 or higher). The medium level indicates that teachers reported being somewhat to well prepared (averages from 2.25 to 2.75), and the low level that they felt only somewhat prepared or less (averages less than 2.25). Because in some countries teachers specialize in separate science subjects, they could answer that they did not teach some of the topics. In computing the index value, topics that a teacher did not teach were excluded from the average.

In general, teachers reported only moderate confidence in their preparation to teach science, with just 20 percent of students, on average internationally, taught by teachers who believed they were very well prepared and another 41 percent by teachers somewhat to well prepared. On average across countries, 39 percent of students had teachers with a low level of confidence, and in three of the highest-performing countries, Hong Kong, Japan, and Korea, more than half the students had teachers who felt only somewhat prepared or less. In the United States, science teachers generally reported greater confidence in their preparation than did their peers in other countries, with only the Czech Republic reporting greater confidence among the comparison countries. Despite this, however, teachers in the U.S. overall and in many Benchmarking entities generally expressed much less confidence in their preparation to teach eighth-grade science than mathematics. In the U.S. as a whole, 87 percent of the students had teachers who reported a high level of confidence in their preparation to teach mathematics,[2] compared with 27 percent for science. This figure for science ranged from 56 percent in the Academy School District to 14 percent in the Delaware Science Coalition across the Benchmarking entities, with half of them exceeding the national average. Teachers in a number of the lower-scoring jurisdictions reported relatively high levels of confidence in their preparation, possibly because they are teaching a science curriculum that is not very demanding.

Exhibit R3.1 in the reference section provides the detail for the 10 topics comprising the confidence in preparation index. Teachers were most confident in their preparation to teach biology topics, with more than 50 percent of students, on average internationally, having teachers who

2 Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., O'Connor, K.M., Chrostowski, S.J., Gregory, K.D., Garden, R.A., and Smith, T.A. (2001), *Mathematics Benchmarking Report, TIMSS 1999 – Eighth Grade: Achievement for U.S. States and Districts in an International Context*, Chestnut Hill, MA: Boston College.

reported feeling very well prepared to teach these topics. Teachers had less confidence in their preparation to teach earth science topics, particularly the solar system and the universe. Between 45 and 51 percent of students across countries had teachers who reported feeling very well prepared to teach chemistry or physics topics, compared with 39 percent for environmental and resource issues and 34 percent for scientific methods and inquiry skills. Teachers in the United States overall expressed greater than average confidence in their preparation to teach topics in earth science, environmental and resource issues, and scientific methods and inquiry skills. The Benchmarking participants generally followed the pattern for the United States.

Exhibit R3.2 shows principals' opinions about the degree to which shortages of qualified science teachers affect the capacity to provide instruction. On average internationally, principals reported that such shortages affect the quality of instruction some or a lot for 35 percent of students in countries with general/integrated science, and for somewhat fewer in the separate-science countries. In the United States, and among Benchmarking participants generally, relatively few students were in schools where such shortages affected instructional capacity. In Idaho, Illinois, Massachusetts, Oregon, and Pennsylvania, less than 10 percent of students were in schools with science teacher shortages, and in the Academy School District, the First in the World Consortium, the Fremont/Lincoln/Westside Public Schools, and Naperville, no students at all were reported to be in such schools. In the Michigan Invitational Group, however, 40 percent of students were in schools with science teacher shortages.

Teachers' beliefs about science learning and instruction are to some degree related to their preparation. Exhibits R3.3 and R3.4 in the reference section show the percentages of eighth-grade students whose science teachers reported certain beliefs about science, the way science should be taught, and the importance of various abilities in achieving success in the discipline. In general, teachers revealed a fairly practical view of science. Across countries and Benchmarking entities, there was substantial agreement that science is primarily a practical and structured guide for addressing real situations, and that it is important for teachers to give students prescriptive and sequential directions for doing science experiments. Also across Benchmarking entities but less so across the comparison countries, there was substantial agreement that science is primarily a formal way of representing the real world. Benchmarking entities were less in agreement that some students have a natural talent for science and others do not. Teachers also generally agreed that all of the skills shown in Exhibit R3.4 (thinking in a sequential and procedural manner, being able to think creatively, understanding how science is used in the real world, and being able to provide reasons to support conclusions) are very important for students' success in science.

How teachers spend their time in school is determined mainly by school and district policies and practices, but the perspectives they gain during their teacher preparation can also have an effect. Across countries, students' science teachers spent only 58 percent of their formally scheduled school time teaching science, and 71 percent of their time teaching altogether (see Exhibit R3.5 in the reference section). Additionally, 10 percent was spent on curriculum planning, and about 20 percent on various administrative and other duties. The results for the United States as a whole and for most of the Benchmarking entities were very similar to the international profile.

		Percentage of Students by Age of Teachers					Percentage of Students by Gender of Teachers	
		29 Years or Under	30-39 Years	40-49 Years	50 Years or Older		Female	Male
Countries								
United States	r	20 (2.6)	19 (2.2)	29 (2.8)	32 (2.7)	r	48 (3.5)	52 (3.5)
Belgium (Flemish)		25 (2.8)	24 (3.1)	34 (3.5)	17 (2.5)		64 (3.9)	36 (3.9)
Canada		21 (3.1)	31 (2.6)	31 (2.9)	18 (2.6)		41 (3.3)	59 (3.3)
Chinese Taipei		17 (3.0)	40 (3.9)	32 (3.7)	11 (2.6)		40 (3.7)	60 (3.7)
Czech Republic		12 (1.8)	20 (2.0)	21 (2.2)	47 (3.1)		74 (2.4)	26 (2.4)
England	s	24 (4.0)	23 (3.6)	31 (4.0)	22 (3.4)	s	43 (4.3)	57 (4.3)
Hong Kong, SAR		34 (4.3)	38 (4.6)	19 (3.6)	9 (2.7)		39 (4.2)	61 (4.2)
Italy		0 (0.0)	8 (2.0)	58 (4.1)	34 (3.8)		76 (3.1)	24 (3.1)
Japan		15 (3.1)	43 (4.2)	28 (3.8)	15 (2.8)		21 (3.6)	79 (3.6)
Korea, Rep. of		17 (2.6)	49 (3.4)	22 (3.3)	12 (2.6)		59 (3.3)	41 (3.3)
Netherlands		19 (2.9)	23 (3.3)	34 (3.8)	25 (3.2)		20 (2.6)	80 (2.6)
Russian Federation		19 (1.7)	27 (1.6)	27 (1.7)	28 (2.0)		88 (1.2)	12 (1.2)
Singapore		25 (4.1)	22 (3.7)	26 (4.1)	26 (3.5)		68 (3.4)	32 (3.4)
States								
Connecticut	s	12 (4.1)	10 (2.9)	31 (7.7)	46 (7.7)	s	47 (7.5)	53 (7.5)
Idaho	r	9 (3.3)	14 (3.4)	44 (7.4)	33 (6.9)	r	44 (6.1)	56 (6.1)
Illinois		15 (5.7)	29 (7.1)	29 (4.8)	28 (6.3)		58 (6.5)	42 (6.5)
Indiana		22 (7.4)	18 (5.0)	35 (7.0)	25 (5.1)		53 (5.7)	47 (5.7)
Maryland	r	21 (4.5)	23 (6.1)	32 (6.8)	24 (5.1)	r	63 (5.7)	37 (5.7)
Massachusetts		13 (3.8)	16 (4.0)	36 (5.2)	36 (5.7)		50 (5.6)	50 (5.6)
Michigan		26 (5.9)	18 (4.2)	22 (4.9)	34 (6.0)		50 (5.4)	50 (5.4)
Missouri		28 (6.5)	21 (5.8)	31 (5.8)	21 (5.6)		67 (5.6)	33 (5.6)
North Carolina		33 (5.0)	22 (4.0)	31 (6.7)	14 (4.8)		60 (6.6)	40 (6.6)
Oregon		5 (2.2)	25 (5.0)	50 (6.4)	20 (3.6)		37 (6.9)	63 (6.9)
Pennsylvania		19 (5.2)	18 (6.7)	32 (5.8)	31 (5.3)		47 (5.6)	53 (5.6)
South Carolina		20 (3.3)	24 (5.7)	30 (5.7)	26 (5.2)		78 (5.8)	22 (5.8)
Texas	r	32 (6.9)	20 (5.6)	24 (6.0)	24 (5.2)	r	70 (6.0)	30 (6.0)
Districts and Consortia								
Academy School Dist. #20, CO		39 (0.4)	12 (0.4)	24 (0.3)	25 (0.3)		53 (0.4)	47 (0.4)
Chicago Public Schools, IL		4 (3.5)	23 (7.2)	49 (9.0)	24 (7.1)		78 (8.7)	22 (8.7)
Delaware Science Coalition, DE	r	38 (6.8)	31 (7.2)	9 (4.0)	22 (5.9)	r	63 (3.4)	37 (3.4)
First in the World Consort., IL		7 (4.8)	26 (8.9)	12 (4.1)	55 (6.7)		42 (5.5)	58 (5.5)
Fremont/Lincoln/WestSide PS, NE		5 (2.7)	26 (6.8)	40 (9.4)	30 (6.6)		39 (7.3)	61 (7.3)
Guilford County, NC		35 (6.7)	16 (3.8)	19 (5.7)	30 (3.6)		67 (4.9)	33 (4.9)
Jersey City Public Schools, NJ	r	28 (3.1)	6 (0.4)	35 (2.0)	32 (2.7)	r	78 (3.3)	22 (3.3)
Miami-Dade County PS, FL	s	18 (5.5)	19 (7.8)	25 (8.8)	37 (8.8)	s	60 (5.8)	40 (5.8)
Michigan Invitational Group, MI	r	9 (5.3)	21 (2.3)	31 (6.4)	40 (3.5)	r	46 (3.0)	54 (3.0)
Montgomery County, MD		x x	x x	x x	x x		x x	x x
Naperville Sch. Dist. #203, IL		10 (3.4)	44 (5.3)	25 (3.7)	21 (1.8)		53 (2.5)	47 (2.5)
Project SMART Consortium, OH		33 (2.6)	19 (4.0)	31 (3.9)	18 (5.3)		29 (3.6)	71 (3.6)
Rochester City Sch. Dist., NY		23 (4.7)	25 (4.3)	43 (6.1)	10 (3.1)		55 (4.4)	45 (4.4)
SW Math/Sci. Collaborative, PA		13 (4.4)	22 (6.1)	22 (6.1)	43 (8.1)		33 (6.2)	67 (6.2)
International Avg. (All Countries)		19 (0.5)	31 (0.5)	30 (0.5)	21 (0.4)		58 (0.6)	42 (0.6)

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

Background data provided by teachers.

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 teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students. An "x" indicates teacher response data available for <50% of students.

Exhibit 6.2

Teachers' Major Area of Study in Their BA, MA, or Teacher Training Certification Program*

TIMSS 1999 Benchmarking
Boston College

8th Grade Science

General/Integrated Science

Percentage of Students Whose Teachers Reported Having the Major Area of Study

		Biology	Physics	Chemistry	Science Education	Mathematics or Mathematics Education	Education	Other
Countries	United States	47 (3.5)	13 (2.2)	21 (3.0)	43 (3.7)	14 (2.5)	56 (3.6)	r 45 (3.7)
	Canada	36 (2.8)	8 (1.9)	17 (2.3)	28 (2.9)	11 (1.8)	51 (3.0)	67 (2.8)
	England	s 49 (4.6)	s 47 (3.8)	s 54 (3.8)	s 54 (3.7)	s 25 (3.9)	s 44 (3.6)	s 35 (4.4)
	Hong Kong, SAR	26 (3.9)	15 (3.4)	29 (4.2)	47 (4.4)	33 (4.5)	38 (4.5)	30 (4.1)
	Italy	61 (3.5)	3 (1.4)	5 (1.5)	– –	23 (3.5)	0 (0.0)	16 (3.1)
	Japan	r 31 (4.7)	r 30 (4.5)	r 37 (4.7)	r 44 (5.0)	r 4 (1.8)	r 18 (3.2)	r 22 (4.0)
	Korea, Rep. of	27 (3.5)	24 (3.5)	28 (3.6)	38 (3.9)	1 (0.8)	10 (2.3)	10 (2.2)
	Singapore	48 (4.7)	20 (3.4)	53 (4.5)	46 (4.3)	49 (4.4)	40 (4.3)	r 29 (4.5)
States	Connecticut	s 41 (7.9)	s 5 (2.7)	s 8 (3.0)	s 45 (7.7)	s 5 (2.6)	s 44 (6.9)	s 59 (6.9)
	Idaho	r 42 (6.4)	r 8 (1.8)	r 18 (4.5)	r 50 (8.0)	r 7 (3.2)	r 68 (8.3)	s 58 (8.7)
	Illinois	44 (6.6)	6 (3.0)	11 (3.2)	46 (7.5)	12 (3.4)	65 (7.4)	r 54 (6.0)
	Indiana	47 (7.1)	23 (7.8)	26 (7.5)	65 (7.4)	21 (7.4)	77 (4.9)	42 (6.4)
	Maryland	r 59 (5.7)	r 12 (4.4)	r 18 (5.1)	r 45 (5.6)	r 9 (3.3)	r 65 (4.5)	r 41 (5.9)
	Massachusetts	55 (5.4)	12 (3.9)	23 (5.6)	51 (6.6)	12 (3.0)	50 (6.2)	44 (5.8)
	Michigan	r 43 (6.0)	r 11 (4.3)	r 19 (5.3)	r 51 (6.2)	r 23 (6.1)	r 72 (4.7)	r 46 (5.6)
	Missouri	56 (7.3)	14 (4.8)	24 (5.7)	72 (5.0)	11 (4.6)	72 (5.1)	r 56 (5.4)
	North Carolina	33 (5.7)	7 (3.4)	14 (3.8)	56 (6.6)	23 (4.7)	53 (6.8)	r 43 (6.1)
	Oregon	51 (7.1)	14 (4.5)	28 (6.4)	74 (6.0)	13 (4.4)	58 (6.4)	46 (6.4)
	Pennsylvania	40 (4.4)	9 (2.9)	20 (5.0)	52 (4.5)	5 (2.1)	64 (4.6)	r 41 (7.6)
	South Carolina	38 (4.2)	11 (3.6)	16 (4.0)	56 (5.7)	12 (4.1)	56 (6.3)	36 (5.6)
	Texas	r 59 (7.7)	r 16 (5.1)	r 20 (5.0)	r 35 (5.2)	r 7 (3.1)	r 45 (6.7)	r 44 (7.5)
Districts	Academy School Dist. #20, CO	61 (0.4)	35 (0.4)	39 (0.4)	46 (0.4)	18 (0.2)	69 (0.4)	61 (0.4)
	Chicago Public Schools, IL	21 (9.4)	6 (4.0)	5 (3.5)	19 (9.4)	23 (10.3)	70 (10.8)	r 45 (10.3)
	Delaware Science Coalition, DE	r 29 (4.8)	r 5 (3.4)	r 7 (3.6)	r 56 (7.0)	r 0 (0.0)	r 47 (7.9)	r 57 (8.5)
	First in the World Consort., IL	60 (7.0)	8 (6.0)	24 (4.6)	44 (4.1)	13 (3.8)	70 (7.2)	56 (4.9)
	Fremont/Lincoln/WestSide PS, NE	71 (4.3)	23 (9.2)	23 (7.3)	79 (7.8)	3 (0.1)	54 (7.9)	r 18 (3.9)
	Guilford County, NC	33 (6.6)	13 (4.3)	20 (6.2)	53 (6.6)	25 (5.4)	60 (6.6)	44 (5.4)
	Jersey City Public Schools, NJ	r 34 (2.9)	r 4 (0.4)	r 7 (0.5)	r 26 (3.8)	r 4 (0.4)	r 49 (2.8)	r 47 (3.0)
	Miami-Dade County PS, FL	s 40 (7.4)	s 10 (5.1)	s 28 (8.9)	s 38 (6.8)	s 5 (3.2)	s 35 (7.2)	s 51 (8.0)
	Michigan Invitational Group, MI	43 (6.6)	16 (2.0)	24 (3.5)	63 (5.3)	8 (2.8)	60 (6.3)	r 57 (4.8)
	Montgomery County, MD	s 40 (7.7)	s 7 (5.1)	s 15 (4.9)	s 60 (5.2)	s 14 (4.5)	s 51 (7.7)	s 46 (8.4)
	Naperville Sch. Dist. #203, IL	58 (3.9)	31 (2.4)	39 (4.0)	36 (2.3)	24 (2.0)	61 (3.8)	41 (5.2)
	Project SMART Consortium, OH	39 (2.2)	22 (3.7)	35 (3.5)	73 (4.4)	12 (3.9)	58 (3.3)	39 (5.7)
	Rochester City Sch. Dist., NY	65 (5.6)	3 (1.3)	22 (4.2)	46 (5.8)	3 (1.4)	61 (6.4)	r 33 (6.1)
	SW Math/Sci. Collaborative, PA	36 (5.5)	9 (4.5)	15 (4.2)	50 (7.0)	11 (4.4)	65 (7.3)	r 39 (6.9)
	International Avg. (All General Science Countries)	42 (0.8)	23 (0.7)	30 (0.8)	44 (0.9)	25 (0.7)	30 (0.7)	29 (0.8)

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

Background data provided by teachers.

* Countries are classified as having either general/integrated science or separate subject area classes at grade 8. Teachers who responded that they majored in more than one subject are reflected in all categories that apply.

a Chinese Taipei: Data for grade 8 physics/chemistry teachers are reported in the physics panel; data for grade 7 biology teachers are not available.

b Netherlands: Data for physics/chemistry teachers are reported in the physics panel.

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 "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

	Biology	Physics	Chemistry	Science Education	Mathematics or Mathematics Education	Education	Other
	Percentage of Students Whose Teachers Reported Having the Major Area of Study						
Earth Science							
Belgium (Flemish)	66 (5.5)	38 (4.4)	57 (5.6)	45 (4.1)	10 (2.8)	41 (4.2)	85 (3.3)
Chinese Taipei	– –	– –	– –	– –	– –	– –	– –
Czech Republic	25 (5.3)	2 (1.5)	4 (2.0)	33 (5.1)	25 (4.0)	35 (5.6)	90 (3.3)
Netherlands	3 (1.6)	2 (1.2)	1 (0.1)	1 (0.7)	1 (0.1)	4 (1.8)	85 (4.5)
Russian Federation	42 (4.1)	4 (1.8)	15 (2.8)	71 (4.1)	7 (2.7)	74 (4.0)	84 (3.2)
International Avg. (All Separate Science Countries)	28 (1.3)	7 (0.7)	13 (0.9)	39 (1.5)	8 (0.8)	37 (1.5)	79 (1.4)
Biology							
Belgium (Flemish)	78 (4.3)	44 (4.9)	56 (4.7)	45 (4.6)	18 (3.7)	41 (4.9)	74 (4.6)
Chinese Taipei [a]	– –	– –	– –	– –	– –	– –	– –
Czech Republic	94 (2.5)	0 (0.0)	32 (4.5)	53 (5.3)	6 (2.3)	50 (4.8)	63 (5.4)
Netherlands	84 (4.1)	3 (1.3)	7 (3.0)	9 (3.6)	4 (2.2)	3 (2.1)	20 (5.9)
Russian Federation	88 (3.0)	10 (2.3)	53 (3.8)	75 (3.2)	8 (1.9)	77 (3.2)	65 (3.6)
International Avg. (All Separate Science Countries)	85 (0.9)	13 (0.8)	36 (1.0)	43 (1.2)	10 (0.7)	39 (1.0)	45 (1.2)
Physics							
Belgium (Flemish)	49 (6.0)	66 (5.6)	62 (6.2)	51 (6.1)	50 (5.7)	45 (6.1)	63 (6.2)
Chinese Taipei [a]	8 (2.4)	60 (4.3)	64 (4.2)	32 (4.1)	7 (2.2)	36 (4.0)	9 (2.5)
Czech Republic	1 (1.1)	88 (3.6)	14 (3.5)	46 (5.0)	61 (5.6)	41 (4.3)	35 (5.0)
Netherlands [b]	14 (4.7)	39 (5.4)	28 (6.7)	15 (4.7)	32 (5.7)	13 (4.5)	23 (5.4)
Russian Federation	1 (0.8)	88 (3.0)	5 (2.1)	73 (3.9)	53 (4.1)	74 (4.2)	64 (3.4)
International Avg. (All Separate Science Countries)	11 (0.8)	75 (1.0)	34 (1.2)	41 (1.2)	44 (1.1)	41 (1.0)	33 (1.1)
Chemistry							
Belgium (Flemish)	– –	– –	– –	– –	– –	– –	– –
Chinese Taipei	– –	– –	– –	– –	– –	– –	– –
Czech Republic	39 (5.2)	9 (3.0)	91 (3.2)	44 (5.2)	22 (4.2)	40 (5.3)	46 (5.4)
Netherlands	– –	– –	– –	– –	– –	– –	– –
Russian Federation	62 (5.9)	14 (3.1)	81 (4.3)	69 (5.9)	14 (3.1)	71 (5.3)	63 (3.7)
International Avg. (All Separate Science Countries)	45 (1.5)	25 (1.5)	87 (1.0)	46 (1.9)	21 (1.4)	45 (1.6)	37 (1.4)

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

Index of Teachers' Confidence in Preparation to Teach Science

Index based on teachers' responses to 10 questions about how prepared they feel to teach different science topics (see reference exhibit R3.1) based on a 3-point scale: 1 = not well prepared; 2 = somewhat prepared; 3 = very well prepared. Average is computed across the 10 items for items for which the teacher did not respond do not teach. High level indicates average is greater than or equal to 2.75. Medium level indicates average is greater than or equal to 2.25 and less than 2.75. Low level indicates average is less than 2.25.

		High CPTS		Medium CPTS		Low CPTS	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Academy School Dist. #20, CO		56 (0.4)	552 (3.1)	30 (0.4)	563 (3.9)	14 (0.2)	578 (4.0)
Project SMART Consortium, OH		42 (3.6)	538 (12.4)	46 (4.6)	541 (13.6)	12 (4.1)	520 (9.1)
Connecticut	s	40 (7.5)	541 (14.2)	43 (7.5)	544 (12.3)	17 (4.4)	519 (12.8)
Czech Republic		40 (2.8)	538 (4.8)	46 (2.8)	544 (5.8)	15 (2.4)	533 (6.2)
Michigan Invitational Group, MI		38 (3.7)	562 (4.8)	46 (6.3)	563 (9.2)	16 (4.8)	574 (12.5)
Oregon		35 (6.7)	541 (10.1)	44 (6.4)	529 (8.4)	21 (5.7)	545 (17.0)
Maryland	r	35 (6.2)	499 (12.5)	44 (5.5)	517 (8.5)	21 (5.0)	489 (18.5)
Naperville Sch. Dist. #203, IL		34 (4.9)	586 (5.2)	59 (5.1)	583 (6.1)	7 (1.6)	575 (8.7)
Rochester City Sch. Dist., NY		33 (6.3)	470 (16.8)	47 (5.4)	447 (6.3)	19 (4.4)	445 (18.5)
First in the World Consort., IL		33 (6.1)	575 (14.3)	66 (6.2)	560 (5.6)	1 (0.1)	~ ~
Indiana		33 (6.7)	531 (12.0)	55 (6.5)	548 (8.1)	12 (4.0)	520 (12.3)
Miami-Dade County PS, FL	s	32 (6.3)	436 (15.3)	48 (9.1)	430 (13.8)	20 (7.7)	413 (37.4)
Texas	r	30 (6.7)	497 (19.7)	45 (6.9)	513 (14.3)	25 (6.0)	516 (17.4)
Illinois		28 (6.5)	538 (12.1)	54 (6.4)	524 (7.6)	18 (3.0)	509 (9.4)
Fremont/Lincoln/WestSide PS, NE		28 (6.9)	536 (6.9)	59 (7.5)	489 (10.4)	13 (2.8)	547 (21.6)
United States	r	27 (3.0)	526 (8.7)	55 (3.5)	519 (5.8)	18 (2.5)	511 (9.2)
North Carolina		27 (5.7)	495 (13.7)	40 (5.4)	512 (7.6)	33 (6.1)	514 (9.5)
Massachusetts		27 (4.7)	529 (11.8)	62 (5.1)	542 (8.3)	11 (3.5)	502 (25.1)
Michigan		26 (5.6)	558 (8.0)	58 (5.7)	554 (10.6)	16 (4.1)	562 (8.7)
SW Math/Sci. Collaborative, PA		26 (4.4)	550 (9.7)	50 (5.8)	541 (9.6)	25 (6.5)	541 (15.5)
South Carolina		24 (6.3)	520 (13.3)	45 (5.7)	508 (8.9)	31 (5.1)	512 (14.2)
Missouri		23 (5.3)	531 (16.0)	57 (6.5)	519 (8.4)	20 (4.1)	527 (11.6)
Pennsylvania		23 (4.9)	542 (7.9)	49 (6.0)	517 (6.5)	28 (5.6)	547 (12.4)
Guilford County, NC		21 (4.9)	524 (21.7)	52 (5.6)	536 (13.1)	27 (4.9)	528 (14.5)
Idaho	r	21 (4.8)	521 (14.9)	53 (7.4)	533 (7.4)	27 (6.7)	522 (8.1)
Belgium (Flemish)		20 (2.5)	536 (9.2)	44 (3.2)	542 (4.7)	36 (3.3)	525 (7.1)
Jersey City Public Schools, NJ	r	20 (3.3)	452 (30.9)	39 (2.1)	435 (8.2)	41 (2.6)	448 (16.2)
Netherlands		19 (2.9)	550 (10.4)	45 (3.8)	545 (10.2)	35 (3.5)	543 (7.4)
Singapore		18 (3.3)	568 (14.4)	44 (4.1)	576 (10.4)	38 (4.4)	559 (13.1)
Canada	r	16 (2.4)	542 (5.3)	47 (3.2)	534 (3.6)	37 (2.8)	533 (4.6)
Chicago Public Schools, IL		15 (7.9)	490 (44.7)	60 (9.1)	452 (12.9)	25 (8.3)	427 (18.2)
Chinese Taipei		14 (3.0)	573 (7.9)	46 (4.8)	576 (5.9)	40 (4.5)	559 (6.3)
Delaware Science Coalition, DE	r	14 (5.8)	521 (32.4)	56 (7.2)	494 (10.1)	30 (6.7)	495 (16.8)
Italy		13 (2.8)	487 (11.6)	54 (3.9)	491 (5.6)	33 (3.4)	499 (5.9)
Hong Kong, SAR		9 (2.3)	552 (12.4)	34 (4.1)	526 (6.1)	57 (4.3)	529 (5.4)
Korea, Rep. of		6 (1.8)	543 (8.8)	32 (3.3)	552 (3.8)	62 (3.5)	548 (3.3)
Japan		3 (1.5)	564 (7.3)	15 (3.1)	548 (6.0)	82 (3.1)	549 (2.6)
Montgomery County, MD		x x	x x	x x	x x	x x	x x
England		– –	– –	– –	– –	– –	– –
Russian Federation		– –	– –	– –	– –	– –	– –
International Avg. (All Countries)		20 (0.5)	487 (1.7)	41 (0.6)	485 (1.1)	39 (0.6)	477 (1.2)

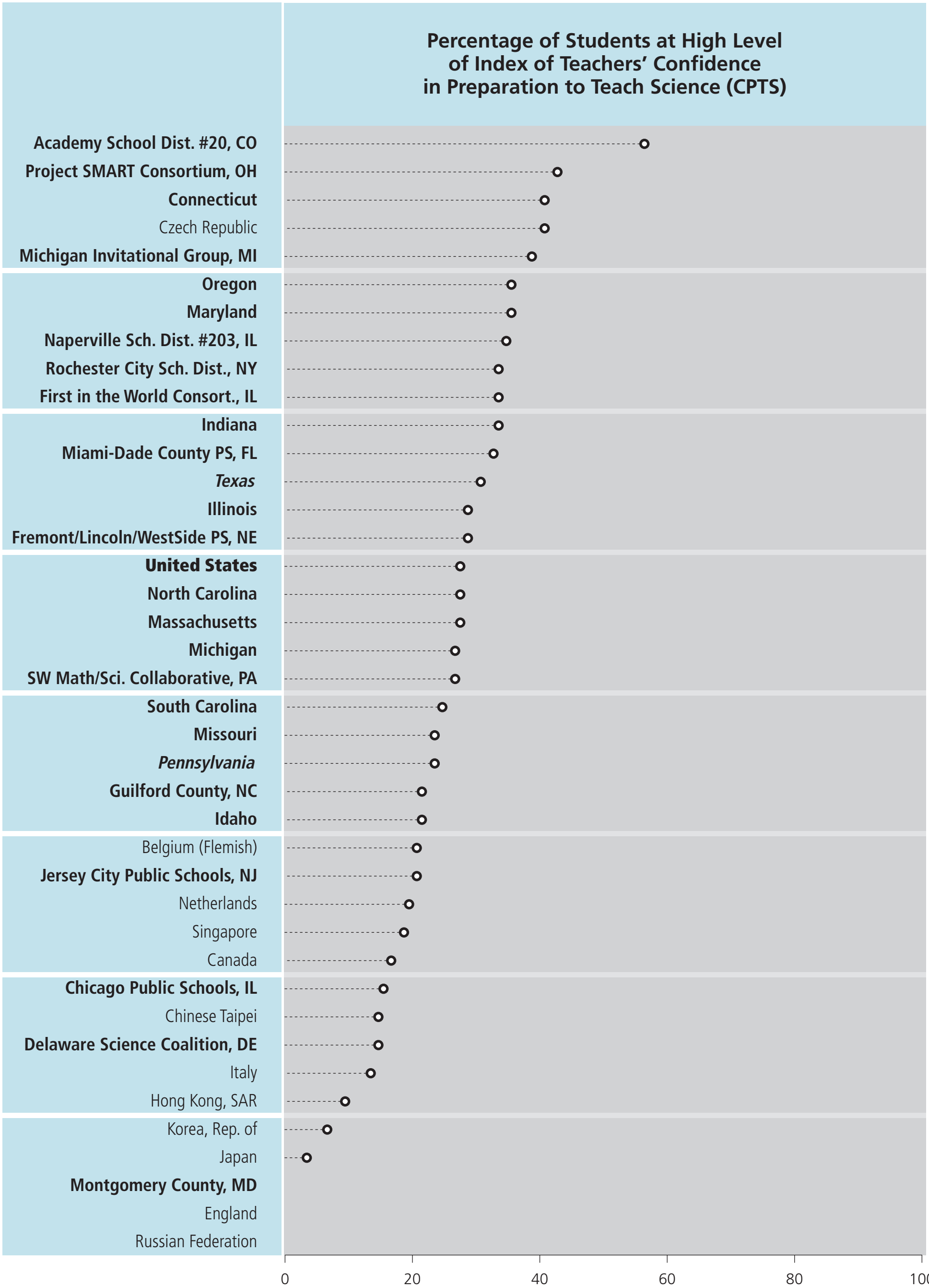
SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

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

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

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

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students. An "x" indicates teacher response data available for <50% of students.



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

How Much School Time Is Devoted to Science Instruction?

Exhibit 6.4 presents information about the amount of instruction in the sciences given to eighth-grade students in the TIMSS 1999 Benchmarking jurisdictions and the comparison countries. Since different systems have school years of different lengths (see Exhibit R3.6) and different arrangements of weekly and daily instruction, the information is given in terms of the average number of hours of science instruction over the school year as reported by science teachers.

Across countries where science is taught as a single subject, the average yearly instructional time for science was 122 hours, representing 12 percent of the total instructional time for all subjects. In general, students in countries with separate science subjects had more total instructional hours in the sciences, with over 220 hours in the Russian Federation and the Czech Republic, for example. Since these students study all of the subjects offered, the total time is the sum of the hours reported by each subject area teacher. In the United States, the average instructional time in science for eighth-grade students was 144 hours. Benchmarking entities that reported more than 160 hours were North and South Carolina, the Michigan Invitational Group, the Fremont/Lincoln/Westside Public Schools, Missouri, and the Academy School District. Entities reporting 120 hours or less were the Naperville School District, the Southwest Pennsylvania Math and Science Collaborative, and the Jersey City Public Schools.

Among the comparison general-science countries, the percentage of instructional time at the eighth grade devoted to the sciences ranged from 19 percent in England to six percent in Italy. In comparison, it ranged from 18 percent in the Michigan Invitational Group to 12 percent in five districts and consortia. Among the selected separate-science countries, the percentage was as high as 24 percent in the Czech Republic and 26 percent in the Russian Federation.

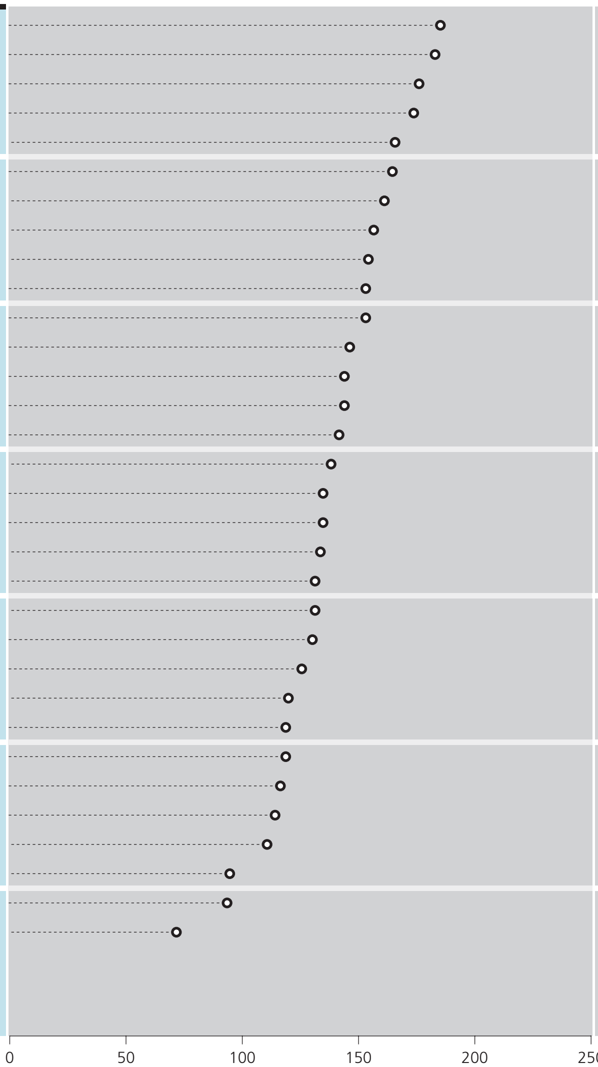
As shown in Exhibit 6.5, teachers of about 60 percent of the students in the single-science countries, on average internationally, reported that science classes meet for at least two hours per week but fewer than three and a half hours. For another 17 percent, classes meet for at least three and a half hours but fewer than five. On average, eighth graders in the United States spend more time in science class per week (61 percent spend three and a half to five hours) than do their counterparts in other general-science countries. This pattern of mostly three and a half to five hours held for nearly all of the Benchmarking entities, with the exception of North Carolina (primarily five hours or more), the Chicago and Jersey City Public Schools, and Naperville (the latter three primarily two to three and a half hours).

The data, however, reveal no clear pattern between the number of in-class instructional hours and science achievement either across or within participating entities. Common sense and research both support the idea that time on task is an important contributor to achievement, yet this time can be spent more or less efficiently. Time alone is not enough; it needs to be spent on high-quality science instruction. Devoting extensive class time to remedial activities can deprive students of this. Also, instructional time can be spent out of school in various tutoring programs; low-performing students may be receiving additional instruction.

Videotapes of mathematics classes in the United States and Japan in TIMSS 1995 revealed that outside interruptions like those for announcements or to conduct administrative tasks can affect the flow of the lesson and detract from instructional time.[3] As shown in Exhibit 6.6, on average internationally almost one-quarter of the students (23 percent) in general-science countries were in science classes that were interrupted pretty often or almost always, and 28 percent were in classes that were never interrupted. The percentage was generally lower in the separate-science countries. In Japan and Korea, more than 60 percent of students were in science classes that were never interrupted – compared with only 13 percent in the United States. In the United States, nearly one-third of the eighth graders were in science classes that were interrupted pretty often or almost always. If anything, the teachers in most of the Benchmarking jurisdictions reported even more interruptions than did teachers in the U.S. overall. The jurisdictions with 20 percent or more of students in classrooms that were never interrupted were the First in the World Consortium, Montgomery County, and Naperville. Conversely, the jurisdictions with the highest percentages of students in classrooms almost always interrupted (17 to 20 percent) were the public school systems of Jersey City, Miami-Dade, and Rochester. Students in science classrooms that were frequently interrupted had substantially lower achievement than their counterparts in classrooms with fewer interruptions.

3 Stigler, J.W., Gonzales, P., Kawanaka, T., Knoll, S., and Serrano, A., (1999), *The TIMSS Videotape Classroom Study: Methods and Findings from an Exploratory Research Project on Eighth-Grade Mathematics Instruction in Germany, Japan, and the United States*, NCES 1999-074, Washington, DC: National Center for Education Statistics.

Exhibit 6.4 Instructional Time in the Sciences at Grade 8*



General/Integrated Science

	Students' Average Yearly Science Instructional Time in Hours		Science Instructional Time as a Percent of Total Instructional Time[1]	
North Carolina	s	184 (14.5)	s	17 (1.5)
England	s	182 (10.7)	s	19 (1.2)
South Carolina	r	175 (9.6)		x x
Michigan Invitational Group, MI	r	173 (20.5)	s	18 (0.4)
Fremont/Lincoln/WestSide PS, NE	s	165 (23.0)		x x
Missouri	s	164 (8.6)	s	16 (0.9)
Academy School Dist. #20, CO		161 (1.1)		x x
Guilford County, NC	s	156 (13.5)		x x
Indiana	r	154 (9.4)	s	14 (0.9)
Massachusetts	s	153 (7.1)		x x
Idaho	s	153 (8.4)		x x
Delaware Science Coalition, DE	s	146 (11.7)		x x
Michigan	r	144 (8.2)		x x
United States	s	144 (4.7)		x x
Maryland	s	141 (10.9)		x x
Illinois	r	138 (8.1)	s	13 (0.9)
Chicago Public Schools, IL	s	135 (14.7)		x x
Oregon	r	135 (6.9)	s	13 (0.8)
Project SMART Consortium, OH	s	133 (1.4)		x x
Texas	s	131 (10.3)		x x
First in the World Consort., IL	s	131 (1.9)	s	12 (0.4)
Rochester City Sch. Dist., NY	s	130 (7.5)	s	12 (0.5)
Pennsylvania	r	126 (6.5)	s	12 (1.0)
Naperville Sch. Dist. #203, IL		120 (0.4)		13 (0.1)
Singapore		119 (2.8)		14 (0.4)
SW Math/Sci. Collaborative, PA	r	119 (5.2)	s	12 (0.8)
Korea, Rep. of		117 (3.3)		11 (0.4)
Canada	s	114 (2.7)	s	12 (0.3)
Hong Kong, SAR	r	111 (3.5)	s	11 (0.5)
Jersey City Public Schools, NJ	s	95 (2.5)		x x
Japan		94 (1.7)		9 (0.2)
Italy		72 (2.0)		6 (0.2)
Connecticut		x x		x x
Miami-Dade County PS, FL		x x		x x
Montgomery County, MD		x x		x x
International Avg. (All General Science Countries)		122 (1.1)		12 (0.1)

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

Science instructional time provided by teachers, and total instructional time provided by schools.

* Countries are classified as having either general/integrated science or separate subject area classes at grade 8.

1 Computed as the ratio of science instructional time to total instructional time averaged across students.

a Chinese Taipei: Data for grade 8 physics/chemistry teachers are reported in the physics panel; data for grade 7 biology teachers are not available.

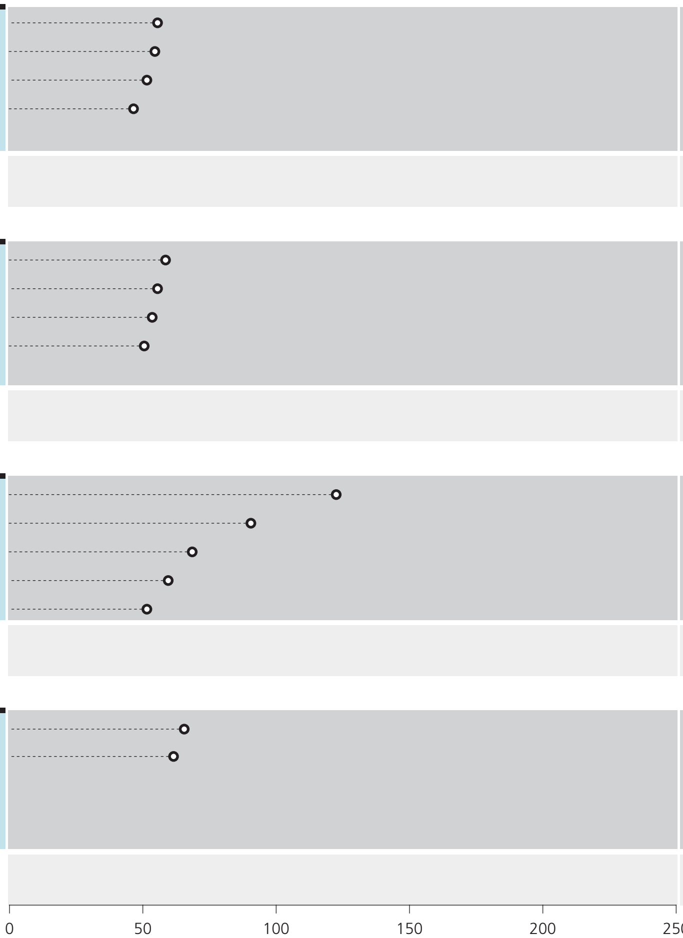
b Netherlands: Data for physics/chemistry teachers are reported in the physics panel.

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 "r" indicates school and/or teacher response data available for 70-84% of students. An "s" indicates school and/or teacher response data available for 50-69% of students. An "x" indicates school and/or teacher response data available for <50% of students.



	Students' Average Yearly Science Instructional Time in Hours		Science Instructional Time as a Percent of Total Instructional Time[1]	
Earth Science				
Netherlands	s	56 (2.3)	s	6 (0.3)
Czech Republic		55 (1.5)		6 (0.2)
Russian Federation	r	52 (1.8)	s	6 (0.2)
Belgium (Flemish)	r	47 (3.4)	r	5 (0.4)
Chinese Taipei		– –		– –
International Avg. (All Separate Science Countries)		56 (1.7)		6 (0.2)
Biology				
Czech Republic		59 (1.8)		6 (0.2)
Netherlands	s	56 (2.0)	s	5 (0.2)
Belgium (Flemish)	r	54 (3.2)	r	6 (0.3)
Russian Federation	r	51 (0.9)	s	6 (0.2)
Chinese Taipei [a]		– –		– –
International Avg. (All Separate Science Countries)		60 (0.9)		6 (0.1)
Physics				
Chinese Taipei [a]		123 (1.5)		9 (0.1)
Belgium (Flemish)	r	91 (7.5)	r	9 (0.8)
Netherlands [b]	s	69 (3.7)	s	7 (0.4)
Czech Republic	r	60 (1.6)	r	6 (0.2)
Russian Federation	r	52 (1.5)	s	6 (0.2)
International Avg. (All Separate Science Countries)		71 (1.0)		7 (0.1)
Chemistry				
Russian Federation	r	66 (1.6)	s	8 (0.2)
Czech Republic		62 (1.6)		6 (0.1)
Belgium (Flemish)		– –		– –
Chinese Taipei		– –		– –
Netherlands		– –		– –
International Avg. (All Separate Science Countries)				7 (0.2)

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

Exhibit 6.5 Number of Hours Science Is Taught Weekly*

TIMSS 1999 Benchmarking
Boston College

8th Grade Science

		5 Hours or More		3.5 Hours to < 5		2 Hours to < 3.5		Less Than 2 Hours	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
General/Integrated Science									
Countries									
United States	r	13 (2.0)	490 (8.0)	61 (3.0)	523 (5.0)	16 (2.3)	533 (11.4)	11 (2.3)	521 (18.3)
Canada	s	5 (1.5)	520 (8.7)	17 (3.2)	549 (6.6)	71 (3.5)	536 (3.3)	7 (1.6)	501 (9.0)
England	s	4 (1.6)	668 (21.8)	17 (4.0)	568 (16.9)	72 (4.3)	532 (6.2)	7 (2.1)	582 (19.4)
Hong Kong, SAR		10 (2.8)	514 (14.2)	7 (2.3)	551 (9.4)	79 (3.9)	532 (4.3)	4 (1.7)	525 (22.7)
Italy		1 (0.8)	~ ~	1 (0.9)	~ ~	71 (3.7)	490 (5.0)	27 (3.5)	498 (5.8)
Japan		0 (0.0)	~ ~	0 (0.0)	~ ~	96 (1.3)	547 (2.4)	4 (1.3)	599 (14.2)
Korea, Rep. of		1 (0.8)	~ ~	4 (1.7)	531 (8.6)	84 (2.6)	550 (2.8)	10 (1.9)	546 (4.7)
Singapore		4 (1.4)	608 (28.0)	50 (4.2)	586 (8.9)	42 (4.2)	550 (14.1)	5 (1.9)	497 (38.7)
States									
Connecticut	s	1 (1.5)	~ ~	59 (8.1)	523 (13.4)	30 (7.4)	550 (12.8)	9 (3.8)	574 (28.2)
Idaho	r	19 (4.5)	515 (11.3)	60 (6.8)	529 (8.9)	10 (4.4)	543 (15.8)	11 (3.5)	536 (17.5)
Illinois		9 (3.0)	478 (20.9)	51 (6.6)	538 (8.0)	29 (5.0)	511 (8.4)	10 (3.7)	564 (16.9)
Indiana		13 (4.1)	545 (13.4)	58 (6.6)	531 (9.5)	25 (6.0)	551 (11.7)	5 (2.3)	521 (67.5)
Maryland	r	11 (3.8)	495 (17.1)	59 (5.4)	519 (7.3)	15 (4.1)	485 (21.3)	14 (4.3)	474 (17.9)
Massachusetts	r	14 (4.0)	526 (12.1)	70 (4.9)	542 (8.5)	15 (4.0)	530 (20.5)	2 (1.2)	~ ~
Michigan	r	10 (2.2)	536 (14.8)	62 (6.2)	553 (8.6)	13 (4.6)	557 (15.3)	15 (4.2)	572 (13.1)
Missouri	r	16 (3.6)	504 (21.4)	71 (4.1)	534 (7.1)	7 (3.5)	508 (22.0)	5 (2.6)	508 (13.8)
North Carolina		41 (7.9)	508 (8.6)	35 (6.6)	510 (13.7)	17 (4.0)	495 (14.1)	7 (3.1)	513 (9.3)
Oregon		10 (4.4)	524 (26.3)	61 (6.5)	546 (8.2)	24 (6.2)	542 (8.5)	5 (2.9)	482 (20.9)
Pennsylvania	r	8 (3.2)	537 (19.0)	50 (4.7)	519 (9.6)	30 (4.4)	537 (8.0)	12 (3.4)	535 (8.6)
South Carolina		26 (5.7)	510 (8.2)	64 (6.5)	515 (10.9)	7 (3.0)	512 (10.2)	4 (1.6)	495 (25.5)
Texas	r	6 (3.2)	494 (73.1)	62 (6.3)	517 (14.4)	15 (4.9)	534 (18.6)	16 (3.7)	492 (18.3)
Districts									
Academy School Dist. #20, CO		19 (0.5)	555 (5.2)	81 (0.5)	560 (3.1)	0 (0.0)	~ ~	0 (0.0)	~ ~
Chicago Public Schools, IL	r	10 (5.3)	400 (39.5)	12 (7.2)	439 (30.0)	75 (9.6)	463 (11.8)	3 (2.9)	421 (6.7)
Delaware Science Coalition, DE	r	10 (3.7)	496 (26.1)	64 (6.6)	493 (13.1)	18 (5.0)	511 (21.4)	8 (4.7)	507 (14.2)
First in the World Consort., IL		6 (5.0)	532 (27.0)	48 (4.9)	583 (6.5)	46 (6.6)	549 (7.9)	0 (0.0)	~ ~
Fremont/Lincoln/WestSide PS, NE	r	8 (7.0)	518 (109.8)	78 (7.4)	507 (7.7)	14 (2.3)	548 (20.9)	0 (0.0)	~ ~
Guilford County, NC		22 (5.5)	525 (14.7)	42 (5.6)	535 (16.5)	11 (2.2)	546 (21.4)	25 (5.4)	539 (13.1)
Jersey City Public Schools, NJ	r	0 (0.0)	~ ~	21 (3.7)	475 (26.8)	55 (4.3)	447 (6.0)	24 (2.2)	428 (15.5)
Miami-Dade County PS, FL	s	29 (9.7)	411 (16.2)	36 (8.9)	449 (11.7)	22 (8.3)	412 (22.6)	12 (4.4)	463 (36.6)
Michigan Invitational Group, MI		21 (5.6)	553 (4.0)	59 (2.0)	577 (9.0)	6 (3.3)	515 (14.5)	15 (5.2)	551 (7.3)
Montgomery County, MD		x x	x x	x x	x x	x x	x x	x x	x x
Naperville Sch. Dist. #203, IL		0 (0.0)	~ ~	15 (0.7)	563 (7.9)	83 (0.7)	589 (4.7)	2 (0.3)	~ ~
Project SMART Consortium, OH	r	7 (0.4)	506 (44.8)	46 (4.6)	542 (12.2)	44 (4.4)	536 (11.9)	3 (0.8)	544 (21.2)
Rochester City Sch. Dist., NY	r	13 (4.8)	497 (23.9)	57 (7.0)	452 (13.9)	15 (4.6)	439 (15.5)	15 (3.4)	423 (22.7)
SW Math/Sci. Collaborative, PA		1 (0.5)	~ ~	43 (7.2)	545 (14.0)	49 (5.9)	545 (9.0)	7 (3.1)	545 (21.1)
International Avg. (All General Science Countries)		9 (0.4)	475 (4.2)	17 (0.6)	500 (4.9)	59 (0.8)	484 (2.7)	15 (0.5)	474 (3.8)

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

Background data provided by teachers.

* Countries are classified as having either general/integrated science or separate subject area classes at grade 8.

a Chinese Taipei: Data for grade 8 physics/chemistry teachers are reported in the physics panel; data for grade 7 biology teachers are not available.

b Netherlands: Data for physics/chemistry teachers are reported in the physics panel.

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.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students. An "x" indicates teacher response data available for <50% of students.

	5 Hours or More		3.5 Hours to < 5		2 Hours to < 3.5		Less Than 2 Hours	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Earth Science								
Belgium (Flemish)	2 (1.1)	~ ~	0 (0.0)	~ ~	14 (4.2)	530 (13.0)	84 (4.4)	541 (5.4)
Chinese Taipei	– –	– –	– –	– –	– –	– –	– –	– –
Czech Republic	0 (0.0)	~ ~	0 (0.0)	~ ~	3 (1.7)	561 (13.4)	97 (1.7)	539 (4.5)
Netherlands	0 (0.0)	~ ~	5 (0.4)	466 (7.8)	6 (3.3)	590 (33.0)	89 (5.7)	550 (6.4)
Russian Federation	0 (0.5)	~ ~	0 (0.0)	~ ~	8 (2.0)	558 (21.6)	91 (2.1)	526 (6.4)
International Avg. (All Separate Science Countries)	1 (0.2)	~ ~	1 (0.2)	~ ~	9 (0.9)	514 (8.3)	90 (1.1)	512 (1.9)
Biology								
Belgium (Flemish) r	3 (1.5)	528 (14.2)	1 (0.0)	~ ~	17 (3.0)	547 (6.8)	79 (3.1)	547 (5.3)
Chinese Taipei [a]	– –	– –	– –	– –	– –	– –	– –	– –
Czech Republic	0 (0.0)	~ ~	0 (0.0)	~ ~	4 (2.1)	562 (16.7)	95 (2.1)	540 (4.6)
Netherlands	0 (0.0)	~ ~	0 (0.0)	~ ~	1 (1.2)	~ ~	99 (1.2)	540 (8.9)
Russian Federation	0 (0.0)	~ ~	1 (0.5)	~ ~	9 (2.2)	548 (14.2)	90 (2.3)	526 (6.3)
International Avg. (All Separate Science Countries)	2 (0.3)	~ ~	2 (0.3)	~ ~	19 (0.8)	487 (5.4)	78 (0.9)	495 (1.7)
Physics								
Belgium (Flemish)	3 (2.1)	553 (35.1)	0 (0.0)	~ ~	43 (6.7)	550 (5.6)	54 (7.0)	551 (6.6)
Chinese Taipei [a]	1 (1.0)	~ ~	41 (4.4)	578 (6.8)	58 (4.5)	561 (4.9)	0 (0.0)	~ ~
Czech Republic	0 (0.0)	~ ~	0 (0.0)	~ ~	7 (2.5)	596 (18.2)	93 (2.5)	537 (4.3)
Netherlands [b]	1 (0.9)	~ ~	0 (0.0)	~ ~	15 (3.9)	543 (6.3)	84 (4.0)	547 (8.7)
Russian Federation	1 (0.8)	~ ~	0 (0.0)	~ ~	6 (1.7)	554 (17.2)	92 (2.1)	527 (6.7)
International Avg. (All Separate Science Countries)	2 (0.4)	~ ~	4 (0.4)	507 (6.6)	27 (0.9)	500 (3.4)	67 (1.0)	495 (2.3)
Chemistry								
Belgium (Flemish)	– –	– –	– –	– –	– –	– –	– –	– –
Chinese Taipei	– –	– –	– –	– –	– –	– –	– –	– –
Czech Republic	0 (0.0)	~ ~	0 (0.0)	~ ~	8 (2.7)	585 (18.5)	92 (2.7)	536 (4.0)
Netherlands	– –	– –	– –	– –	– –	– –	– –	– –
Russian Federation	0 (0.0)	~ ~	1 (0.6)	~ ~	63 (3.8)	526 (6.0)	36 (3.9)	532 (11.6)
International Avg. (All Separate Science Countries)	1 (0.3)	~ ~	2 (0.4)	~ ~	30 (1.2)	499 (4.2)	67 (1.2)	505 (2.8)

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

Exhibit 6.6 Frequency of Outside Interruption During Science Lessons*

8th Grade Science

	Never		Once in a While		Pretty Often		Almost Always	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
General/Integrated Science								
Countries								
United States	13 (0.7)	519 (7.3)	57 (1.2)	539 (4.7)	18 (0.7)	501 (5.3)	11 (0.8)	470 (7.5)
Canada	13 (0.7)	530 (4.9)	63 (0.9)	542 (2.4)	16 (0.7)	523 (3.3)	9 (0.5)	514 (7.9)
Chinese Taipei [a]	27 (1.1)	566 (4.7)	54 (1.0)	579 (5.4)	14 (0.8)	556 (7.3)	5 (0.6)	547 (11.4)
England	14 (1.1)	557 (9.1)	68 (1.1)	549 (5.1)	14 (0.9)	513 (6.4)	5 (0.5)	479 (13.2)
Hong Kong, SAR	41 (1.1)	534 (4.1)	47 (0.9)	534 (3.7)	9 (0.7)	507 (9.3)	3 (0.4)	498 (10.3)
Italy	19 (1.1)	493 (7.9)	53 (1.2)	503 (4.0)	16 (0.9)	486 (6.7)	12 (0.8)	470 (7.3)
Japan	64 (1.3)	550 (3.4)	32 (1.2)	553 (3.7)	4 (0.3)	530 (11.7)	1 (0.2)	~ ~
Korea, Rep. of	61 (0.9)	544 (2.8)	34 (0.8)	561 (3.3)	4 (0.3)	536 (9.3)	2 (0.2)	~ ~
Singapore	19 (0.7)	555 (11.1)	62 (1.2)	583 (7.0)	13 (0.8)	535 (10.6)	6 (0.5)	530 (11.4)
States								
Connecticut	15 (1.3)	546 (11.7)	55 (2.2)	551 (9.7)	18 (1.5)	506 (11.8)	12 (1.3)	499 (12.2)
Idaho	13 (1.2)	520 (10.7)	59 (1.7)	542 (5.3)	17 (1.3)	517 (10.3)	12 (1.4)	490 (7.3)
Illinois	19 (1.4)	530 (8.1)	56 (1.7)	537 (7.3)	16 (1.2)	488 (9.9)	9 (1.0)	482 (10.0)
Indiana	13 (1.1)	540 (8.0)	60 (1.9)	549 (6.5)	17 (1.3)	513 (10.5)	10 (1.4)	519 (19.5)
Maryland	15 (1.2)	522 (8.0)	55 (1.5)	529 (6.6)	17 (1.2)	498 (9.5)	13 (1.0)	462 (8.9)
Massachusetts	15 (1.0)	540 (10.7)	59 (1.2)	548 (7.5)	17 (1.1)	515 (7.7)	9 (0.7)	487 (15.9)
Michigan	13 (1.6)	547 (11.2)	58 (1.6)	564 (6.4)	19 (1.0)	530 (9.8)	9 (1.3)	508 (9.5)
Missouri	13 (1.2)	523 (9.7)	54 (1.7)	541 (7.2)	20 (1.1)	508 (7.2)	13 (1.1)	482 (9.4)
North Carolina	8 (0.7)	509 (11.2)	57 (1.5)	527 (7.0)	21 (1.2)	498 (7.4)	14 (1.3)	462 (11.0)
Oregon	13 (1.0)	532 (8.6)	57 (1.6)	554 (5.5)	19 (1.3)	530 (8.6)	11 (1.0)	505 (11.5)
Pennsylvania	16 (1.1)	538 (12.3)	57 (1.4)	544 (6.8)	17 (0.8)	513 (8.9)	10 (1.0)	489 (7.1)
South Carolina	11 (0.8)	504 (12.1)	57 (1.6)	538 (5.9)	20 (1.2)	485 (7.9)	12 (1.2)	460 (9.5)
Texas	13 (0.9)	496 (17.4)	55 (1.4)	532 (8.9)	21 (1.1)	506 (13.4)	12 (0.9)	481 (12.9)
Districts								
Academy School Dist. #20, CO	7 (0.9)	553 (11.9)	59 (1.6)	573 (3.0)	23 (1.3)	549 (6.1)	11 (0.9)	526 (6.2)
Chicago Public Schools, IL	11 (1.5)	425 (12.1)	54 (3.3)	467 (10.3)	22 (2.0)	444 (10.3)	13 (1.4)	431 (14.9)
Delaware Science Coalition, DE	16 (1.5)	506 (13.6)	54 (2.0)	528 (8.4)	18 (1.4)	497 (12.0)	13 (1.3)	467 (12.5)
First in the World Consort., IL	22 (2.0)	570 (8.2)	62 (1.8)	572 (5.0)	12 (2.1)	537 (10.0)	4 (0.7)	521 (15.7)
Fremont/Lincoln/WestSide PS, NE	12 (1.6)	519 (10.8)	55 (2.1)	541 (5.9)	19 (2.0)	497 (9.1)	14 (1.1)	451 (11.7)
Guilford County, NC	10 (0.8)	525 (12.2)	60 (1.7)	553 (7.3)	20 (1.6)	519 (13.4)	10 (0.8)	488 (13.2)
Jersey City Public Schools, NJ	11 (1.3)	408 (12.5)	49 (3.1)	460 (8.2)	23 (1.6)	446 (13.9)	17 (1.9)	425 (13.9)
Miami-Dade County PS, FL	14 (0.8)	424 (12.2)	45 (1.8)	454 (9.1)	23 (1.7)	425 (8.2)	17 (1.4)	405 (22.0)
Michigan Invitational Group, MI	10 (1.1)	567 (7.6)	64 (1.5)	575 (6.3)	17 (2.1)	555 (14.0)	8 (1.2)	523 (10.8)
Montgomery County, MD	20 (1.4)	544 (7.8)	53 (1.3)	548 (5.0)	18 (1.3)	508 (7.5)	9 (0.7)	492 (12.1)
Naperville Sch. Dist. #203, IL	30 (1.6)	589 (4.7)	56 (1.6)	588 (5.0)	9 (0.7)	572 (7.6)	5 (0.7)	542 (14.9)
Project SMART Consortium, OH	18 (1.4)	554 (9.4)	57 (1.6)	553 (10.2)	17 (1.2)	517 (7.5)	8 (0.8)	478 (11.6)
Rochester City Sch. Dist., NY s	10 (2.7)	494 (20.9)	48 (3.3)	489 (8.3)	22 (2.5)	444 (13.3)	20 (3.2)	450 (14.7)
SW Math/Sci. Collaborative, PA	18 (2.4)	545 (12.6)	60 (2.5)	551 (6.8)	14 (1.4)	540 (9.5)	7 (1.1)	515 (14.1)
International Avg. (All General Science Countries)	28 (0.2)	479 (1.3)	49 (0.2)	494 (1.1)	14 (0.1)	462 (1.6)	9 (0.1)	440 (2.8)

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 for physics/chemistry teachers are reported in the physics panel.

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.

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

	Never		Once in a While		Pretty Often		Almost Always	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Earth Science								
Belgium (Flemish)	35 (1.3)	541 (4.2)	53 (1.2)	551 (3.6)	8 (0.6)	525 (9.3)	5 (0.5)	503 (10.9)
Czech Republic	47 (1.7)	542 (4.1)	45 (1.5)	543 (5.9)	5 (0.5)	518 (9.3)	3 (0.7)	530 (16.1)
Netherlands	44 (1.5)	541 (8.3)	48 (1.7)	555 (6.8)	5 (0.6)	521 (15.8)	2 (0.5)	~ ~
Russian Federation	21 (1.5)	544 (11.4)	62 (1.3)	537 (6.1)	9 (0.7)	502 (10.2)	8 (0.7)	503 (8.9)
International Avg. (All Separate Science Countries)	40 (0.4)	526 (2.1)	47 (0.4)	523 (1.6)	7 (0.2)	491 (2.9)	6 (0.2)	473 (3.5)
Biology								
Belgium (Flemish)	36 (1.3)	538 (5.2)	55 (1.4)	543 (3.1)	6 (0.5)	542 (9.9)	4 (0.7)	485 (10.3)
Czech Republic	40 (1.7)	540 (4.3)	52 (1.6)	541 (5.6)	5 (0.6)	527 (14.0)	3 (0.4)	530 (20.0)
Netherlands	41 (1.8)	537 (9.0)	53 (2.0)	551 (8.1)	4 (0.7)	520 (16.1)	2 (0.6)	~ ~
Russian Federation	19 (1.5)	545 (13.4)	64 (1.3)	535 (6.0)	10 (0.7)	506 (7.2)	8 (0.5)	507 (9.3)
International Avg. (All Separate Science Countries)	36 (0.4)	521 (1.9)	51 (0.4)	522 (1.6)	8 (0.2)	496 (3.4)	5 (0.1)	477 (3.1)
Physics								
Belgium (Flemish)	32 (1.8)	548 (6.4)	58 (1.7)	546 (4.5)	7 (0.7)	538 (16.0)	4 (0.7)	529 (22.4)
Czech Republic	48 (1.8)	541 (4.2)	44 (1.5)	544 (6.7)	5 (0.8)	520 (14.0)	3 (0.6)	532 (16.0)
Netherlands [b]	42 (1.7)	544 (8.3)	50 (1.6)	550 (6.6)	5 (0.8)	533 (14.5)	3 (0.5)	521 (16.9)
Russian Federation	22 (1.5)	545 (10.8)	62 (1.4)	537 (6.4)	8 (0.5)	505 (9.5)	8 (0.5)	498 (7.5)
International Avg. (All Separate Science Countries)	38 (0.4)	525 (1.7)	48 (0.4)	523 (1.6)	8 (0.2)	495 (3.0)	6 (0.2)	486 (3.4)
Chemistry								
Belgium (Flemish)	– –	– –	– –	– –	– –	– –	– –	– –
Czech Republic	45 (1.8)	538 (4.2)	46 (1.6)	546 (5.4)	5 (0.6)	532 (10.8)	3 (0.7)	503 (14.8)
Netherlands	– –	– –	– –	– –	– –	– –	– –	– –
Russian Federation	21 (1.6)	548 (10.5)	62 (1.3)	534 (6.0)	9 (0.6)	503 (9.9)	8 (0.6)	509 (8.6)
International Avg. (All Separate Science Countries)	38 (0.4)	519 (2.0)	48 (0.4)	518 (2.0)	8 (0.2)	487 (3.3)	6 (0.2)	478 (3.3)

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

What Activities Do Students Do in Their Science Lessons?

Because it can affect pedagogical strategies, class size is shown in Exhibit 6.7. Teachers' reports on the size of their eighth-grade science class reveal that across countries the average was 31 students, but there was considerable variation even among the higher-performing countries – from 43 students in Korea to 20 in Belgium (Flemish). Average class size was relatively uniform across all of the Benchmarking entities, ranging from 23 to 32 students. The relationship between class size and achievement is difficult to disentangle, given the variety of policies and practices and the fact that smaller classes can be used for both advanced and remedial learning. It makes sense, however, that teachers may have an easier time managing and conducting more student centered instructional activities with smaller classes.

Extensive research about class size in relation to achievement indicates that the existence of such a relationship is dependent on the situation.[4] Dramatic reductions in class size can be related to gains in achievement, but the chief effects of smaller classes often are in relation to teacher attitudes and instructional behaviors. Also, the research is more consistent in suggesting that reductions in class size have the potential to help students in the primary grades. The TIMSS 1999 data support the complexity of this issue. Four of the five highest-performing countries – Chinese Taipei, Singapore, Japan, and Korea – were among those with the largest science classes. Within countries, several show little or no relationship between achievement and class size, often because students are mostly all in classes of similar size. Within other countries, there appears to be a curvilinear relationship, or those students with higher achievement appear to be in larger classes. In some countries, larger classes may represent the more usual situation for science teaching, with smaller classes used primarily for students needing remediation or for those students in the less-advanced tracks.

Exhibit 6.8 presents a profile of the activities most commonly encountered in science classes around the world, as reported by science teachers. On average internationally, the most common activity was teacher lecture (24 percent of class time), followed by students conducting experiments (15 percent) and teacher-guided student practice (14 percent). Re-teaching and clarification of content and procedures, student independent practice, tests and quizzes, and teacher demonstrations of experiments each occupied 10 percent of class time. In general for the United States as a whole and the Benchmarking entities, teachers' reports on the frequency of these

4 Mayer, D.P., Mullens, J.E., and Moore, M.T. (2000), *Monitoring School Quality: An Indicators Report*, NCES 2001-030, Washington, DC: National Center for Education Statistics.

activities matched the international profile. According to U.S. science teachers, class time is spent as follows: 19 percent on lecture style teacher presentation; 23 percent on teacher-guided or independent student practice; 17 percent on students conducting experiments; eight percent on teachers demonstrating experiments; nine percent on re-teaching and clarification; nine percent on tests and quizzes, eight percent on homework review; six percent on administrative tasks; and three percent on other activities.

As shown in Exhibit 6.9, most students internationally (80 percent on average in general-science countries) agreed with teachers' reports about the prevalence of teacher-guided activities, saying that their teachers frequently showed them how to do science problems. Approximately 70 percent of the students in the United States overall and in most of the Benchmarking entities reported this also. According to students, working independently on worksheets or textbooks also occurred frequently internationally (56 percent), and was even more pervasive throughout the Benchmarking entities, where between 70 and 85 percent in most entities reported doing this activity almost always or pretty often. As for working on science projects, the Benchmarking entities typically were above the international average (51 percent), ranging from 49 to 77 percent.

Compared with students internationally, eighth graders in each of the Benchmarking jurisdictions and in the United States overall reported an unusually large amount of classroom time devoted to working on homework. Internationally, 51 percent of the students reported frequently discussing their completed homework in science class. The figure for the United States was 63 percent, and it ranged from 52 percent in Texas to 82 percent in Naperville for the Benchmarking jurisdictions. A slightly greater difference was evident for frequently beginning homework in class – 41 percent internationally compared with 57 percent for the United States. In the Benchmarking jurisdictions, from 41 to 74 percent of the students reported beginning their homework in class almost always or pretty often.

As might be anticipated, students reported that use of the board was an extremely common presentational mode in science class (see Exhibit 6.10). On average internationally for the general-science countries, 86 percent of students reported that teachers used the board at least pretty often, and 42 percent reported that students did so. Using the board seems to be less common in the United States, especially for students (29 percent). In the United States, use of an overhead projector is a popular presentational mode, especially for teachers – 59 percent compared with 32 percent internationally. This mode was used frequently for more than

70 percent of the students in Maryland, North Carolina, Oregon, South Carolina, Texas, the Academy School District, Guilford County, Montgomery County, and Rochester. Use of a computer by the teacher to demonstrate ideas in science was more prevalent in the U.S. (20 percent of students) than internationally (10 percent), and among Benchmarking entities ranged from 12 percent in Chicago and Guilford County to 28 percent in Jersey City and Montgomery County.

Effective science instruction requires the teacher to guide, focus, challenge, and encourage student learning. Problem-solving activities typically call upon students to use higher-order thinking skills. To examine the emphasis on reasoning and problem-solving in science class, TIMSS created an index of teachers' emphasis on scientific reasoning and problem-solving (ESRPS). As shown in Exhibit 6.11, the index is based on teachers' reports about how often they asked students to explain the reasoning behind an idea, represent and analyze relationships using tables, charts, and graphs, work on problems for which there is no immediately obvious method of solution, write explanations about what was observed and why it happened, and put events or objects in order and give a reason for the organization. Students were placed in the high category if, on average, they were asked to do these activities in most of their lessons. The medium level represents students asked to do these activities in some to most lessons, and students in the low category did them only in some lessons or rarely.

On average internationally, 16 percent of students had teachers who placed a high emphasis on scientific reasoning and problem-solving, ranging from four percent in Belgium (Flemish) to about one-third in Japan among the comparison countries. While the emphasis on scientific reasoning and problem-solving was associated with achievement in some countries, there was no strong or consistent relationship internationally or across entities. There was tremendous variation among the Benchmarking participants on this index, ranging from 63 percent of students in the high category in Naperville to nine percent or less in Chicago, Rochester, the Michigan Invitational Group, and Idaho.

Exhibit R3.7 in the reference section shows the percentages of students asked in most or every lesson to engage in each of the activities included in the problem-solving index. The most common problem-solving activity was for teachers to ask students to explain the reasoning behind an idea. On average internationally, 68 percent of students had teachers who asked them to do this in most or every lesson. On average also, a majority of students (52 percent) were asked to write explanations about what was observed and why it happened in most or every lesson, but only 15 percent were asked to work on problems for which there was no immediately obvious method of solution. In the United States and among Benchmarking participants generally, teachers more often asked students to explain the reasoning behind an idea (80 percent of students in the United States, and up to 100 percent in Naperville), but otherwise approximated the international averages.

The choices teachers make determine, to a large extent, what students learn. An important aspect of teaching science is the emphasis placed on scientific investigation. In order to measure this, TIMSS created an index of emphasis on conducting experiments in science classes (ECES), shown in Exhibit 6.12. The index is based on students' and teachers' reports of the frequency of the teacher demonstrating experiments and the students conducting experiments or practical investigations. A high level indicates that the teacher reported that at least 25 percent of class time is spent on the teacher demonstrating or students conducting experiments, and the student reported that these occur almost always or pretty often. A low level indicates that the teacher reported that 10 percent or less of class time is spent on the teacher demonstrating or students conducting experiments, and the student reported that these occur once in a while or never. The middle category includes all other combinations of responses.

Internationally on average, 38 percent of students in countries with general/integrated science were in classes with a high emphasis on experiments, ranging from two percent in Italy to 78 percent in Hong Kong. There was great variation among the Benchmarking participants also, from a high of 79 percent in Naperville to a low of 17 percent in the Delaware Science Coalition. In general, lower percentages of students in the high category were found in the countries with separate sciences, but this varied across science subjects, with the greatest emphasis on experiments in the physical sciences. Earth science had the least emphasis on experiments. Across countries, 52 percent of earth science students were in the low category, but only 21 percent of students in biology, five percent in physics and chemistry, and three percent in general/integrated science had classes with low emphasis on experiments.

Exhibits R3.8 and R3.9 in the reference section summarize students' responses to the questions on the frequency of teachers demonstrating and students conducting experiments that were included in the index of emphasis on conducting experiments. On average internationally, 71 percent of students in general/integrated science reported that their teachers demonstrate experiments almost always or pretty often. Only 29 percent of Italian students reported that their teachers did so, compared with 91 percent of the students in England. The United States and the Benchmarking participants generally were close to the international average. Among separate-science countries, teacher demonstrations of experiments were reported most often in chemistry (68 percent) and physics (61 percent), and less frequently in biology (42 percent) and earth science (19 percent).

Students' reports on the frequency with which they conduct experiments or practical investigations in class show a similar pattern across science subjects but a lower frequency than for teachers' demonstration of experiments. Internationally, 57 percent of students in countries with general/integrated science reported that they do an experiment or practical investigation almost always or pretty often. Across countries with separate sciences, only 15 percent of the students in earth science, 27 percent in biology, and 39 percent in physics and chemistry reported doing experiments this frequently. In the United States, 65 percent of students reported frequently doing experiments or practical investigations, and among Benchmarking participants the percentage ranged from 44 percent in Chicago to more than 85 percent in the Academy School District, First in the World, and Naperville.

Teachers were not asked about the emphasis placed on using things from everyday life in solving science problems, but students were (see Exhibit R3.10). In most of the countries, students reported a moderate emphasis on doing this type of problem in science class. Almost half (49 percent), on average internationally, said these activities occur once in a while or pretty often in science class. The figures were comparable for the United States and most Benchmarking jurisdictions. More than half the students in Connecticut, Maryland, North and South Carolina, Chicago, the Fremont/Lincoln/Westside Public Schools, Guilford County, Jersey City, Miami-Dade, Naperville, and Rochester reported that they use things from everyday life in solving science problems almost always or pretty often.

Exhibit 6.7 Science Class Size

8th Grade Science

		Overall Average Class Size	1 - 20 Students		21 - 35 Students		36 or More Students	
			Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Countries								
United States	r	26 (0.5)	15 (2.1)	530 (9.4)	80 (2.4)	522 (5.4)	5 (1.4)	493 (14.9)
Belgium (Flemish)	r	20 (0.5)	61 (3.9)	527 (5.1)	38 (3.9)	540 (7.2)	1 (1.0)	~ ~
Canada	s	27 (0.3)	12 (2.1)	525 (7.8)	86 (2.2)	535 (3.1)	2 (0.8)	~ ~
Chinese Taipei		39 (0.5)	0 (0.0)	~ ~	14 (2.9)	564 (12.4)	86 (2.9)	569 (4.8)
Czech Republic		24 (0.4)	19 (3.8)	525 (7.6)	81 (3.8)	544 (5.3)	0 (0.0)	~ ~
England		x x	x x	x x	x x	x x	x x	x x
Hong Kong, SAR		39 (0.3)	1 (0.0)	~ ~	13 (3.1)	487 (8.2)	86 (3.2)	537 (4.1)
Italy		20 (0.3)	55 (3.9)	486 (5.3)	44 (3.9)	502 (6.1)	1 (0.0)	~ ~
Japan		36 (0.3)	1 (0.0)	~ ~	41 (3.1)	547 (3.4)	58 (3.0)	550 (2.8)
Korea, Rep. of		43 (0.7)	0 (0.0)	~ ~	10 (2.2)	537 (6.1)	90 (2.2)	550 (2.7)
Netherlands	r	25 (0.4)	11 (3.3)	492 (20.1)	89 (3.3)	554 (8.1)	0 (0.0)	~ ~
Russian Federation		24 (0.5)	19 (3.1)	501 (11.3)	81 (3.1)	536 (6.7)	0 (0.0)	~ ~
Singapore		37 (0.3)	1 (0.4)	~ ~	32 (3.8)	565 (16.0)	68 (3.8)	571 (8.0)
States								
Connecticut	s	24 (1.5)	32 (6.2)	516 (15.7)	64 (6.9)	549 (12.3)	4 (2.6)	458 (93.8)
Idaho	s	23 (0.6)	25 (4.9)	524 (13.4)	74 (4.9)	529 (7.9)	1 (0.3)	~ ~
Illinois	r	25 (0.6)	15 (2.7)	531 (11.0)	82 (2.9)	525 (6.0)	3 (1.4)	432 (15.5)
Indiana	r	25 (1.5)	30 (6.9)	555 (9.8)	67 (6.8)	532 (9.3)	3 (1.8)	552 (28.9)
Maryland	s	27 (0.5)	6 (1.5)	533 (25.1)	94 (1.6)	506 (8.0)	1 (0.4)	~ ~
Massachusetts	r	24 (0.8)	24 (3.4)	520 (14.6)	75 (3.4)	546 (7.4)	1 (1.0)	~ ~
Michigan	r	26 (0.6)	11 (3.3)	552 (13.8)	88 (3.4)	558 (7.4)	1 (1.0)	~ ~
Missouri	r	24 (0.9)	31 (4.6)	508 (13.0)	65 (4.6)	533 (6.4)	4 (2.7)	555 (22.6)
North Carolina	r	27 (1.9)	20 (5.8)	490 (18.5)	71 (7.1)	510 (7.6)	9 (4.4)	504 (22.4)
Oregon	r	27 (1.1)	17 (4.0)	526 (15.2)	81 (4.0)	547 (5.9)	1 (1.3)	~ ~
Pennsylvania	r	24 (0.6)	21 (4.5)	522 (8.1)	78 (4.5)	527 (7.4)	1 (0.5)	~ ~
South Carolina	r	25 (1.5)	31 (5.2)	503 (9.4)	63 (6.1)	518 (9.1)	6 (3.3)	565 (35.5)
Texas	s	25 (2.1)	25 (5.3)	484 (23.0)	69 (3.1)	531 (10.1)	5 (0.5)	536 (6.5)
Districts and Consortia								
Academy School Dist. #20, CO		27 (0.1)	2 (0.3)	~ ~	98 (0.3)	558 (2.2)	0 (0.0)	~ ~
Chicago Public Schools, IL	r	27 (1.4)	9 (4.5)	437 (16.0)	80 (5.9)	454 (10.8)	11 (6.6)	419 (9.2)
Delaware Science Coalition, DE	s	28 (0.7)	7 (2.1)	399 (21.4)	80 (6.2)	508 (12.9)	13 (5.7)	427 (15.7)
First in the World Consort., IL		27 (0.3)	17 (3.4)	577 (11.7)	78 (3.7)	562 (6.1)	5 (0.6)	590 (30.7)
Fremont/Lincoln/WestSide PS, NE	r	25 (1.9)	23 (5.8)	527 (20.4)	75 (4.7)	515 (8.1)	3 (0.1)	382 (7.2)
Guilford County, NC		26 (0.4)	7 (2.7)	569 (25.2)	90 (2.7)	528 (9.0)	3 (0.5)	619 (17.4)
Jersey City Public Schools, NJ	s	27 (2.4)	19 (7.1)	450 (12.3)	71 (5.8)	443 (11.8)	9 (4.4)	454 (16.3)
Miami-Dade County PS, FL	s	32 (1.0)	9 (4.1)	345 (38.3)	59 (7.3)	449 (12.4)	32 (6.8)	428 (11.6)
Michigan Invitational Group, MI	r	26 (0.2)	5 (1.3)	552 (7.9)	94 (1.3)	566 (7.5)	1 (0.0)	~ ~
Montgomery County, MD		x x	x x	x x	x x	x x	x x	x x
Naperville Sch. Dist. #203, IL		27 (0.2)	7 (1.6)	583 (8.2)	93 (1.6)	584 (4.1)	0 (0.0)	~ ~
Project SMART Consortium, OH	r	24 (0.3)	22 (3.0)	545 (17.5)	77 (2.9)	537 (9.5)	0 (0.0)	~ ~
Rochester City Sch. Dist., NY		23 (0.6)	29 (5.1)	442 (16.1)	71 (5.1)	461 (10.9)	0 (0.0)	~ ~
SW Math/Sci. Collaborative, PA		25 (1.1)	19 (4.7)	534 (17.1)	78 (4.6)	543 (7.9)	2 (0.2)	~ ~
International Avg. (All Countries)		31 (0.1)	16 (0.4)	477 (2.8)	52 (0.5)	486 (1.5)	31 (0.4)	462 (4.8)

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

Background data provided by teachers.

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 teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students. An "x" indicates teacher response data available for <50% of students.

Exhibit 6.8 Time Spent on Various Activities in Science Class

	Average Percentage of Class Time Spent in a Typical Month of Lessons									
	Administrative Tasks	Homework Review	Lecture-Style Presentation by Teacher	Teacher-Guided Student Practice	Re-teaching and Clarification of Content/ Procedures	Student Independent Practice	Tests and Quizzes	Teacher Demonstrations of Experiments	Students Conducting Experiments	Other
Countries										
United States	r 6 (0.5)	r 8 (0.4)	r 19 (0.8)	r 12 (0.5)	r 9 (0.3)	r 11 (0.4)	r 9 (0.3)	r 8 (0.4)	r 17 (0.9)	r 3 (0.5)
Belgium (Flemish)	r 4 (0.3)	r 5 (0.5)	r 32 (1.9)	r 11 (0.7)	r 10 (0.6)	r 9 (0.5)	r 9 (0.4)	r 10 (0.7)	r 8 (0.8)	r 2 (0.4)
Canada	r 4 (0.2)	r 9 (0.4)	r 19 (0.8)	r 12 (0.4)	r 8 (0.3)	r 11 (0.9)	r 8 (0.3)	r 8 (0.4)	r 22 (1.1)	s 3 (0.6)
Chinese Taipei	3 (0.6)	8 (0.4)	39 (1.4)	9 (0.6)	8 (0.4)	5 (0.3)	8 (0.4)	6 (0.3)	13 (0.7)	1 (0.3)
Czech Republic	2 (0.2)	4 (0.2)	32 (0.6)	18 (0.6)	9 (0.3)	12 (0.4)	8 (0.2)	7 (0.3)	5 (0.3)	3 (0.2)
England	s 3 (0.3)	s 3 (0.3)	s 13 (0.7)	s 19 (1.2)	s 8 (0.5)	s 13 (0.7)	s 7 (0.3)	10 (0.4)	s 24 (1.4)	x x
Hong Kong, SAR	4 (0.5)	7 (0.5)	20 (1.2)	8 (0.6)	7 (0.5)	6 (0.5)	6 (0.3)	13 (0.7)	29 (1.3)	2 (0.4)
Italy	2 (0.2)	10 (0.5)	29 (0.8)	15 (0.6)	13 (0.5)	7 (0.4)	12 (0.5)	7 (0.4)	5 (0.4)	r 1 (0.3)
Japan	2 (0.3)	3 (0.3)	31 (1.4)	11 (0.9)	11 (0.6)	5 (0.5)	5 (0.3)	9 (0.6)	24 (1.5)	2 (0.4)
Korea, Rep. of	4 (0.7)	6 (0.4)	34 (1.4)	8 (0.5)	9 (0.5)	7 (0.6)	5 (0.3)	7 (0.4)	18 (1.0)	2 (0.3)
Netherlands	4 (0.4)	13 (0.7)	13 (1.0)	7 (0.5)	14 (0.7)	23 (1.1)	r 10 (0.4)	5 (0.2)	5 (0.5)	6 (0.7)
Russian Federation	2 (0.1)	13 (0.4)	29 (0.6)	12 (0.3)	9 (0.1)	11 (0.3)	9 (0.3)	6 (0.2)	6 (0.2)	5 (0.2)
Singapore	4 (0.4)	9 (0.5)	27 (1.3)	11 (1.0)	7 (0.5)	7 (0.5)	7 (0.4)	7 (0.6)	23 (1.1)	2 (0.2)
States										
Connecticut	s 4 (0.4)	s 8 (0.6)	s 16 (1.7)	s 12 (1.3)	s 9 (0.6)	s 9 (0.6)	s 8 (0.5)	8 (0.8)	s 25 (2.2)	s 2 (0.5)
Idaho	r 5 (0.6)	r 8 (0.6)	r 18 (1.2)	r 12 (0.8)	r 9 (0.7)	r 14 (1.0)	r 8 (0.6)	r 9 (0.7)	r 15 (1.9)	r 3 (0.9)
Illinois	4 (0.4)	8 (0.5)	21 (1.9)	12 (1.0)	8 (0.8)	11 (1.1)	9 (1.0)	7 (0.7)	r 21 (3.4)	r 4 (1.3)
Indiana	5 (0.7)	8 (0.6)	17 (1.8)	11 (0.8)	9 (1.1)	12 (1.0)	9 (0.7)	8 (0.6)	20 (2.0)	r 4 (0.9)
Maryland	r 6 (0.7)	r 7 (0.5)	r 10 (0.9)	r 11 (0.7)	r 9 (0.7)	r 12 (1.0)	r 8 (0.6)	r 9 (0.7)	r 26 (2.2)	s 2 (0.4)
Massachusetts	r 5 (0.6)	r 10 (1.5)	r 16 (1.0)	r 10 (0.9)	r 10 (0.5)	r 10 (1.0)	r 10 (1.0)	r 9 (0.8)	r 21 (1.7)	s 4 (1.1)
Michigan	r 6 (0.8)	r 10 (0.7)	r 17 (1.3)	r 11 (0.7)	r 8 (0.5)	r 11 (0.9)	r 8 (0.4)	r 9 (0.5)	r 20 (1.9)	r 3 (0.6)
Missouri	r 5 (0.5)	r 9 (0.5)	r 16 (1.5)	r 14 (1.0)	r 9 (0.7)	r 12 (1.0)	r 9 (0.6)	r 8 (0.7)	r 16 (2.2)	r 4 (0.8)
North Carolina	6 (0.7)	9 (0.8)	18 (1.7)	16 (1.1)	9 (0.7)	13 (1.0)	9 (0.4)	8 (1.0)	14 (1.4)	r 3 (0.7)
Oregon	6 (0.6)	7 (0.5)	13 (1.3)	11 (0.8)	8 (0.8)	13 (1.1)	7 (0.5)	9 (0.8)	23 (2.0)	r 3 (1.0)
Pennsylvania	7 (1.0)	10 (1.4)	21 (1.6)	15 (2.5)	11 (0.9)	13 (2.0)	10 (1.8)	8 (1.3)	17 (3.2)	r 2 (0.6)
South Carolina	6 (0.6)	8 (0.5)	17 (1.4)	12 (0.8)	10 (0.5)	11 (0.8)	11 (0.8)	9 (1.1)	16 (1.6)	r 3 (0.9)
Texas	r 7 (1.7)	r 8 (0.7)	r 17 (1.9)	r 14 (1.0)	r 9 (0.8)	r 12 (1.1)	r 8 (0.7)	r 7 (0.9)	r 22 (2.1)	r 3 (0.4)
Districts and Consortia										
Academy School Dist. #20, CO	6 (0.0)	10 (0.1)	13 (0.1)	9 (0.0)	8 (0.0)	12 (0.1)	8 (0.0)	6 (0.0)	26 (0.1)	1 (0.0)
Chicago Public Schools, IL	r 4 (0.8)	r 7 (0.9)	r 21 (2.8)	r 14 (2.2)	r 9 (1.0)	r 11 (1.2)	r 9 (1.2)	r 8 (1.2)	r 16 (2.6)	r 2 (0.9)
Delaware Science Coalition, DE	s 5 (0.6)	s 9 (0.7)	s 21 (1.9)	s 13 (1.1)	s 9 (0.7)	s 11 (0.7)	s 8 (0.8)	8 (0.5)	s 13 (1.0)	s 3 (0.8)
First in the World Consort., IL	4 (0.3)	7 (0.6)	18 (1.4)	11 (1.0)	9 (0.4)	10 (0.6)	6 (0.5)	9 (0.6)	24 (1.8)	2 (0.8)
Fremont/Lincoln/WestSide PS, NE	8 (0.6)	7 (0.5)	15 (1.2)	10 (1.0)	9 (1.3)	14 (4.7)	6 (0.3)	5 (0.7)	25 (3.0)	r 2 (1.0)
Guilford County, NC	6 (0.5)	8 (0.6)	15 (1.2)	14 (0.9)	9 (0.6)	12 (0.6)	9 (0.5)	8 (0.5)	18 (1.3)	4 (0.9)
Jersey City Public Schools, NJ	r 6 (0.3)	r 8 (0.2)	r 18 (1.0)	r 11 (0.4)	r 12 (0.5)	r 15 (0.6)	r 10 (0.0)	r 9 (0.3)	r 19 (1.1)	s 3 (0.6)
Miami-Dade County PS, FL	s 6 (0.5)	s 9 (0.6)	s 14 (1.3)	s 10 (1.0)	s 10 (0.8)	s 11 (1.2)	s 10 (0.8)	11 (1.0)	s 20 (1.9)	s 5 (1.3)
Michigan Invitational Group, MI	5 (0.2)	9 (0.8)	20 (0.7)	10 (0.6)	8 (0.3)	12 (1.0)	8 (0.3)	8 (0.6)	16 (1.1)	r 3 (0.3)
Montgomery County, MD	x x	x x	x x	x x	x x	x x	x x	x x	x x	x x
Naperville Sch. Dist. #203, IL	3 (0.2)	9 (0.5)	13 (0.8)	11 (0.5)	9 (0.3)	10 (0.6)	9 (0.5)	5 (0.2)	29 (0.6)	1 (0.0)
Project SMART Consortium, OH	r 5 (0.4)	r 9 (0.3)	r 15 (1.0)	r 11 (0.3)	r 8 (0.6)	r 11 (0.6)	r 8 (0.2)	r 8 (0.6)	r 21 (1.1)	r 5 (0.5)
Rochester City Sch. Dist., NY	r 8 (0.7)	r 10 (0.5)	r 13 (0.8)	r 10 (0.5)	r 13 (0.4)	r 9 (0.5)	r 10 (0.5)	r 7 (0.5)	r 23 (1.1)	r 5 (1.1)
SW Math/Sci. Collaborative, PA	6 (1.1)	8 (0.9)	19 (2.1)	13 (0.9)	9 (0.8)	11 (1.3)	8 (0.5)	11 (1.2)	17 (1.8)	r 2 (0.7)
International Avg. (All Countries)	4 (0.1)	9 (0.1)	24 (0.2)	14 (0.2)	10 (0.1)	10 (0.1)	10 (0.1)	10 (0.1)	15 (0.2)	3 (0.1)

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

Background data provided by teachers.

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 teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students. An "x" indicates teacher response data available for <50% students.

Exhibit 6.9 Students Doing Various Activities in Science Class*

TIMSS 1999 Benchmarking
Boston College

8th Grade Science

	Percentage of Students Reporting Almost Always or Pretty Often				
General/Integrated Science	We Discuss Our Completed Homework	Teacher Shows Us How to Do Science Problems	We Work on Worksheets or Textbooks on Our Own	We Work on Science Projects	We Begin Our Homework
Countries					
United States	63 (1.9)	69 (1.4)	76 (1.5)	59 (1.3)	57 (2.0)
Canada	56 (1.4)	74 (1.2)	76 (1.1)	62 (1.5)	68 (1.8)
Chinese Taipei [a]	50 (1.4)	88 (0.7)	61 (1.3)	52 (1.3)	29 (0.9)
England	53 (1.6)	87 (0.9)	63 (2.1)	55 (1.6)	28 (1.3)
Hong Kong, SAR	33 (1.0)	86 (0.8)	54 (1.1)	43 (1.1)	34 (1.1)
Italy	49 (1.4)	56 (1.5)	38 (1.3)	35 (1.7)	30 (1.6)
Japan	10 (0.8)	74 (1.1)	29 (1.3)	21 (0.8)	7 (0.6)
Korea, Rep. of	14 (0.8)	73 (1.1)	27 (0.8)	36 (1.0)	12 (0.6)
Singapore	58 (0.9)	85 (0.9)	75 (0.9)	39 (1.5)	44 (1.6)
States					
Connecticut	71 (2.9)	71 (2.4)	75 (2.5)	60 (3.0)	51 (2.5)
Idaho	57 (2.0)	71 (2.1)	79 (2.0)	65 (2.4)	72 (2.2)
Illinois	66 (2.2)	66 (1.9)	76 (2.3)	61 (2.1)	67 (1.9)
Indiana	63 (1.8)	68 (2.4)	74 (2.8)	65 (2.3)	73 (2.4)
Maryland	64 (1.9)	72 (1.6)	77 (1.7)	60 (1.9)	41 (1.9)
Massachusetts	67 (2.5)	74 (2.0)	73 (1.7)	60 (2.2)	49 (2.0)
Michigan	67 (2.4)	69 (2.3)	82 (1.3)	60 (2.5)	74 (2.3)
Missouri	63 (2.4)	67 (2.1)	80 (1.9)	63 (2.7)	72 (2.6)
North Carolina	70 (2.1)	78 (1.9)	84 (2.1)	61 (2.2)	61 (2.6)
Oregon	58 (1.9)	64 (1.5)	71 (2.3)	73 (2.2)	65 (2.6)
Pennsylvania	61 (3.1)	61 (2.0)	72 (2.6)	57 (3.8)	50 (2.6)
South Carolina	71 (2.5)	71 (2.5)	81 (2.3)	56 (2.3)	58 (3.0)
Texas	52 (2.6)	67 (2.8)	78 (2.0)	56 (2.5)	54 (2.3)
Districts					
Academy School Dist. #20, CO	73 (1.5)	76 (1.1)	74 (1.1)	65 (1.4)	69 (1.4)
Chicago Public Schools, IL	65 (4.3)	69 (3.0)	79 (3.0)	49 (4.3)	55 (4.0)
Delaware Science Coalition, DE	61 (3.7)	64 (2.2)	81 (2.1)	59 (2.2)	55 (2.5)
First in the World Consort., IL	65 (2.9)	68 (1.8)	69 (2.5)	68 (2.7)	48 (2.7)
Fremont/Lincoln/WestSide PS, NE	67 (1.9)	75 (3.1)	76 (2.2)	69 (1.9)	63 (2.3)
Guilford County, NC	67 (2.3)	73 (2.0)	87 (1.1)	59 (2.1)	58 (2.6)
Jersey City Public Schools, NJ	63 (2.0)	78 (3.8)	78 (2.0)	60 (2.3)	41 (2.5)
Miami-Dade County PS, FL	63 (3.7)	78 (2.4)	82 (1.1)	63 (3.3)	51 (3.8)
Michigan Invitational Group, MI	70 (1.6)	67 (2.2)	81 (1.5)	58 (2.2)	69 (1.8)
Montgomery County, MD	55 (3.3)	59 (1.7)	74 (1.9)	61 (3.8)	43 (2.8)
Naperville Sch. Dist. #203, IL	82 (1.7)	75 (2.0)	79 (1.9)	62 (1.9)	66 (1.6)
Project SMART Consortium, OH	71 (2.2)	66 (2.2)	74 (1.9)	57 (1.9)	63 (2.2)
Rochester City Sch. Dist., NY	s 64 (3.8)	s 82 (1.4)	s 84 (1.8)	s 77 (2.9)	s 54 (4.2)
SW Math/Sci. Collaborative, PA	57 (3.8)	67 (2.7)	75 (2.7)	54 (3.3)	52 (3.8)
International Avg. (All General Science Countries)	51 (0.3)	80 (0.2)	56 (0.3)	51 (0.3)	41 (0.3)

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 for physics/chemistry teachers are reported in the physics panel.

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.

	Percentage of Students Reporting Almost Always or Pretty Often				
	We Discuss Our Completed Homework	Teacher Shows Us How to Do Science Problems	We Work on Worksheets or Textbooks on Our Own	We Work on Science Projects	We Begin Our Homework
Earth Science					
Belgium (Flemish)	22 (1.4)	21 (1.0)	46 (1.3)	15 (0.9)	10 (0.8)
Czech Republic	27 (1.8)	96 (0.7)	49 (2.6)	15 (1.3)	13 (1.2)
Netherlands	70 (2.3)	43 (2.4)	80 (1.9)	14 (1.6)	74 (2.1)
Russian Federation	39 (1.2)	44 (1.6)	62 (1.3)	29 (1.3)	21 (0.8)
International Avg. (All Separate Science Countries)	41 (0.5)	60 (0.5)	56 (0.5)	31 (0.5)	29 (0.4)
Biology					
Belgium (Flemish)	22 (1.1)	21 (1.7)	42 (1.5)	24 (1.3)	7 (0.9)
Czech Republic	25 (1.6)	98 (0.6)	41 (2.5)	15 (1.2)	15 (1.2)
Netherlands	57 (4.0)	45 (2.1)	79 (3.6)	17 (1.7)	70 (3.1)
Russian Federation	38 (1.2)	36 (1.5)	64 (1.5)	27 (1.4)	18 (1.1)
International Avg. (All Separate Science Countries)	40 (0.5)	54 (0.4)	51 (0.5)	32 (0.4)	27 (0.4)
Physics					
Belgium (Flemish)	28 (2.1)	58 (2.6)	45 (2.0)	35 (1.8)	11 (1.3)
Czech Republic	29 (1.7)	98 (0.4)	40 (1.6)	27 (1.4)	14 (1.4)
Netherlands [b]	64 (2.9)	55 (2.5)	81 (1.9)	17 (1.5)	73 (2.7)
Russian Federation	44 (1.2)	89 (0.9)	64 (1.3)	33 (1.1)	24 (1.0)
International Avg. (All Separate Science Countries)	45 (0.5)	81 (0.3)	52 (0.4)	40 (0.4)	31 (0.4)
Chemistry					
Belgium (Flemish)	– –	– –	– –	– –	– –
Czech Republic	30 (1.9)	97 (0.9)	40 (2.1)	35 (1.4)	13 (1.2)
Netherlands	– –	– –	– –	– –	– –
Russian Federation	48 (1.2)	89 (0.8)	64 (1.6)	30 (1.2)	21 (1.1)
International Avg. (All Separate Science Countries)	45 (0.5)	85 (0.3)	50 (0.5)	44 (0.5)	28 (0.4)

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

Exhibit 6.10 Presentational Modes Used in Science Class*

		Percentage of Students Reporting Almost Always or Pretty Often				
		Teacher Uses the Board	Teacher Uses an Overhead Projector	Teacher Uses a Computer to Demonstrate Ideas in Science	Students Use the Board	Students Use an Overhead Projector
General/Integrated Science						
Countries	United States	75 (1.6)	59 (2.3)	20 (1.4)	29 (1.0)	19 (1.1)
	Canada	81 (1.0)	55 (1.8)	10 (0.7)	19 (0.8)	11 (0.6)
	Chinese Taipei [a]	92 (0.6)	7 (1.0)	5 (0.4)	39 (1.1)	3 (0.4)
	England	93 (1.2)	36 (2.7)	8 (0.8)	16 (1.2)	6 (0.6)
	Hong Kong, SAR	88 (0.9)	25 (2.1)	9 (1.2)	32 (1.2)	6 (0.6)
	Italy	73 (1.4)	9 (0.9)	9 (0.9)	59 (1.3)	7 (0.7)
	Japan	98 (0.3)	10 (1.5)	2 (0.8)	21 (1.5)	1 (0.2)
	Korea, Rep. of	86 (1.1)	26 (2.4)	13 (1.7)	23 (1.1)	7 (0.8)
	Singapore	92 (0.9)	81 (1.5)	19 (2.0)	40 (1.6)	22 (1.0)
States	Connecticut	78 (3.1)	57 (4.8)	18 (2.0)	32 (2.8)	18 (1.8)
	Idaho	78 (2.3)	56 (4.3)	24 (2.5)	26 (2.1)	17 (1.5)
	Illinois	71 (2.6)	57 (4.4)	20 (2.0)	27 (2.6)	16 (1.4)
	Indiana	73 (2.3)	53 (3.8)	22 (2.5)	29 (2.5)	18 (1.6)
	Maryland	68 (2.4)	78 (2.5)	22 (1.6)	34 (1.9)	33 (1.8)
	Massachusetts	79 (2.5)	52 (4.1)	17 (2.0)	29 (2.1)	16 (1.3)
	Michigan	77 (2.2)	57 (3.3)	17 (1.6)	29 (2.7)	19 (1.6)
	Missouri	77 (2.0)	59 (3.4)	22 (2.3)	31 (2.6)	21 (1.8)
	North Carolina	76 (2.3)	74 (3.3)	19 (1.4)	41 (2.1)	30 (2.2)
	Oregon	62 (2.8)	76 (3.8)	20 (2.2)	26 (1.9)	28 (2.3)
	Pennsylvania	74 (2.7)	57 (3.3)	17 (1.9)	26 (1.9)	14 (1.3)
	South Carolina	70 (2.1)	73 (3.6)	21 (2.2)	29 (1.7)	20 (1.1)
	Texas	72 (2.0)	76 (2.2)	21 (2.1)	26 (1.8)	22 (1.9)
Districts	Academy School Dist. #20, CO	82 (1.0)	84 (1.1)	19 (1.0)	33 (1.2)	25 (1.3)
	Chicago Public Schools, IL	70 (5.1)	28 (7.2)	12 (2.2)	29 (3.6)	16 (4.0)
	Delaware Science Coalition, DE	71 (2.9)	56 (3.7)	20 (1.9)	24 (2.0)	20 (1.7)
	First in the World Consort., IL	79 (3.2)	59 (6.2)	20 (1.8)	29 (1.5)	19 (2.5)
	Fremont/Lincoln/WestSide PS, NE	72 (2.1)	68 (3.5)	26 (2.4)	35 (3.3)	26 (2.4)
	Guilford County, NC	72 (2.1)	71 (4.2)	12 (1.3)	32 (2.7)	26 (2.2)
	Jersey City Public Schools, NJ	81 (1.5)	46 (2.2)	28 (1.8)	29 (1.5)	17 (1.3)
	Miami-Dade County PS, FL	74 (3.2)	58 (4.1)	25 (2.5)	34 (2.7)	26 (2.4)
	Michigan Invitational Group, MI	84 (1.4)	57 (2.0)	17 (2.9)	26 (2.5)	17 (1.8)
	Montgomery County, MD	62 (3.2)	77 (3.1)	28 (2.8)	25 (2.1)	25 (1.7)
	Naperville Sch. Dist. #203, IL	90 (0.9)	66 (2.0)	18 (1.1)	30 (2.0)	23 (1.4)
	Project SMART Consortium, OH	70 (2.0)	61 (2.4)	24 (1.8)	31 (2.3)	21 (1.6)
	Rochester City Sch. Dist., NY	s 59 (3.6)	80 (2.9)	26 (2.8)	33 (3.2)	37 (3.9)
	SW Math/Sci. Collaborative, PA	75 (3.9)	45 (5.0)	15 (2.4)	25 (2.8)	12 (1.5)
	International Avg. (All General Science Countries)	86 (0.2)	32 (0.4)	10 (0.2)	42 (0.2)	13 (0.2)

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 for physics/chemistry teachers are reported in the physics panel.

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.

	Teacher Uses the Board	Teacher Uses an Overhead Projector	Teacher Uses a Computer to Demonstrate Ideas in Science	Students Use the Board	Students Use an Overhead Projector
	Percentage of Students Reporting Almost Always or Pretty Often				
Earth Science					
Belgium (Flemish)	68 (2.2)	57 (2.4)	3 (0.4)	12 (0.7)	6 (0.6)
Czech Republic	65 (2.8)	12 (1.6)	3 (0.5)	40 (2.2)	5 (0.7)
Netherlands	71 (2.5)	19 (3.0)	6 (1.0)	8 (1.1)	5 (1.1)
Russian Federation	78 (1.1)	8 (0.7)	2 (0.4)	65 (1.3)	5 (0.5)
International Avg. (All Separate Science Countries)	65 (0.6)	25 (0.6)	5 (0.2)	39 (0.5)	10 (0.3)
Biology					
Belgium (Flemish)	75 (1.9)	50 (2.3)	3 (0.6)	13 (0.9)	4 (0.7)
Czech Republic	79 (2.3)	17 (2.1)	3 (1.0)	40 (2.2)	4 (0.5)
Netherlands	75 (2.4)	14 (2.7)	3 (0.7)	7 (0.9)	3 (0.6)
Russian Federation	80 (1.3)	10 (1.0)	2 (0.2)	61 (1.6)	5 (0.6)
International Avg. (All Separate Science Countries)	73 (0.5)	28 (0.5)	5 (0.2)	37 (0.4)	9 (0.2)
Physics					
Belgium (Flemish)	77 (2.2)	26 (2.9)	4 (0.8)	18 (1.5)	5 (0.7)
Czech Republic	87 (1.1)	18 (1.8)	5 (0.7)	66 (2.1)	6 (0.6)
Netherlands [b]	73 (2.0)	13 (2.1)	5 (1.0)	9 (1.3)	3 (0.5)
Russian Federation	91 (0.6)	10 (0.9)	3 (0.4)	82 (1.0)	6 (0.5)
International Avg. (All Separate Science Countries)	83 (0.3)	23 (0.5)	7 (0.2)	56 (0.4)	10 (0.2)
Chemistry					
Belgium (Flemish)	– –	– –	– –	– –	– –
Czech Republic	90 (1.3)	19 (2.3)	3 (0.8)	67 (2.2)	5 (0.8)
Netherlands	– –	– –	– –	– –	– –
Russian Federation	93 (0.6)	9 (0.7)	2 (0.3)	84 (1.2)	5 (0.5)
International Avg. (All Separate Science Countries)	87 (0.3)	23 (0.5)	6 (0.2)	68 (0.4)	10 (0.3)

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

Exhibit 6.11 Index of Teachers' Emphasis on Scientific Reasoning and Problem-Solving (ESRPS)

8th Grade Science

Index of Teachers' Emphasis on Scientific Reasoning and Problem-Solving

Index based on teachers' responses to five questions about how often they ask students to: 1) explain the reasoning behind an idea; 2) represent and analyze relationships using tables, charts, graphs; 3) work on problems for which there is no immediately obvious method of solution; 4) write explanations about what was observed and why it happened; 5) put events or objects in order and give a reason for the organization (see reference exhibit R3.7). Average is computed across the five items based on a 4-point scale: 1 = never or almost never; 2 = some lessons; 3 = most lessons; 4 = every lesson. High level indicates average is greater than or equal to 3. Medium level indicates average is greater than or equal to 2.25 and less than 3. Low level indicates average is less than 2.25.

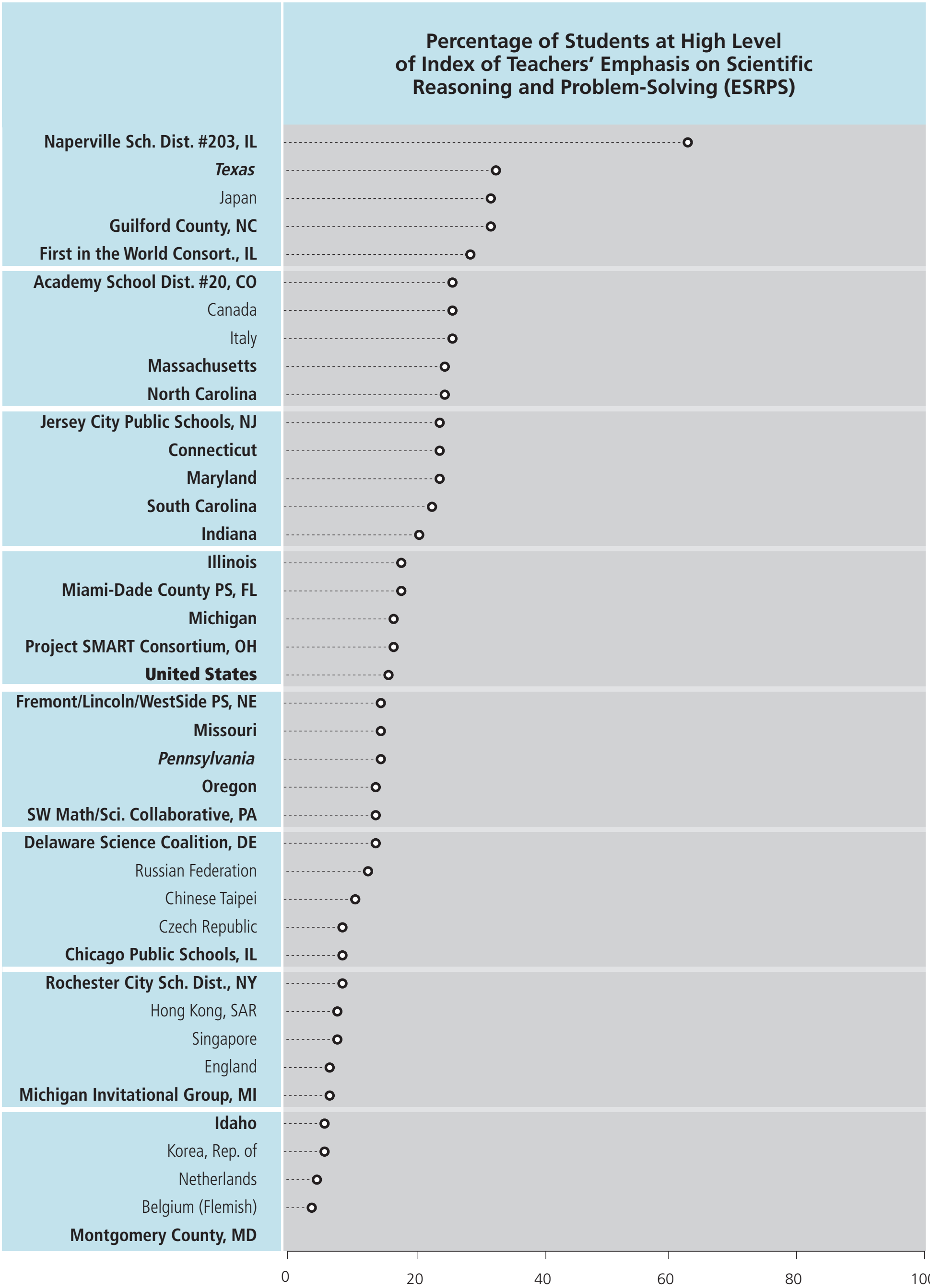
		High ESRPS		Medium ESRPS		Low ESRPS	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Naperville Sch. Dist. #203, IL		63 (4.1)	578 (5.1)	31 (4.1)	592 (9.1)	6 (0.7)	615 (14.8)
Texas	r	33 (7.7)	506 (20.4)	48 (6.3)	528 (10.7)	19 (4.0)	479 (25.0)
Japan		32 (4.0)	555 (3.1)	37 (4.4)	549 (3.5)	31 (3.9)	545 (3.7)
Guilford County, NC		32 (5.2)	526 (15.9)	40 (4.8)	543 (12.3)	28 (4.1)	524 (20.2)
First in the World Consort., IL		29 (6.2)	553 (11.5)	46 (7.5)	576 (9.4)	25 (2.7)	556 (6.1)
Academy School Dist. #20, CO		26 (0.3)	556 (3.9)	57 (0.4)	563 (3.4)	17 (0.3)	550 (2.4)
Canada	r	26 (3.1)	551 (5.5)	48 (3.4)	530 (4.4)	26 (2.7)	528 (5.7)
Italy		26 (3.8)	490 (7.4)	46 (4.4)	490 (5.9)	28 (3.7)	502 (6.8)
Massachusetts	r	25 (4.6)	517 (12.3)	52 (5.4)	535 (9.4)	23 (3.4)	552 (15.0)
North Carolina		25 (5.7)	509 (18.8)	41 (5.2)	505 (8.5)	35 (5.2)	504 (11.3)
Jersey City Public Schools, NJ	r	24 (4.8)	460 (12.0)	56 (6.0)	449 (13.2)	20 (5.2)	435 (9.8)
Connecticut	s	24 (7.3)	525 (15.4)	46 (6.2)	547 (15.8)	30 (6.3)	527 (13.4)
Maryland	s	24 (3.7)	490 (14.9)	53 (4.7)	509 (11.1)	23 (4.8)	506 (12.0)
South Carolina		23 (5.3)	511 (16.7)	51 (5.5)	519 (8.3)	26 (5.2)	504 (17.7)
Indiana		21 (5.0)	527 (13.0)	58 (6.6)	544 (8.1)	22 (5.6)	532 (13.7)
Illinois		18 (5.5)	542 (12.8)	43 (6.0)	522 (8.9)	39 (6.6)	524 (7.9)
Miami-Dade County PS, FL	s	18 (4.4)	403 (17.3)	55 (8.1)	420 (11.6)	28 (9.0)	469 (12.2)
Michigan	r	17 (5.2)	531 (12.4)	46 (6.5)	562 (9.2)	37 (5.0)	556 (8.6)
Project SMART Consortium, OH	r	17 (2.9)	522 (15.7)	35 (4.0)	529 (14.7)	47 (4.2)	549 (13.0)
United States	r	16 (2.3)	519 (9.7)	51 (3.2)	524 (6.3)	33 (3.7)	514 (6.5)
Fremont/Lincoln/WestSide PS, NE		15 (6.9)	530 (7.7)	44 (6.2)	508 (9.6)	41 (9.2)	511 (12.7)
Missouri	r	15 (4.9)	530 (20.9)	49 (6.9)	524 (9.4)	35 (5.2)	530 (8.5)
Pennsylvania		15 (6.5)	543 (14.9)	43 (5.3)	534 (5.3)	43 (8.3)	518 (10.0)
Oregon		14 (4.2)	533 (14.9)	48 (6.3)	540 (10.9)	38 (6.3)	540 (9.1)
SW Math/Sci. Collaborative, PA		14 (4.2)	533 (11.5)	45 (8.5)	546 (9.4)	41 (9.2)	546 (14.3)
Delaware Science Coalition, DE	r	14 (4.6)	527 (26.1)	55 (6.7)	489 (10.6)	32 (7.2)	500 (16.1)
Russian Federation		13 (1.5)	548 (13.0)	50 (2.6)	530 (7.1)	37 (2.5)	523 (5.7)
Chinese Taipei		11 (2.5)	589 (13.5)	34 (4.3)	576 (7.4)	54 (4.4)	559 (4.9)
Czech Republic		9 (1.7)	543 (8.2)	42 (3.1)	543 (6.1)	48 (3.4)	537 (4.5)
Chicago Public Schools, IL	r	9 (5.3)	377 (36.2)	65 (7.3)	466 (13.0)	26 (7.6)	447 (8.1)
Rochester City Sch. Dist., NY	r	9 (3.1)	406 (23.0)	64 (5.7)	459 (10.0)	28 (5.2)	446 (18.2)
Hong Kong, SAR		8 (2.5)	554 (12.3)	29 (4.4)	538 (7.0)	63 (4.6)	524 (4.9)
Singapore		8 (2.4)	600 (20.7)	29 (3.8)	579 (15.8)	63 (4.2)	559 (10.0)
England	s	7 (2.3)	541 (28.3)	41 (4.6)	557 (7.5)	51 (4.7)	540 (8.0)
Michigan Invitational Group, MI		7 (0.7)	513 (6.7)	46 (4.3)	565 (8.2)	46 (4.6)	572 (7.5)
Idaho	r	6 (3.0)	518 (12.5)	54 (5.8)	532 (7.5)	40 (6.4)	524 (11.4)
Korea, Rep. of		6 (1.9)	541 (10.4)	48 (4.1)	552 (3.3)	46 (3.9)	547 (3.2)
Netherlands		5 (1.4)	570 (13.1)	35 (4.3)	559 (6.9)	60 (4.6)	536 (10.1)
Belgium (Flemish)		4 (0.8)	550 (7.4)	20 (2.6)	537 (11.5)	77 (2.6)	533 (4.7)
Montgomery County, MD		x x	x x	x x	x x	x x	x x
International Avg. (All Countries)		16 (0.4)	490 (1.9)	44 (0.6)	488 (1.2)	40 (0.6)	482 (1.1)

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.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students. An "x" indicates teacher response data available for <50% of students.



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

Exhibit 6.12 Index of Emphasis on Conducting Experiments in Science Classes (ECES)

Index of Emphasis on Conducting Experiments in Science Classes

Index based on teachers' reports on the percentage of time they spend demonstrating experiments; teachers' reports on the percentage of time students spend conducting experiments; students' reports on how often the teacher gives a demonstration of an experiment in science lessons; students' reports on how often they conduct an experiment or practical investigation in class (see exhibits 6.8, R3.8 and R3.9). In countries where science is taught as separate subjects, students were asked about each subject area separately, and only teachers who teach a particular subject are represented in the figures shown for that subject. High level indicates the teacher reported that at least 25 percent of class time is spent on the teacher demonstrating experiments or students conducting experiments, and the student reported that the teacher gives a demonstration of an experiment or the student conducts an experiment or practical investigation in class almost always or pretty often. Low level indicates the teacher reported that less than 10 percent of class time is spent on the teacher demonstrating experiments or students conducting experiments, and the student reported that the teacher gives a demonstration of an experiment and the student conducts an experiment or practical investigation in class once in a while or never. Medium level includes all other possible combinations of responses.

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		High ECES		Medium ECES		Low ECES	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
General/Integrated Science (ECES-G)							
Naperville Sch. Dist. #203, IL		79 (3.8)	584 (5.3)	21 (3.8)	592 (11.8)	0 (0.0)	~ ~
Hong Kong, SAR		78 (3.3)	536 (3.8)	22 (3.2)	516 (9.3)	1 (0.4)	~ ~
England	s	59 (4.9)	556 (7.9)	40 (4.9)	539 (8.0)	0 (0.0)	~ ~
Maryland	s	59 (5.3)	518 (8.9)	40 (5.3)	502 (7.3)	1 (0.4)	~ ~
First in the World Consort., IL		56 (6.9)	573 (6.0)	44 (6.9)	555 (8.0)	0 (0.0)	~ ~
Academy School Dist. #20, CO		56 (0.7)	563 (3.5)	44 (0.7)	558 (2.9)	0 (0.0)	~ ~
Connecticut	s	56 (6.9)	550 (13.8)	44 (6.9)	534 (8.0)	0 (0.3)	~ ~
Singapore		55 (4.1)	580 (10.0)	44 (4.0)	556 (12.7)	1 (0.6)	~ ~
Japan		54 (4.0)	552 (3.2)	45 (3.8)	549 (2.6)	1 (0.6)	~ ~
Fremont/Lincoln/WestSide PS, NE	r	52 (8.2)	524 (9.4)	47 (7.7)	514 (9.7)	1 (0.6)	~ ~
Oregon	r	49 (4.9)	557 (8.5)	50 (4.8)	533 (5.7)	2 (0.8)	~ ~
Canada	r	47 (3.8)	539 (4.1)	52 (3.9)	533 (3.6)	1 (0.5)	~ ~
Miami-Dade County PS, FL	s	47 (10.3)	420 (6.8)	53 (10.3)	451 (15.8)	0 (0.0)	~ ~
Michigan	r	44 (6.0)	566 (5.6)	54 (6.1)	548 (10.1)	2 (1.6)	~ ~
Project SMART Consortium, OH	r	43 (3.5)	544 (11.8)	57 (3.5)	535 (10.9)	0 (0.0)	~ ~
Texas	s	41 (6.0)	524 (11.5)	56 (5.8)	518 (14.8)	3 (1.1)	421 (48.8)
Indiana	r	41 (6.9)	545 (10.2)	59 (6.9)	540 (8.1)	1 (0.4)	~ ~
Massachusetts	r	40 (4.9)	551 (6.3)	58 (5.0)	532 (9.1)	2 (1.5)	~ ~
SW Math/Sci. Collaborative, PA		39 (6.9)	559 (6.8)	57 (6.3)	539 (11.0)	4 (2.9)	511 (20.7)
Jersey City Public Schools, NJ	r	38 (4.0)	435 (9.8)	60 (4.0)	460 (12.7)	2 (0.2)	~ ~
Illinois	r	34 (6.3)	542 (7.1)	61 (6.4)	520 (7.6)	4 (1.9)	533 (27.9)
Idaho	r	34 (6.5)	534 (11.5)	65 (6.6)	528 (7.1)	1 (0.9)	~ ~
Pennsylvania	r	33 (6.8)	549 (8.9)	60 (4.4)	528 (7.8)	7 (4.1)	491 (12.2)
United States	r	31 (2.6)	531 (6.8)	64 (2.6)	523 (5.3)	4 (1.1)	529 (7.5)
Missouri	r	31 (5.8)	536 (7.7)	62 (5.7)	524 (10.4)	7 (3.0)	526 (23.0)
Chicago Public Schools, IL	r	29 (9.2)	493 (17.7)	65 (8.2)	439 (9.4)	7 (4.3)	462 (28.1)
South Carolina	r	28 (5.1)	528 (9.9)	71 (5.0)	510 (6.9)	1 (0.7)	~ ~
Korea, Rep. of		27 (3.1)	558 (3.4)	71 (3.0)	546 (3.0)	2 (0.7)	~ ~
Guilford County, NC		27 (4.0)	540 (15.6)	73 (4.0)	532 (9.2)	1 (0.0)	~ ~
North Carolina	r	24 (6.1)	505 (14.1)	72 (6.1)	510 (6.2)	4 (1.6)	486 (27.0)
Michigan Invitational Group, MI	r	22 (2.8)	577 (20.5)	78 (2.8)	564 (4.5)	0 (0.0)	~ ~
Delaware Science Coalition, DE	s	17 (5.5)	519 (28.9)	79 (5.7)	513 (9.2)	3 (0.9)	506 (38.5)
Chinese Taipei [a]		14 (2.8)	574 (9.2)	84 (2.9)	570 (4.9)	2 (0.6)	~ ~
Italy		2 (0.6)	~ ~	73 (3.0)	493 (4.3)	25 (2.9)	498 (6.7)
Montgomery County, MD		x x	x x	x x	x x	x x	x x
Rochester City Sch. Dist., NY		x x	x x	x x	x x	x x	x x
International Avg. (All General Science Countries)		38 (0.7)	483 (1.7)	59 (0.7)	478 (1.3)	3 (0.2)	459 (5.3)

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

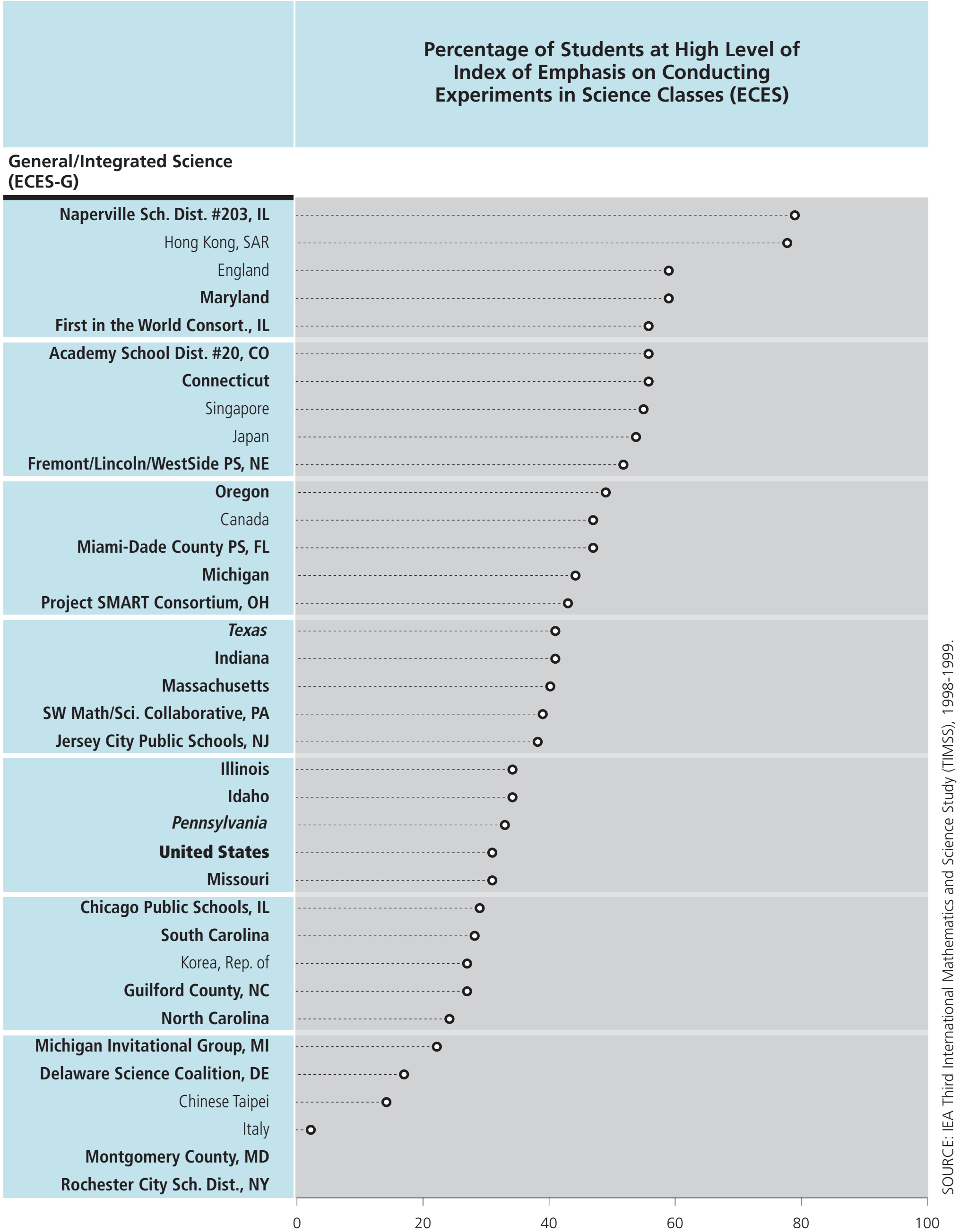
[a] Chinese Taipei: Students were asked about 'natural science'; data pertain to grade 8 physics/chemistry course.

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.

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

An "r" indicates teacher and/or student response data available for 70-84% of students. An "s" indicates teacher and/or student response data available for 50-69% of students. An "x" indicates teacher and/or student response data available for <50% of students.


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

		High ECES		Medium ECES		Low ECES	
		Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Earth Science (ECES-E)							
Belgium (Flemish)	r	2 (0.6)	~ ~	43 (3.6)	530 (5.3)	56 (3.8)	549 (5.9)
Czech Republic		0 (0.0)	~ ~	24 (4.4)	526 (5.3)	76 (4.4)	544 (4.3)
Netherlands	r	0 (0.0)	~ ~	12 (1.9)	526 (15.6)	88 (1.9)	551 (7.3)
Russian Federation		0 (0.0)	~ ~	45 (2.8)	521 (8.6)	55 (2.8)	538 (7.0)
International Avg. (All Separate Science Countries)		1 (0.2)	~ ~	48 (1.1)	505 (2.7)	52 (1.1)	525 (2.2)
Biology (ECES-B)							
Belgium (Flemish)	r	15 (2.7)	543 (5.6)	77 (3.1)	549 (4.6)	8 (1.7)	537 (11.7)
Netherlands	r	1 (0.7)	~ ~	76 (5.1)	545 (12.1)	23 (5.1)	533 (10.3)
Russian Federation		1 (0.4)	~ ~	79 (2.5)	530 (6.7)	20 (2.5)	540 (9.0)
Czech Republic		0 (0.0)	~ ~	72 (3.5)	538 (5.0)	28 (3.5)	547 (7.3)
International Avg. (All Separate Science Countries)		4 (0.4)	494 (10.9)	76 (1.0)	515 (1.9)	21 (0.9)	520 (2.9)
Physics (ECES-P)							
Belgium (Flemish)	r	46 (6.6)	557 (10.5)	52 (6.7)	549 (6.6)	2 (0.2)	~ ~
Netherlands [b]	r	16 (4.4)	550 (11.8)	78 (5.0)	551 (7.9)	6 (3.2)	497 (36.9)
Czech Republic		14 (2.9)	536 (10.9)	82 (2.8)	544 (4.7)	5 (1.4)	555 (12.8)
Russian Federation		5 (1.9)	538 (18.4)	90 (2.1)	533 (6.2)	5 (1.0)	516 (16.9)
International Avg. (All Separate Science Countries)		21 (1.0)	524 (3.3)	74 (1.0)	514 (1.7)	5 (0.5)	507 (5.3)
Chemistry (ECES-C)							
Czech Republic		10 (3.0)	556 (13.9)	87 (3.0)	538 (4.2)	3 (0.9)	545 (14.0)
Russian Federation		2 (1.5)	~ ~	93 (1.5)	532 (6.3)	5 (0.9)	532 (17.4)
Belgium (Flemish)		– –	– –	– –	– –	– –	– –
Netherlands		– –	– –	– –	– –	– –	– –
International Avg. (All Separate Science Countries)		11 (0.9)	508 (5.5)	84 (0.9)	506 (2.0)	5 (0.4)	495 (5.9)

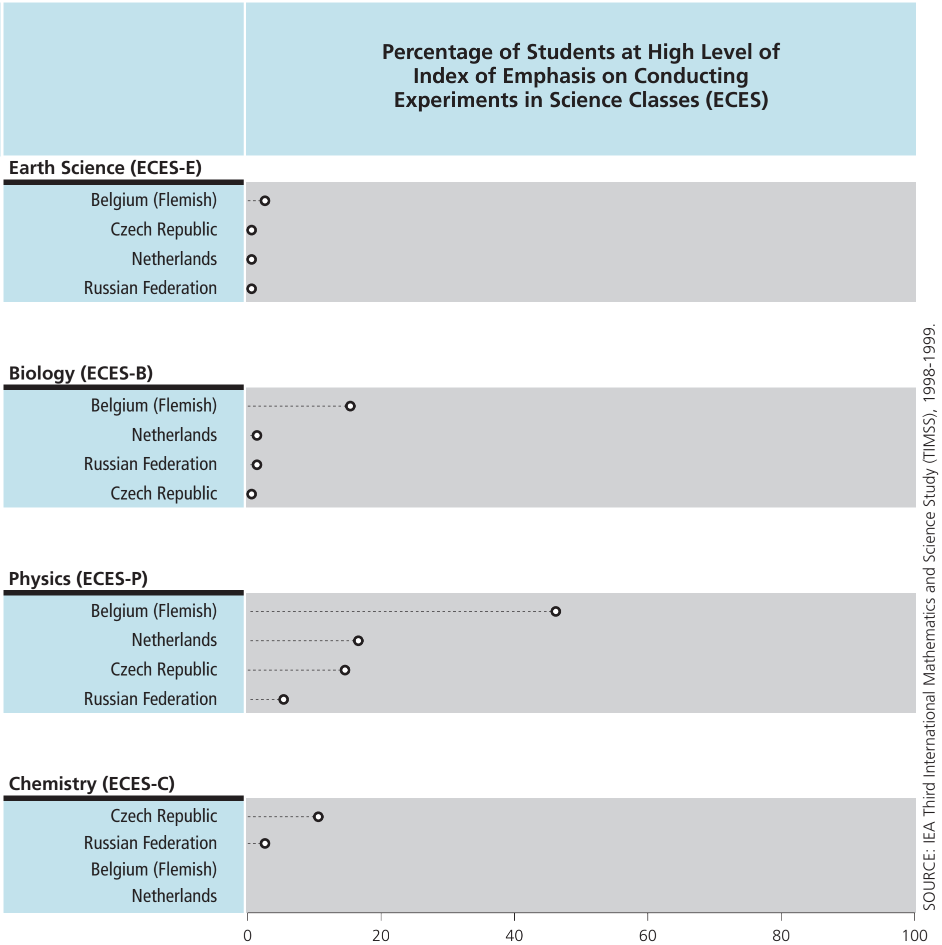
SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1998-1999.

b Netherlands: Data for physics/chemistry teachers are reported in the physics panel.

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

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

An "r" indicates teacher and/or student response data available for 70-84% of students.



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

How Are Computers Used?

Students' reports on the frequency of computer use in science class are presented in Exhibit 6.13. Internationally, very few students reported frequent use of computers in any of the science subjects, although somewhat greater use was found across the countries with general/integrated science. Computer use was most frequent in the United States, where 21 percent of students reported using computers in science class almost always or pretty often, compared with eight percent on average internationally. Use among Benchmarking participants ranged from 12 percent in the Chicago Public Schools to 35 percent in the Jersey City Public Schools.

Because the Internet provides a wealth of opportunities for students to collect and analyze information, TIMSS began asking about students' access to the Internet and whether they used the World Wide Web to access information for science projects. The data in Exhibit 6.14 indicate great variation in Internet access across countries and across the Benchmarking participants. Still, the international averages show about one-quarter of the students with access to the Internet at school. The international average for using the Internet to access information for science class on even a monthly basis was 12 percent (less than half those reporting access). For the Benchmarking jurisdictions, Internet access at school ranged from 31 to 32 percent in Rochester and Chicago to 98 percent in First in the World and Naperville. Jurisdictions reporting 30 percent or more of the students accessing information for science class on a monthly basis were Connecticut, Massachusetts, the Academy School District, the Delaware Science Coalition, First in the World, Jersey City, Montgomery County, and Naperville. In general, Internet use for science projects was more common among Benchmarking participants than in any of the comparison countries.

Percentage of Students Reporting Almost Always or Pretty Often

Participants with General/ Integrated Science	
Countries	
United States	21 (1.4)
Canada	14 (0.7)
Chinese Taipei [a]	5 (0.3)
England	10 (1.1)
Hong Kong, SAR	6 (0.6)
Italy	10 (1.2)
Japan	2 (0.8)
Korea, Rep. of	7 (0.9)
Singapore	15 (1.4)
States	
Connecticut	20 (2.0)
Idaho	22 (2.8)
Illinois	20 (2.0)
Indiana	20 (1.8)
Maryland	20 (1.8)
Massachusetts	18 (2.3)
Michigan	15 (1.6)
Missouri	21 (2.6)
North Carolina	20 (1.5)
Oregon	22 (2.5)
Pennsylvania	16 (1.9)
South Carolina	20 (1.9)
Texas	17 (1.3)
Districts and Consortia	
Academy School Dist. #20, CO	23 (1.1)
Chicago Public Schools, IL	12 (2.2)
Delaware Science Coalition, DE	21 (1.4)
First in the World Consort., IL	30 (2.5)
Fremont/Lincoln/WestSide PS, NE	30 (2.6)
Guilford County, NC	17 (1.9)
Jersey City Public Schools, NJ	35 (2.4)
Miami-Dade County PS, FL	24 (2.4)
Michigan Invitational Group, MI	18 (2.2)
Montgomery County, MD	31 (3.8)
Naperville Sch. Dist. #203, IL	23 (1.5)
Project SMART Consortium, OH	27 (1.9)
Rochester City Sch. Dist., NY	s 24 (3.7)
SW Math/Sci. Collaborative, PA	16 (2.7)
International Avg. (All General Science Countries)	8 (0.2)

Countries with Separate Science Subjects	Earth Science	Biology	Physics	Chemistry
Belgium (Flemish)	2 (0.4)	2 (0.6)	3 (0.5)	– –
Czech Republic	2 (0.4)	2 (0.8)	2 (0.6)	1 (0.5)
Netherlands [b]	5 (0.7)	2 (0.3)	3 (0.4)	– –
Russian Federation	2 (0.3)	1 (0.2)	2 (0.3)	2 (0.2)
International Avg. (All Separate Science Countries)	4 (0.2)	3 (0.2)	5 (0.2)	4 (0.2)

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. Percentages for separate science subject areas are based only on those students taking each subject.

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

[b] Netherlands: Data for physics/chemistry teachers are reported in the physics panel.

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.

Exhibit 6.14 Access to the Internet and Use of the Internet for Science Projects

	Percentage of Students				
	Have Access to the Internet			Use the Internet for Science Projects at Least Once a Month	
	At Home	At School	Elsewhere	Use E-mail to Work with Students in Other Schools	Use the World Wide Web to Access Information
Countries					
United States	59 (1.7)	76 (3.2)	81 (0.9)	9 (0.5)	29 (1.3)
Belgium (Flemish)	27 (0.9)	44 (2.7)	64 (1.1)	3 (0.4)	10 (0.9)
Canada	57 (1.3)	87 (1.5)	84 (0.8)	6 (0.4)	25 (0.9)
Chinese Taipei	32 (1.1)	61 (3.2)	41 (0.8)	9 (0.4)	15 (0.6)
Czech Republic	7 (0.7)	16 (2.6)	39 (1.6)	2 (0.3)	5 (0.5)
England	36 (1.1)	65 (3.1)	53 (1.3)	6 (0.5)	22 (1.1)
Hong Kong, SAR	34 (1.1)	26 (2.2)	34 (0.8)	8 (0.6)	13 (0.7)
Italy	13 (0.7)	20 (2.2)	27 (1.1)	5 (0.5)	8 (0.7)
Japan	r 13 (0.9)	6 (1.6)	2 (0.3)	7 (0.8)	7 (0.8)
Korea, Rep. of	23 (0.7)	6 (1.2)	36 (1.0)	4 (0.3)	6 (0.4)
Netherlands	41 (1.8)	53 (5.4)	74 (1.8)	4 (0.7)	8 (0.8)
Russian Federation	3 (0.3)	1 (0.4)	17 (0.9)	3 (0.3)	4 (0.4)
Singapore	47 (1.9)	48 (3.2)	39 (0.9)	9 (0.6)	19 (0.9)
States					
Connecticut	71 (2.5)	85 (2.3)	85 (0.8)	11 (1.1)	32 (1.6)
Idaho	53 (2.7)	84 (4.1)	78 (1.4)	8 (0.8)	25 (2.4)
Illinois	56 (2.3)	79 (3.6)	79 (1.5)	8 (0.7)	26 (1.9)
Indiana	59 (2.0)	70 (5.8)	85 (1.5)	8 (0.8)	22 (1.8)
Maryland	66 (1.8)	77 (3.2)	83 (0.8)	11 (0.9)	28 (1.4)
Massachusetts	68 (2.1)	78 (3.6)	83 (1.3)	11 (1.1)	35 (1.9)
Michigan	61 (2.4)	80 (3.7)	83 (1.2)	8 (0.8)	24 (1.5)
Missouri	49 (1.5)	77 (5.3)	82 (1.0)	8 (0.5)	24 (1.0)
North Carolina	51 (2.0)	80 (2.7)	82 (0.9)	9 (0.7)	25 (1.5)
Oregon	61 (2.1)	85 (4.4)	82 (1.7)	7 (0.6)	28 (2.2)
Pennsylvania	64 (2.7)	69 (4.0)	82 (0.9)	8 (0.5)	28 (1.9)
South Carolina	52 (2.2)	92 (1.5)	81 (1.3)	9 (0.7)	26 (1.4)
Texas	54 (3.5)	82 (3.5)	79 (2.2)	11 (0.8)	27 (1.4)
Districts and Consortia					
Academy School Dist. #20, CO	84 (1.1)	93 (0.7)	78 (1.2)	9 (0.9)	37 (1.3)
Chicago Public Schools, IL	35 (2.4)	32 (6.8)	72 (1.9)	7 (1.0)	18 (2.3)
Delaware Science Coalition, DE	66 (2.3)	88 (1.5)	84 (1.0)	13 (1.1)	38 (1.8)
First in the World Consort., IL	82 (1.0)	98 (0.6)	86 (1.7)	10 (1.4)	40 (2.1)
Fremont/Lincoln/WestSide PS, NE	61 (1.9)	91 (1.4)	85 (1.6)	8 (1.2)	24 (2.2)
Guilford County, NC	64 (1.9)	89 (1.0)	89 (1.1)	8 (0.8)	28 (2.0)
Jersey City Public Schools, NJ	38 (2.2)	92 (1.2)	71 (2.1)	14 (1.6)	36 (2.6)
Miami-Dade County PS, FL	47 (3.1)	59 (6.7)	73 (2.4)	17 (1.9)	29 (2.1)
Michigan Invitational Group, MI	62 (2.1)	90 (1.3)	83 (1.4)	5 (0.8)	28 (2.0)
Montgomery County, MD	77 (1.8)	92 (1.0)	74 (2.2)	12 (1.1)	39 (2.8)
Naperville Sch. Dist. #203, IL	86 (1.0)	98 (0.4)	87 (0.8)	9 (0.6)	30 (1.3)
Project SMART Consortium, OH	63 (1.8)	83 (1.1)	91 (0.7)	9 (0.8)	27 (1.4)
Rochester City Sch. Dist., NY	31 (2.3)	31 (1.6)	74 (2.0)	10 (0.9)	19 (1.3)
SW Math/Sci. Collaborative, PA	58 (2.7)	80 (4.7)	83 (1.6)	6 (0.7)	23 (1.9)
International Avg. (All Countries)	19 (0.2)	27 (0.4)	43 (0.2)	7 (0.1)	12 (0.1)

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.

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

What Are the Roles of Homework and Assessment?

The amount of time students spend on homework assignments is an important consideration in examining their opportunity to learn science. Exhibit 6.15 presents the index of teachers' emphasis on science homework (ESH). Students in the high category had teachers who reported giving relatively long homework assignments (more than 30 minutes) on a relatively frequent basis (at least once or twice a week). Those in the low category had teachers who gave short assignments (less than 30 minutes) relatively infrequently (less than once a week or never). The medium level includes all other combinations of responses. Details from teachers' reports about the length and frequency of their homework assignments are found in the reference section in Exhibit R3.11.

The results show substantial variation across countries and Benchmarking entities in the emphasis placed on homework. Together with Italy among the comparison countries, the Academy School District had more than half its students in the high category. For the remaining Benchmarking participants, the majority of students were in the medium category. Countries with one-third or more of their students in the low category included Korea, Japan, Belgium (Flemish), and the Czech Republic. Only the Fremont/Lincoln/Westside Public Schools had a comparable percentage among Benchmarking participants. There was little relationship between the amount of homework assigned and students' performance. Again, lower-performing students may need more homework assignments for remedial reasons.

Since problem-solving activities will potentially be more beneficial if they can be extended to out-of-class-situations and stretched over a longer time, TIMSS asked teachers how often they assigned science homework based on projects and investigations. The data in Exhibit R3.12 in the reference section show that this was a more common practice in the United States and the Benchmarking jurisdictions than in the comparison countries, with the exception of Canada. Although the percentage of students in classes where this type of science homework is sometimes or always assigned was well above the international average of 34 percent in most Benchmarking jurisdictions, it ranged from 18 percent in the Rochester City School District to 92 percent in the Naperville School District. In some countries the students who were sometimes or always assigned science projects as homework performed slightly better than those who were rarely or never assigned it.

One theme in recommendations for educational reform is to make assessment a continuous process that relies on a variety of methods and sources of data, rather than on a few high-stakes tests. Exhibit 6.16 shows teachers' reports about the weight given to various types of assessment. Teachers in the United States as a whole and in most of the Benchmarking jurisdictions reported placing less weight on informal assessment approaches than did teachers internationally. On average internationally, the most emphasis was placed on teacher-made tests requiring explanations and on students' responses in class, which were given quite a lot or a great deal of weight for 76 and 75 percent of the students, respectively. The next heaviest weight internationally was given to observations of students (68 percent). While the weight given teacher-made tests requiring explanations was similar to or greater than the international average in many Benchmarking jurisdictions, students' responses in class and observations of students were given less weight in the United States as a whole and in most Benchmarking jurisdictions (generally for about half the students or less). Exceptions included Chicago, the Delaware Science Coalition, Jersey City, and Miami-Dade.

Internationally, the least weight reportedly was given to external standardized tests, with just 33 percent of students having science teachers who reported giving them quite a lot or a great deal of weight. Science teachers in the United States and across Benchmarking participants generally gave less weight to these tests. The percentage of students whose teachers give a lot of weight to such assessments ranged from less than 10 percent in Indiana, Maryland, Pennsylvania, the Academy School District, First in the World, and Naperville, to more than 40 percent in the Jersey City Public Schools.

As shown in Exhibit R3.13, eighth-grade students reported substantial variation in the frequency of testing in their science classes. On average internationally, 58 percent of students in general/integrated science classes and about 50 percent of students in separate science classes reported having a quiz or test almost always or pretty often. Testing was reported to be relatively frequent in the United States, where 77 percent of students reported often having a quiz or test in science class. Across the Benchmarking participants generally, between 70 and 85 percent of eighth-grade students were in science classes with frequent testing.

Index of Teachers' Emphasis on Science Homework

Index based on teachers' responses to two questions about how often they usually assign science homework and how many minutes of science homework they usually assign students (see reference exhibit R3.11). High level indicates the assignment of more than 30 minutes of homework at least once or twice a week. Low level indicates the assignment of less than 30 minutes of homework less than once a week or never assigning homework. Medium level includes all other possible combinations of responses.

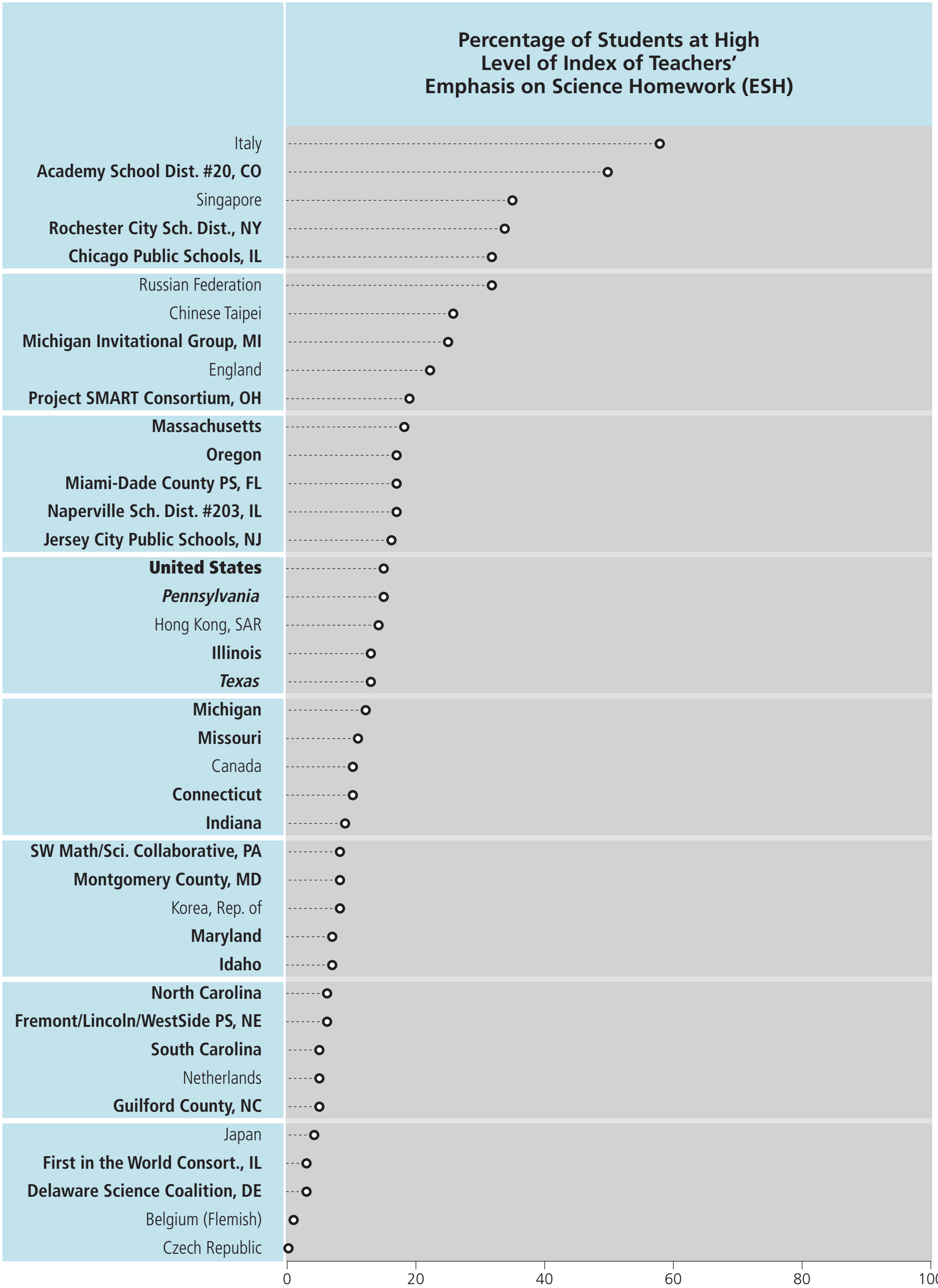
	High ESH		Medium ESH		Low ESH	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Italy	58 (3.3)	493 (5.9)	34 (3.2)	495 (5.5)	8 (1.8)	486 (12.0)
Academy School Dist. #20, CO	50 (0.4)	563 (2.8)	50 (0.4)	555 (2.9)	0 (0.0)	~ ~
Singapore	35 (4.3)	570 (12.3)	55 (4.1)	575 (11.2)	11 (2.4)	524 (19.3)
Rochester City Sch. Dist., NY	34 (4.7)	468 (14.9)	52 (5.3)	444 (7.9)	13 (4.4)	447 (15.9)
Chicago Public Schools, IL	32 (8.9)	449 (20.4)	68 (8.9)	452 (11.2)	0 (0.0)	~ ~
Russian Federation	32 (2.6)	527 (8.3)	66 (2.6)	530 (6.6)	3 (0.8)	542 (18.4)
Chinese Taipei	26 (3.8)	584 (7.8)	54 (4.4)	566 (5.5)	20 (3.3)	558 (7.9)
Michigan Invitational Group, MI	25 (2.6)	567 (19.0)	75 (2.6)	563 (5.4)	0 (0.0)	~ ~
England	22 (2.9)	563 (11.3)	74 (3.1)	533 (5.2)	4 (1.3)	511 (12.4)
Project SMART Consortium, OH	19 (2.8)	568 (16.5)	70 (2.3)	534 (9.9)	12 (2.6)	510 (13.9)
Massachusetts	18 (3.8)	529 (15.5)	82 (3.8)	534 (8.2)	0 (0.0)	~ ~
Oregon	17 (5.1)	548 (11.0)	68 (5.8)	534 (7.0)	14 (4.8)	538 (12.3)
Miami-Dade County PS, FL	17 (5.1)	435 (11.3)	81 (5.7)	424 (11.3)	2 (2.2)	~ ~
Naperville Sch. Dist. #203, IL	17 (2.8)	594 (9.6)	83 (2.8)	583 (4.6)	0 (0.0)	~ ~
Jersey City Public Schools, NJ	16 (2.8)	438 (16.2)	82 (2.9)	439 (11.5)	3 (0.1)	403 (10.6)
United States	15 (1.8)	507 (9.5)	77 (2.4)	517 (5.2)	8 (1.7)	505 (15.6)
Pennsylvania	15 (4.5)	531 (16.8)	76 (5.3)	531 (6.7)	9 (3.0)	496 (19.9)
Hong Kong, SAR	14 (2.8)	527 (8.3)	68 (4.0)	533 (4.2)	19 (3.6)	521 (11.6)
Illinois	13 (3.9)	499 (16.8)	74 (6.0)	521 (8.0)	12 (4.2)	549 (8.5)
Texas	13 (3.5)	518 (22.2)	70 (4.6)	508 (12.3)	17 (5.0)	505 (13.3)
Michigan	12 (3.4)	524 (15.7)	81 (4.3)	544 (9.6)	7 (3.2)	566 (10.3)
Missouri	11 (3.7)	534 (9.6)	76 (4.9)	519 (7.6)	14 (3.1)	538 (8.2)
Canada	10 (2.3)	542 (8.9)	80 (2.8)	534 (2.6)	10 (1.9)	515 (6.4)
Connecticut	10 (3.2)	521 (27.2)	89 (3.2)	531 (10.9)	1 (0.5)	~ ~
Indiana	9 (2.8)	548 (21.1)	80 (5.7)	531 (7.2)	11 (4.4)	544 (29.4)
SW Math/Sci. Collaborative, PA	8 (3.6)	531 (12.5)	78 (6.2)	544 (8.9)	13 (4.6)	548 (11.1)
Montgomery County, MD	8 (2.2)	522 (14.1)	87 (2.1)	532 (4.1)	5 (0.4)	542 (9.3)
Korea, Rep. of	8 (2.2)	559 (7.9)	55 (3.9)	549 (3.3)	37 (3.8)	547 (3.4)
Maryland	7 (1.8)	479 (18.3)	88 (2.4)	509 (8.2)	5 (1.5)	494 (12.9)
Idaho	7 (2.0)	531 (22.7)	69 (6.5)	526 (6.3)	24 (6.0)	527 (9.4)
North Carolina	6 (2.6)	495 (22.5)	82 (4.0)	510 (7.8)	12 (2.8)	497 (11.9)
Fremont/Lincoln/WestSide PS, NE	6 (4.3)	525 (88.6)	60 (4.6)	519 (5.3)	33 (3.8)	497 (15.4)
South Carolina	5 (2.4)	538 (10.4)	87 (3.4)	510 (7.5)	8 (2.2)	514 (13.6)
Netherlands	5 (1.3)	573 (9.5)	82 (3.0)	548 (6.6)	13 (3.1)	514 (11.3)
Guilford County, NC	5 (1.6)	536 (37.2)	83 (3.8)	536 (9.4)	12 (3.4)	518 (25.1)
Japan	4 (1.7)	546 (11.0)	53 (4.1)	551 (3.0)	43 (4.2)	548 (2.9)
First in the World Consort., IL	3 (3.3)	540 (38.9)	87 (3.5)	566 (5.7)	10 (1.2)	573 (5.3)
Delaware Science Coalition, DE	3 (2.5)	527 (12.0)	89 (4.6)	500 (9.0)	8 (3.9)	482 (36.8)
Belgium (Flemish)	1 (0.5)	~ ~	39 (3.5)	528 (6.3)	60 (3.4)	537 (4.7)
Czech Republic	0 (0.3)	~ ~	29 (2.9)	541 (4.8)	70 (2.9)	539 (5.0)
International Avg. (All Countries)	19 (0.4)	484 (2.6)	62 (0.6)	486 (1.0)	18 (0.4)	485 (2.6)

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 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.

Exhibit 6.16 Types of Assessment Teachers Give Quite a Lot or A Great Deal of Weight

8th Grade Science

	Percentage of Students by Type of Assessment						
	External Standardized Tests	Teacher-Made Tests Requiring Explanations	Teacher-Made Objective Tests	Homework Assignments	Projects or Practical Exercises	Observations of Students	Students' Responses in Class
Countries							
United States	r 18 (2.5)	r 70 (2.8)	r 60 (3.2)	r 66 (2.8)	r 82 (2.7)	r 49 (3.6)	r 49 (2.6)
Belgium (Flemish)	9 (2.1)	96 (1.6)	30 (2.7)	r 32 (2.9)	r 43 (3.6)	r 44 (3.3)	56 (3.3)
Canada	r 13 (2.5)	r 66 (3.0)	r 59 (3.6)	r 60 (3.0)	r 84 (3.0)	r 50 (3.1)	r 44 (3.0)
Chinese Taipei	36 (4.1)	43 (4.5)	69 (4.1)	67 (3.6)	55 (4.1)	67 (3.8)	76 (3.4)
Czech Republic	45 (3.2)	96 (1.2)	40 (3.3)	23 (2.8)	56 (3.3)	78 (2.4)	97 (0.8)
England	s 57 (3.9)	s 68 (4.3)	s 25 (4.2)	s 77 (3.6)	s 80 (3.0)	s 74 (3.6)	s 71 (4.2)
Hong Kong, SAR	17 (3.1)	58 (4.2)	76 (3.5)	33 (3.8)	23 (3.8)	23 (3.6)	30 (4.1)
Italy	22 (2.8)	95 (1.7)	74 (3.2)	64 (4.0)	71 (3.4)	96 (1.6)	98 (1.2)
Japan	15 (2.6)	64 (4.3)	55 (4.3)	48 (4.3)	81 (3.6)	74 (3.9)	66 (3.5)
Korea, Rep. of	51 (4.1)	84 (2.8)	76 (3.6)	89 (2.5)	99 (0.6)	92 (2.2)	81 (3.1)
Netherlands	24 (3.2)	97 (1.0)	73 (4.6)	17 (2.6)	32 (3.6)	24 (3.5)	23 (3.1)
Russian Federation	– –	97 (0.6)	64 (1.9)	77 (2.2)	83 (1.6)	97 (0.7)	96 (1.1)
Singapore	28 (3.9)	70 (4.2)	67 (3.5)	39 (4.5)	61 (4.2)	40 (4.2)	36 (4.5)
States							
Connecticut	s 12 (4.6)	s 85 (5.2)	s 58 (7.7)	s 74 (5.3)	s 89 (4.4)	s 69 (5.8)	s 53 (6.2)
Idaho	r 15 (4.5)	r 70 (5.6)	r 63 (6.7)	r 61 (6.0)	r 81 (5.3)	r 28 (6.4)	r 23 (7.0)
Illinois	r 13 (4.3)	63 (7.1)	71 (5.9)	67 (5.7)	81 (4.8)	41 (6.6)	37 (6.6)
Indiana	9 (3.7)	73 (5.7)	70 (6.7)	52 (7.5)	80 (5.0)	39 (8.0)	36 (6.8)
Maryland	r 6 (3.0)	r 80 (4.2)	s 53 (5.5)	s 43 (4.6)	s 99 (0.8)	s 45 (6.3)	r 43 (5.9)
Massachusetts	r 22 (4.1)	r 83 (4.7)	r 50 (5.7)	r 63 (6.0)	r 86 (3.6)	r 48 (6.5)	r 39 (6.1)
Michigan	r 18 (5.4)	r 83 (3.6)	r 63 (7.1)	r 70 (6.3)	r 87 (4.0)	r 41 (5.2)	r 36 (5.5)
Missouri	r 11 (4.2)	r 76 (5.0)	r 71 (6.0)	r 56 (5.7)	r 83 (4.0)	r 35 (6.5)	r 31 (6.3)
North Carolina	23 (6.0)	76 (5.0)	67 (5.3)	54 (6.3)	87 (4.4)	53 (6.6)	54 (6.3)
Oregon	12 (4.4)	65 (5.5)	70 (5.3)	72 (6.6)	96 (1.9)	39 (6.5)	36 (5.1)
Pennsylvania	9 (3.3)	69 (4.3)	77 (4.3)	54 (7.2)	83 (5.7)	50 (5.7)	46 (5.0)
South Carolina	18 (4.3)	77 (5.7)	71 (5.2)	44 (6.5)	79 (4.3)	48 (6.3)	41 (6.8)
Texas	r 13 (4.7)	r 68 (6.8)	r 78 (5.8)	r 59 (5.6)	r 92 (2.6)	r 58 (5.6)	r 58 (6.3)
Districts and Consortia							
Academy School Dist. #20, CO	0 (0.0)	92 (0.1)	84 (0.4)	69 (0.3)	92 (0.1)	18 (0.3)	28 (0.4)
Chicago Public Schools, IL	r 22 (11.2)	r 66 (9.9)	r 67 (7.7)	r 49 (9.4)	r 73 (10.9)	r 63 (11.4)	r 72 (10.4)
Delaware Science Coalition, DE	r 12 (3.9)	r 76 (5.6)	r 67 (6.1)	s 44 (7.1)	r 82 (2.8)	r 60 (6.1)	r 59 (5.0)
First in the World Consort., IL	6 (2.4)	84 (4.9)	59 (4.5)	45 (6.9)	100 (0.0)	58 (6.0)	39 (4.7)
Fremont/Lincoln/WestSide PS, NE	14 (7.6)	68 (8.3)	60 (4.6)	57 (9.6)	99 (0.4)	r 27 (3.3)	r 18 (4.8)
Guilford County, NC	14 (5.2)	82 (5.1)	68 (5.2)	43 (4.8)	90 (4.2)	58 (5.5)	55 (4.8)
Jersey City Public Schools, NJ	r 42 (4.5)	r 88 (4.0)	r 71 (2.7)	r 62 (4.9)	r 82 (1.7)	r 63 (4.9)	r 68 (4.4)
Miami-Dade County PS, FL	s 20 (7.3)	s 66 (7.9)	s 68 (8.4)	s 57 (6.4)	s 88 (4.6)	s 72 (7.9)	s 60 (9.7)
Michigan Invitational Group, MI	10 (0.7)	72 (4.0)	75 (4.2)	59 (4.5)	70 (3.4)	44 (2.8)	18 (1.1)
Montgomery County, MD	x x	x x	x x	x x	x x	x x	x x
Naperville Sch. Dist. #203, IL	8 (3.6)	91 (3.9)	54 (3.6)	59 (1.7)	90 (3.6)	61 (3.7)	23 (4.1)
Project SMART Consortium, OH	r 16 (1.3)	r 51 (5.0)	r 66 (4.5)	r 65 (3.9)	r 71 (4.1)	r 29 (3.6)	r 25 (4.2)
Rochester City Sch. Dist., NY	r 27 (3.5)	r 84 (4.0)	r 68 (5.2)	r 30 (5.1)	r 97 (2.5)	r 41 (6.1)	r 32 (6.0)
SW Math/Sci. Collaborative, PA	13 (5.4)	65 (4.2)	79 (5.5)	53 (6.1)	78 (5.3)	36 (6.1)	43 (6.6)
International Avg. (All Countries)	33 (0.5)	76 (0.5)	60 (0.6)	58 (0.6)	65 (0.6)	68 (0.5)	75 (0.5)

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

Background data provided by teachers.

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 "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students. An "x" indicates teacher response data available for <50% of students.

In What Types of Professional Development Activities Do U.S. Science Teachers Participate?

As a TIMSS 1999 national option, the United States asked science teachers to describe their professional development during the 1998-99 school year, defined as June 1998 to May 1999. Since no other countries asked these questions, cross-country comparisons are not possible. Comparisons, however, can be made to the United States as a whole and among the Benchmarking jurisdictions. Teachers were asked both how often they observed and were observed by other teachers (see Exhibit 6.17). In the U.S. overall, these observations of and by teachers were reported by the science teachers of 24 and 36 percent of the students, respectively. Among the Benchmarking states, the results for classroom observation as a professional development approach resembled the national results. Among districts and consortia, observations were used more extensively in Guilford County, Montgomery County, and the Rochester City School District.

The professional development activities teachers were asked about include the following school- and district-based activities: immersion or internship activities; receiving mentoring, coaching, lead teaching, or observation; teacher resource centers; committees or task forces; and teacher study groups. As shown in Exhibit 6.18, participation on committees or task forces was the most frequently used of these activities. It was reported nationally by the science teachers of more than half the eighth graders (54 percent), and was similarly popular among the Benchmarking participants.

Science teachers were asked about their participation in several types of workshops, conferences, and networks, including within-district workshops and institutes; out-of-district workshops and institutes; teacher collaborative or networks; out-of-district conferences; and other forms of organized professional development (see Exhibit 6.19). They were also asked about individual activities, including taking courses for college credit; individual research projects; individual learning; and other individual professional development activities (see Exhibit 6.20). Of all of the professional development activities, within-district workshops or institutes (75 percent of the students) and individual learning (83 percent) were generally the most frequent activities in which science teachers of U.S. eighth-grade students participated during the 1998-99 school year. Even though there was considerable variation, these activities were also widely reported by teachers in the Benchmarking jurisdictions.

Teachers' reports about the areas heavily emphasized in their professional development are presented in Exhibit 6.21. Nationally, science teachers of 59 percent of eighth graders reported that curriculum was emphasized quite a lot or a great deal. The next greatest emphasis was on general pedagogy (54 percent of students) and content knowledge (51 percent), followed by subject-specific pedagogy and instructional technology (47 percent for each). Teachers reported the least emphasis on assessment (38 percent) and leadership development (20 percent). Again, although there was variation across the Benchmarking participants, the national pattern held in many jurisdictions.

Further detail about the types of content emphasized in professional development is provided in Exhibit 6.22. Nationally, teachers reported that the six content areas (earth science; biology; chemistry; physics; environmental and resource issues; and the nature of science and scientific inquiry and skills) were emphasized about equally, with most emphasis on the nature of science and inquiry skills (60 percent) and least on chemistry (39 percent). In general, a similar pattern was found in the Benchmarking states. There was more variation within some districts and consortia. For example, the Delaware Science Coalition focused relatively more emphasis on professional development in earth science (75 percent), environmental and resource issues (62 percent), and the nature of science and inquiry skills (73 percent) than in the other areas (21 to 29 percent). The Rochester City School District placed little emphasis on earth science (five percent), but rather more on biology (54 percent).

Science teachers in the United States reported a relatively heavy focus on curriculum in their professional development activities. Their reports about familiarity with various curriculum documents are presented in Exhibit 6.23. Nationally, teachers of most students (more than 90 percent) reported that they were fairly or very familiar with the curriculum guides for their school and their school district, and this held across most of the Benchmarking jurisdictions. U.S. science teachers of only 31 percent of the eighth-grade students reported being very familiar with the AAAS *Benchmarks for Science Literacy*. For the Benchmarking states, this ranged from just 15 percent in Idaho to 61 percent in Maryland. For districts and consortia, it ranged from 20 percent in the Southwest Pennsylvania Math and Science Collaborative to 63 percent in the Fremont/Lincoln/Westside Public Schools.

Fewer teachers than might be anticipated reported being at least fairly familiar with their state curriculum guides. Nationally, 79 percent of the eighth graders had science teachers who so reported. Among states the figure ranged from 53 percent in Pennsylvania to 97 percent in Massachusetts and South Carolina, and among districts and consortia from 44 percent in the Southwest Pennsylvania Math and Science Collaborative to 97 percent in the Delaware Science Coalition and Guilford County.

Exhibit 6.17 Students Taught by Teachers Who Participated in Professional Development – Classroom Observation

	Observation of Other Teachers[1]			Observation by Other Teachers[2]		
		Percent of Students	Number of Class Periods Observed Averaged Across Students[3]		Percent of Students	Number of Class Periods Observed Averaged Across Students[3]
States						
Connecticut	s	17 (4.8)	4 (1.0)	r	30 (6.0)	7 (2.3)
Idaho		24 (5.2)	5 (1.8)		28 (5.9)	5 (1.2)
Illinois		13 (3.9)	3 (0.5)		21 (4.8)	15 (4.6)
Indiana		13 (4.1)	3 (0.7)		22 (4.8)	7 (2.8)
Maryland	r	27 (5.1)	7 (2.2)		39 (5.3)	3 (0.3)
Massachusetts		23 (3.8)	4 (0.7)		38 (5.9)	5 (1.0)
Michigan	r	14 (3.5)	6 (2.2)		44 (5.9)	4 (1.3)
Missouri		24 (4.9)	5 (2.1)		39 (6.6)	6 (2.7)
North Carolina		35 (6.4)	3 (0.2)		48 (5.1)	5 (1.5)
Oregon	r	14 (4.6)	4 (0.7)		27 (6.7)	5 (0.9)
Pennsylvania		28 (7.6)	6 (1.2)		34 (7.2)	4 (0.9)
South Carolina		28 (5.1)	4 (0.7)		38 (5.0)	4 (0.7)
Texas	r	41 (6.4)	8 (1.7)		48 (6.3)	5 (0.8)
Districts and Consortia						
Academy School Dist. #20, CO		26 (0.4)	6 (0.1)		20 (0.3)	3 (0.0)
Chicago Public Schools, IL	r	18 (9.7)	4 (1.8)		28 (10.0)	2 (0.9)
Delaware Science Coalition, DE		19 (3.6)	4 (0.5)		36 (6.0)	2 (0.4)
First in the World Consort., IL		23 (6.9)	8 (2.1)		33 (7.2)	8 (1.2)
Fremont/Lincoln/WestSide PS, NE		38 (9.1)	3 (0.3)		36 (7.2)	3 (0.3)
Guilford County, NC		42 (5.8)	3 (0.4)		61 (4.5)	3 (0.3)
Jersey City Public Schools, NJ	r	13 (3.9)	4 (0.2)		39 (2.8)	18 (1.9)
Miami-Dade County PS, FL	r	25 (6.3)	4 (1.0)	r	38 (7.7)	3 (0.4)
Michigan Invitational Group, MI	r	27 (3.7)	5 (0.3)		29 (2.9)	7 (0.8)
Montgomery County, MD	s	43 (6.3)	5 (0.9)		72 (6.9)	4 (0.5)
Naperville Sch. Dist. #203, IL		18 (4.3)	3 (0.5)		18 (4.3)	3 (0.2)
Project SMART Consortium, OH		28 (4.1)	4 (0.3)		42 (4.3)	4 (0.4)
Rochester City Sch. Dist., NY		44 (4.2)	6 (2.0)	s	59 (4.7)	20 (2.2)
SW Math/Sci. Collaborative, PA		27 (6.9)	3 (0.4)		43 (8.8)	5 (2.5)
United States	r	24 (3.5)	5 (0.9)		36 (3.8)	5 (0.9)

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

Background data provided by teachers.

1 Based on complete class periods teachers observed other teachers in their school teach science from the beginning of the 1998-99 school year until the time of testing.

2 Based on complete class periods teachers were observed while teaching science by other teachers in their school from the beginning of the 1998-99 school year until the time of testing.

3 Teachers who did not participate in the professional development activity were not included in the average.

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 teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Exhibit 6.18 Students Taught by Teachers Who Participated in Professional Development – School- and District-Based Activities*

	Immersion or Internship Activities		Receipt of Mentoring or Observation		Teacher Resource Center		Committees or Task Forces		Teacher Study Groups	
	Percent of Students	Teacher Hours Averaged Across Students[1]	Percent of Students	Teacher Hours Averaged Across Students[1]	Percent of Students	Teacher Hours Averaged Across Students[1]	Percent of Students	Teacher Hours Averaged Across Students[1]	Percent of Students	Teacher Hours Averaged Across Students[1]
States										
Connecticut	s 3 (2.0)	46 (36.0)	s 24 (5.7)	9 (2.3)	s 11 (4.3)	12 (3.2)	s 60 (6.4)	15 (3.4)	s 25 (5.8)	10 (1.7)
Idaho	2 (0.1)	~ ~	23 (5.4)	7 (1.1)	6 (1.7)	11 (7.5)	35 (6.7)	13 (1.8)	r 17 (3.2)	9 (3.2)
Illinois	1 (0.5)	~ ~	13 (4.6)	12 (4.3)	27 (7.0)	5 (1.0)	64 (7.1)	9 (1.6)	25 (6.4)	18 (7.4)
Indiana	r 8 (4.4)	47 (12.0)	32 (5.4)	9 (2.8)	r 12 (4.4)	4 (1.6)	70 (5.6)	13 (3.1)	r 22 (4.6)	15 (7.7)
Maryland	r 6 (3.1)	45 (28.2)	r 34 (5.0)	7 (1.6)	r 23 (4.9)	6 (0.5)	r 51 (5.9)	12 (1.5)	r 25 (4.0)	12 (2.3)
Massachusetts	9 (3.9)	20 (5.4)	29 (5.3)	9 (3.8)	r 16 (4.0)	7 (1.6)	66 (6.2)	17 (2.7)	35 (6.2)	16 (3.3)
Michigan	r 6 (3.3)	70 (21.8)	r 32 (7.3)	6 (1.7)	r 25 (5.3)	7 (1.5)	r 59 (5.7)	11 (1.3)	r 25 (5.7)	9 (1.7)
Missouri	r 2 (1.3)	~ ~	r 38 (7.5)	13 (3.4)	r 23 (6.6)	3 (0.5)	r 57 (4.9)	13 (1.9)	r 25 (6.1)	7 (1.4)
North Carolina	r 10 (4.2)	29 (7.1)	r 46 (6.5)	6 (0.9)	r 25 (5.0)	8 (3.0)	r 50 (5.8)	8 (1.3)	r 32 (5.1)	21 (6.6)
Oregon	r 5 (2.4)	22 (15.4)	r 35 (7.5)	8 (3.1)	r 16 (5.7)	3 (0.5)	r 61 (6.5)	26 (5.9)	r 28 (6.8)	10 (2.4)
Pennsylvania	6 (2.0)	7 (2.7)	34 (6.6)	5 (0.8)	15 (4.1)	7 (1.8)	48 (5.6)	10 (1.1)	19 (4.1)	14 (5.3)
South Carolina	7 (3.1)	6 (4.9)	39 (6.4)	8 (1.1)	19 (4.5)	9 (2.6)	50 (6.8)	8 (1.1)	18 (5.4)	7 (2.2)
Texas	r 13 (4.6)	18 (5.9)	r 47 (6.7)	11 (3.1)	r 30 (5.9)	12 (4.3)	r 54 (7.1)	12 (2.9)	r 23 (5.5)	7 (1.2)
Districts and Consortia										
Academy School Dist. #20, CO	0 (0.0)	~ ~	40 (0.4)	3 (0.0)	0 (0.0)	~ ~	r 60 (0.5)	12 (0.1)	r 10 (0.3)	2 (0.0)
Chicago Public Schools, IL	r 4 (0.5)	2 (0.0)	r 24 (11.3)	11 (7.7)	r 42 (12.4)	3 (0.5)	r 44 (8.8)	8 (1.2)	r 19 (6.9)	14 (8.6)
Delaware Science Coalition, DE	r 23 (3.7)	24 (6.4)	r 25 (4.4)	10 (2.3)	30 (5.2)	5 (0.8)	29 (5.7)	14 (2.1)	24 (4.9)	9 (4.2)
First in the World Consort., IL	r 0 (0.0)	~ ~	28 (7.3)	10 (2.4)	38 (7.7)	5 (0.9)	59 (6.9)	10 (2.1)	57 (4.2)	8 (1.1)
Fremont/Lincoln/WestSide PS, NE	r 0 (0.0)	~ ~	39 (7.6)	3 (0.2)	r 19 (7.8)	3 (0.2)	71 (9.5)	13 (3.5)	35 (7.8)	10 (1.5)
Guilford County, NC	3 (1.9)	8 (0.0)	45 (4.8)	6 (1.2)	r 30 (4.4)	5 (0.7)	49 (3.5)	12 (1.1)	29 (6.3)	20 (3.9)
Jersey City Public Schools, NJ	s 4 (0.2)	20 (0.0)	s 36 (1.8)	8 (0.3)	s 12 (0.6)	17 (0.0)	s 48 (2.5)	4 (0.1)	s 29 (1.6)	24 (0.4)
Miami-Dade County PS, FL	r 6 (3.8)	11 (6.0)	r 32 (6.9)	6 (3.1)	r 42 (4.9)	11 (4.0)	r 46 (6.9)	8 (2.1)	r 30 (9.5)	14 (4.2)
Michigan Invitational Group, MI	r 4 (0.3)	6 (0.0)	r 17 (2.6)	12 (0.9)	r 22 (4.6)	4 (0.6)	r 64 (4.6)	13 (2.6)	r 9 (3.1)	4 (0.5)
Montgomery County, MD	s 4 (3.5)	84 (24.7)	s 41 (9.6)	13 (5.1)	s 13 (7.2)	2 (0.5)	s 37 (6.3)	21 (8.2)	s 23 (9.2)	24 (5.7)
Naperville Sch. Dist. #203, IL	0 (0.0)	~ ~	38 (4.4)	3 (0.2)	16 (2.1)	30 (1.5)	86 (3.9)	15 (1.8)	10 (3.8)	2 (0.0)
Project SMART Consortium, OH	0 (0.0)	~ ~	34 (5.8)	17 (4.9)	12 (4.1)	3 (0.7)	44 (5.4)	8 (0.6)	20 (2.9)	12 (2.1)
Rochester City Sch. Dist., NY	14 (3.4)	86 (0.9)	34 (6.1)	32 (4.5)	r 27 (3.0)	5 (0.9)	47 (4.9)	19 (2.4)	25 (5.0)	12 (1.8)
SW Math/Sci. Collaborative, PA	12 (4.0)	8 (4.1)	35 (7.1)	7 (1.7)	21 (5.4)	13 (3.7)	51 (7.0)	9 (2.2)	18 (4.5)	9 (2.0)
United States	r 9 (2.2)	32 (9.5)	r 30 (2.8)	7 (1.3)	r 20 (2.2)	9 (1.5)	r 54 (4.6)	13 (1.4)	r 23 (3.4)	9 (1.6)

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

Background data provided by teachers.

* Based on participation in professional development activities from June 1998 until the time of testing.

1 Teachers who did not participate in the professional development activity were not included in the average.

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 average hours.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Exhibit 6.19 Students Taught by Teachers Who Participated in Professional Development – Workshops, Conferences, and Networks*

8th Grade Science

	Within-District Workshops/ Institutes		Out-of-District Workshops/ Institutes		Teacher Collaborative or Networks		Out-of-District Conferences		Other Organized Professional Development	
	Percent of Students	Teacher Hours Averaged Across Students[1]	Percent of Students	Teacher Hours Averaged Across Students[1]	Percent of Students	Teacher Hours Averaged Across Students[1]	Percent of Students	Teacher Hours Averaged Across Students[1]	Percent of Students	Teacher Hours Averaged Across Students[1]
States										
Connecticut	s 91 (2.4)	15 (2.1)	s 43 (6.7)	9 (1.6)	s 22 (6.4)	16 (4.5)	s 38 (7.1)	12 (2.5)	s 18 (5.6)	9 (2.3)
Idaho	65 (7.2)	14 (1.4)	31 (7.2)	20 (3.5)	16 (4.0)	20 (6.2)	36 (7.6)	15 (2.4)	r 17 (4.4)	15 (7.7)
Illinois	r 69 (7.2)	13 (1.7)	43 (8.0)	24 (3.9)	23 (5.0)	12 (2.5)	29 (7.6)	11 (1.6)	27 (5.7)	8 (1.1)
Indiana	66 (6.8)	7 (0.9)	43 (7.8)	14 (4.4)	31 (6.8)	10 (3.0)	r 47 (6.7)	18 (4.5)	r 13 (4.3)	7 (2.0)
Maryland	r 80 (4.9)	17 (1.7)	r 31 (5.1)	18 (3.9)	r 30 (5.6)	11 (1.8)	r 30 (5.9)	12 (1.6)	r 29 (5.4)	14 (4.2)
Massachusetts	82 (4.5)	18 (2.1)	42 (6.2)	17 (3.1)	38 (6.7)	13 (2.8)	51 (6.3)	12 (1.1)	r 23 (5.7)	12 (3.2)
Michigan	r 68 (5.9)	11 (1.4)	r 62 (5.6)	12 (2.1)	r 13 (3.8)	10 (2.3)	r 53 (6.0)	10 (0.8)	r 18 (4.5)	6 (1.0)
Missouri	r 86 (5.3)	16 (2.6)	r 49 (6.8)	13 (2.6)	r 24 (5.8)	14 (3.6)	r 45 (6.6)	19 (4.5)	r 25 (6.2)	8 (2.8)
North Carolina	r 73 (6.0)	14 (2.0)	r 24 (6.6)	35 (9.7)	r 28 (6.4)	15 (4.1)	r 29 (5.9)	15 (2.9)	r 17 (3.7)	11 (4.6)
Oregon	r 91 (2.8)	18 (3.3)	r 40 (7.6)	12 (3.4)	r 28 (6.6)	10 (3.4)	r 35 (7.4)	9 (1.8)	r 23 (6.0)	14 (6.8)
Pennsylvania	65 (5.0)	14 (3.3)	34 (4.8)	13 (2.2)	24 (4.0)	9 (2.9)	17 (2.9)	15 (3.1)	21 (5.6)	7 (1.4)
South Carolina	85 (4.5)	18 (2.4)	39 (7.1)	17 (2.4)	29 (4.7)	10 (2.0)	45 (6.6)	13 (1.7)	28 (5.0)	12 (4.4)
Texas	r 91 (3.3)	19 (2.5)	r 62 (6.9)	16 (2.4)	r 30 (5.4)	18 (8.6)	r 55 (7.0)	17 (3.1)	s 23 (6.0)	6 (0.7)
Districts and Consortia										
Academy School Dist. #20, CO	62 (0.4)	10 (0.1)	41 (0.4)	29 (0.3)	47 (0.4)	15 (0.2)	53 (0.4)	14 (0.1)	r 13 (0.2)	5 (0.0)
Chicago Public Schools, IL	r 71 (9.7)	10 (2.4)	r 31 (7.3)	9 (1.3)	r 27 (9.4)	9 (4.2)	r 25 (9.5)	7 (1.8)	s 38 (12.4)	8 (3.5)
Delaware Science Coalition, DE	66 (5.9)	16 (1.8)	29 (5.3)	15 (3.3)	32 (5.3)	10 (3.8)	26 (5.2)	19 (4.6)	r 14 (4.1)	10 (2.2)
First in the World Consort., IL	53 (5.4)	10 (2.0)	33 (6.3)	11 (0.4)	45 (7.8)	38 (5.0)	34 (7.2)	15 (3.1)	45 (7.0)	13 (1.4)
Fremont/Lincoln/WestSide PS, NE	96 (2.5)	10 (0.9)	35 (1.6)	8 (1.0)	24 (5.6)	3 (0.1)	37 (7.9)	11 (1.7)	26 (8.7)	5 (1.1)
Guilford County, NC	82 (5.8)	22 (2.7)	17 (3.7)	11 (0.7)	18 (5.4)	17 (4.0)	17 (2.2)	8 (1.0)	18 (4.9)	11 (1.7)
Jersey City Public Schools, NJ	s 72 (1.5)	8 (0.2)	r 43 (2.1)	24 (0.6)	s 29 (1.4)	9 (0.1)	s 22 (1.2)	15 (0.3)	s 16 (1.2)	6 (0.2)
Miami-Dade County PS, FL	r 80 (7.5)	28 (5.6)	r 29 (7.2)	18 (8.9)	r 16 (4.6)	17 (4.6)	r 11 (4.8)	12 (3.2)	s 26 (6.4)	21 (9.5)
Michigan Invitational Group, MI	r 76 (5.1)	9 (0.5)	r 61 (5.0)	10 (1.1)	r 29 (5.3)	9 (0.9)	r 35 (3.9)	13 (1.3)	r 21 (4.5)	12 (1.4)
Montgomery County, MD	s 65 (11.2)	19 (2.7)	s 34 (7.0)	18 (3.3)	s 29 (7.5)	12 (2.4)	s 36 (9.5)	11 (2.6)	s 49 (6.9)	16 (1.4)
Naperville Sch. Dist. #203, IL	95 (1.9)	21 (1.2)	40 (4.5)	24 (6.0)	r 51 (2.1)	11 (0.7)	6 (1.7)	6 (0.0)	28 (4.3)	12 (1.0)
Project SMART Consortium, OH	74 (4.3)	12 (0.9)	39 (5.5)	16 (1.7)	13 (2.6)	7 (0.7)	17 (2.9)	8 (1.0)	17 (5.0)	14 (3.0)
Rochester City Sch. Dist., NY	r 73 (6.7)	10 (0.5)	22 (3.6)	7 (0.4)	r 23 (4.0)	16 (1.8)	21 (4.0)	24 (5.0)	22 (4.4)	25 (9.4)
SW Math/Sci. Collaborative, PA	72 (7.6)	12 (2.0)	37 (5.4)	20 (5.5)	28 (7.0)	8 (3.3)	27 (6.1)	15 (2.7)	17 (7.0)	7 (3.1)
United States	r 75 (3.1)	16 (1.1)	r 46 (3.7)	13 (1.5)	r 22 (3.0)	12 (2.8)	r 35 (2.8)	14 (1.7)	r 18 (2.8)	17 (3.8)

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

Background data provided by teachers.

* Based on participation in professional development activities from June 1998 until the time of testing.

1 Teachers who did not participate in the professional development activity were not included in the average.

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 teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Exhibit 6.20 Students Taught by Teachers Who Participated in Professional Development – Individual Activities*

TIMSS 1999 Benchmarking
Boston College

8th Grade Science

	Courses for College Credit[1]			Individual Research Projects			Individual Learning			Other Individual Professional Development		
		Percent of Students	Teacher Hours Averaged Across Students[2]		Percent of Students	Teacher Hours Averaged Across Students[2]		Percent of Students	Teacher Hours Averaged Across Students[2]		Percent of Students	Teacher Hours Averaged Across Students[2]
States												
Connecticut	s	17 (6.2)	73 (10.7)	s	38 (7.4)	20 (3.8)	s	80 (3.9)	41 (4.6)	s	49 (6.6)	19 (2.9)
Idaho		72 (6.8)	34 (4.5)	r	27 (6.1)	22 (3.8)		87 (4.9)	37 (4.8)	r	33 (6.9)	34 (5.7)
Illinois		25 (5.4)	23 (7.7)		36 (6.3)	24 (4.7)		92 (3.0)	37 (3.6)	r	29 (6.4)	24 (3.5)
Indiana	r	26 (6.2)	27 (7.3)		22 (5.9)	22 (7.5)		88 (6.9)	32 (4.6)	r	24 (5.5)	31 (10.8)
Maryland	r	43 (6.6)	26 (3.3)	r	37 (6.6)	18 (2.5)	r	88 (3.2)	37 (3.8)	r	32 (5.6)	29 (5.1)
Massachusetts		23 (5.0)	51 (10.5)		37 (6.2)	21 (3.5)		84 (5.1)	40 (3.5)	s	39 (7.8)	28 (7.4)
Michigan	r	25 (4.4)	35 (8.5)	r	39 (6.6)	22 (4.2)	r	92 (3.8)	35 (3.8)	r	36 (5.4)	25 (6.8)
Missouri	r	28 (6.9)	24 (8.5)	r	38 (6.5)	7 (1.1)	r	96 (2.3)	27 (3.6)	r	41 (6.6)	22 (5.5)
North Carolina	r	20 (3.3)	14 (3.9)		39 (4.3)	22 (6.3)		84 (3.3)	33 (4.0)	r	36 (7.1)	32 (7.5)
Oregon	r	27 (6.9)	30 (5.7)	r	42 (7.8)	15 (3.9)	r	85 (3.8)	32 (4.9)	s	43 (7.8)	29 (6.3)
Pennsylvania		24 (4.6)	38 (8.2)		28 (4.9)	16 (2.9)		75 (4.2)	37 (4.0)		37 (4.5)	29 (5.0)
South Carolina		39 (6.4)	29 (5.0)		42 (5.9)	16 (3.4)		89 (3.8)	30 (4.1)	r	27 (6.4)	24 (6.5)
Texas	r	30 (5.5)	18 (6.5)	r	18 (5.3)	14 (4.0)	r	83 (5.0)	33 (3.4)	r	42 (4.7)	21 (4.2)
Districts and Consortia												
Academy School Dist. #20, CO		74 (0.4)	31 (0.4)		43 (0.5)	15 (0.1)		83 (0.2)	30 (0.2)	r	22 (0.2)	15 (0.0)
Chicago Public Schools, IL	r	55 (12.6)	16 (4.3)	r	56 (10.5)	11 (2.7)	r	88 (6.5)	35 (9.3)	s	23 (10.4)	21 (8.7)
Delaware Science Coalition, DE	r	22 (5.1)	29 (6.0)		28 (3.5)	25 (6.5)		79 (4.3)	47 (4.3)	r	28 (6.6)	37 (4.9)
First in the World Consort., IL	r	23 (7.8)	14 (5.9)		51 (8.6)	42 (10.3)		100 (0.0)	39 (5.0)		59 (6.4)	28 (4.6)
Fremont/Lincoln/WestSide PS, NE		20 (7.4)	82 (5.7)	r	31 (10.5)	7 (1.0)		84 (4.6)	28 (3.4)	r	44 (7.0)	22 (2.5)
Guilford County, NC		7 (3.2)	22 (6.3)		30 (5.7)	23 (7.2)		88 (4.2)	24 (3.6)		40 (5.9)	22 (5.2)
Jersey City Public Schools, NJ	s	13 (4.1)	73 (7.7)	s	22 (3.7)	17 (0.4)	r	71 (1.4)	37 (1.7)	s	24 (1.3)	18 (0.5)
Miami-Dade County PS, FL	r	31 (7.8)	19 (5.2)	r	45 (7.5)	16 (4.3)	r	76 (6.9)	34 (5.7)	s	48 (9.2)	22 (5.4)
Michigan Invitational Group, MI	r	17 (2.3)	43 (4.4)	r	41 (5.6)	14 (1.2)	r	91 (2.8)	34 (2.6)	s	29 (3.1)	19 (0.9)
Montgomery County, MD	s	47 (5.6)	28 (9.4)	s	31 (8.5)	28 (5.9)	s	91 (1.3)	42 (3.5)	s	33 (7.3)	26 (8.3)
Naperville Sch. Dist. #203, IL		16 (2.1)	11 (0.7)		57 (5.2)	9 (0.4)		96 (0.8)	32 (1.9)	s	22 (2.7)	34 (5.9)
Project SMART Consortium, OH		30 (4.6)	36 (4.0)		32 (3.3)	21 (2.3)		94 (2.5)	40 (2.8)	r	28 (5.0)	20 (2.2)
Rochester City Sch. Dist., NY	r	24 (4.3)	7 (0.6)		21 (4.4)	30 (3.3)		89 (3.7)	41 (3.1)		37 (5.1)	39 (7.0)
SW Math/Sci. Collaborative, PA		18 (5.5)	16 (5.9)		36 (6.6)	15 (3.4)		87 (5.5)	44 (5.6)		37 (8.8)	34 (6.8)
United States	r	30 (2.9)	42 (5.9)	r	38 (3.0)	18 (1.8)	r	83 (2.8)	38 (2.5)	r	37 (3.4)	27 (3.0)

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

Background data provided by teachers.

* Based on participation in professional development activities from June 1998 until the time of testing.

1 The response range had a maximum of 90 hours spent in courses for college credit.

2 Teachers who did not participate in the professional development activity were not included in the average.

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 teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Exhibit 6.21 Professional Development Topics Emphasized Quite a Lot or A Great Deal

8th Grade Science

	Percentage of Students Whose Teachers Reported That the Topic is Emphasized Quite a Lot or A Great Deal in Their Professional Development[1]						
	Content Knowledge	Curriculum	General Instruction/ Pedagogy	Subject-Specific Instruction/ Pedagogy	Assessment	Instructional Technology	Leadership Development
States							
Connecticut	s 40 (6.5)	s 56 (7.1)	s 44 (7.1)	s 33 (6.0)	s 35 (6.7)	s 43 (6.3)	s 14 (4.1)
Idaho	37 (5.1)	43 (6.0)	39 (5.4)	32 (5.6)	17 (5.0)	59 (6.4)	20 (4.6)
Illinois	45 (6.8)	50 (6.4)	46 (7.7)	38 (7.5)	32 (7.1)	50 (7.9)	21 (5.4)
Indiana	r 41 (5.7)	r 63 (5.6)	r 49 (6.3)	r 42 (6.1)	r 36 (6.2)	r 49 (6.3)	r 25 (5.6)
Maryland	r 30 (5.1)	r 63 (5.4)	r 51 (7.1)	r 35 (5.7)	r 37 (6.6)	r 47 (6.0)	r 15 (3.3)
Massachusetts	53 (5.8)	65 (6.2)	41 (5.2)	31 (4.3)	36 (5.5)	40 (5.4)	r 19 (5.3)
Michigan	r 46 (6.7)	r 64 (5.7)	r 45 (5.7)	r 47 (6.5)	r 29 (5.9)	r 36 (6.5)	r 18 (4.9)
Missouri	r 34 (5.4)	r 69 (5.6)	r 70 (5.9)	r 52 (7.4)	r 59 (6.9)	r 37 (7.4)	r 17 (4.8)
North Carolina	r 41 (6.1)	r 50 (5.6)	r 53 (5.7)	r 38 (5.4)	r 28 (4.7)	r 50 (6.4)	r 28 (6.1)
Oregon	r 39 (6.9)	r 65 (7.4)	r 30 (6.4)	r 38 (7.8)	r 51 (6.9)	r 44 (7.2)	r 8 (3.6)
Pennsylvania	44 (5.6)	43 (6.4)	38 (5.2)	27 (4.6)	r 30 (5.1)	49 (5.4)	20 (4.4)
South Carolina	41 (5.3)	80 (3.8)	44 (5.7)	46 (5.3)	29 (5.2)	49 (4.4)	18 (3.8)
Texas	r 52 (5.6)	r 69 (4.3)	r 67 (6.3)	r 49 (6.2)	r 23 (7.2)	r 58 (7.1)	r 19 (5.8)
Districts and Consortia							
Academy School Dist. #20, CO	36 (0.4)	69 (0.4)	58 (0.4)	62 (0.4)	38 (0.4)	59 (0.4)	14 (0.2)
Chicago Public Schools, IL	r 48 (12.5)	r 52 (13.3)	r 51 (12.7)	r 53 (13.1)	r 43 (10.5)	r 44 (14.0)	s 31 (10.6)
Delaware Science Coalition, DE	24 (3.5)	58 (5.5)	22 (4.4)	39 (4.7)	18 (4.5)	44 (6.7)	16 (4.2)
First in the World Consort., IL	38 (7.5)	41 (8.9)	70 (5.1)	64 (7.7)	33 (7.4)	42 (5.0)	12 (2.6)
Fremont/Lincoln/WestSide PS, NE	31 (8.1)	66 (4.9)	43 (3.9)	17 (7.8)	27 (8.0)	64 (4.0)	11 (0.5)
Guilford County, NC	34 (5.0)	57 (3.6)	67 (3.4)	48 (3.8)	44 (4.3)	59 (4.7)	31 (5.9)
Jersey City Public Schools, NJ	s 58 (2.2)	s 61 (2.1)	s 58 (2.3)	s 50 (2.6)	s 55 (2.4)	s 48 (2.7)	s 37 (3.2)
Miami-Dade County PS, FL	r 59 (11.1)	r 63 (5.9)	r 70 (7.9)	r 63 (9.9)	r 55 (7.6)	r 47 (10.8)	r 29 (8.2)
Michigan Invitational Group, MI	r 28 (4.6)	r 63 (5.7)	r 44 (5.2)	r 31 (5.5)	r 17 (2.7)	r 35 (5.3)	r 23 (4.0)
Montgomery County, MD	s 40 (8.6)	s 66 (8.7)	s 68 (5.4)	s 46 (7.0)	s 20 (6.6)	s 58 (8.9)	s 25 (6.8)
Naperville Sch. Dist. #203, IL	26 (4.3)	94 (2.1)	31 (4.2)	42 (5.6)	r 56 (5.2)	76 (3.7)	28 (2.0)
Project SMART Consortium, OH	39 (3.6)	72 (4.4)	36 (4.0)	41 (3.7)	11 (2.2)	59 (4.4)	8 (2.8)
Rochester City Sch. Dist., NY	r 26 (5.2)	r 44 (6.4)	r 78 (4.7)	r 37 (6.1)	r 25 (5.7)	r 21 (5.9)	r 18 (5.1)
SW Math/Sci. Collaborative, PA	43 (6.1)	52 (7.8)	39 (6.1)	31 (6.3)	25 (6.4)	56 (9.0)	16 (5.8)
United States	51 (4.2)	59 (3.7)	54 (3.6)	47 (3.7)	38 (3.8)	47 (3.9)	20 (2.4)

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

Background data provided by teachers.

1 Based on participation in professional development activities from June 1998 until the time of testing. Does not include students whose teachers reported that they do not teach the topic.

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 teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

	Earth Science		Biology		Chemistry		Physics		Environmental and Resource Issues		Nature of Science and Scientific Inquiry Skills	
States												
Connecticut	s	31 (7.7)	s	25 (6.8)	s	43 (7.7)	s	33 (7.0)	s	46 (8.0)	s	61 (8.0)
Idaho	r	44 (6.5)	r	27 (7.0)	r	38 (5.7)	r	44 (7.7)	r	38 (5.2)	r	49 (5.8)
Illinois	r	46 (7.3)		39 (8.6)		46 (8.2)	r	33 (7.3)		50 (6.7)		50 (7.3)
Indiana	r	48 (7.0)	r	36 (6.7)	r	61 (6.3)	r	47 (8.1)	r	47 (7.7)	r	63 (5.6)
Maryland	r	54 (6.8)	r	35 (5.7)	r	41 (6.2)	r	41 (6.0)	r	41 (5.4)	r	57 (5.9)
Massachusetts	r	52 (6.7)	r	37 (6.7)	r	41 (5.2)	r	42 (6.2)	r	38 (5.2)	r	54 (6.5)
Michigan	r	39 (6.4)	r	34 (7.1)	r	41 (5.6)	r	60 (5.8)	r	44 (7.4)	r	60 (7.4)
Missouri	r	53 (9.0)	r	36 (8.3)	r	33 (6.6)	r	31 (6.4)	r	52 (6.8)	r	68 (5.2)
North Carolina	r	43 (6.3)	r	22 (4.5)	r	30 (5.7)	r	20 (4.7)	r	35 (6.6)	r	42 (6.7)
Oregon	r	60 (6.8)	r	37 (7.0)	r	38 (6.6)	r	34 (6.7)	r	36 (7.1)	r	74 (5.7)
Pennsylvania	r	32 (6.0)	r	31 (5.7)	r	34 (6.9)	r	30 (6.6)	r	38 (6.0)	r	45 (5.7)
South Carolina		68 (5.2)		36 (6.0)		41 (6.2)		43 (6.6)		61 (6.6)		73 (5.8)
Texas	r	76 (5.2)	r	55 (7.7)	r	58 (7.7)	r	48 (7.6)	r	51 (6.4)	r	67 (6.5)
Districts and Consortia												
Academy School Dist. #20, CO		53 (0.5)		27 (0.3)		44 (0.4)		47 (0.5)		35 (0.3)		58 (0.4)
Chicago Public Schools, IL	s	48 (13.5)	s	54 (12.7)	s	32 (14.1)	s	39 (13.9)	r	60 (12.3)	s	73 (5.9)
Delaware Science Coalition, DE	r	75 (5.2)	s	21 (6.6)	s	26 (5.6)	s	29 (7.7)	r	62 (6.1)	s	72 (6.6)
First in the World Consort., IL		25 (8.5)		27 (7.8)		33 (8.6)		42 (8.1)		28 (9.1)		62 (7.8)
Fremont/Lincoln/WestSide PS, NE		32 (7.4)		39 (3.4)		40 (4.8)		34 (4.6)		53 (9.9)		64 (8.9)
Guilford County, NC		53 (6.3)	r	10 (3.1)	r	31 (5.5)	r	19 (5.4)		35 (6.1)		59 (6.5)
Jersey City Public Schools, NJ	s	67 (3.6)	s	60 (3.3)	s	43 (2.4)	s	52 (2.9)	s	51 (2.8)	s	65 (2.1)
Miami-Dade County PS, FL	s	42 (8.9)	s	33 (8.3)	r	38 (9.3)	s	43 (5.3)	r	57 (9.7)	s	73 (6.9)
Michigan Invitational Group, MI	r	47 (5.7)	r	25 (4.9)	r	37 (3.6)	r	36 (4.0)	r	29 (4.5)	r	58 (5.1)
Montgomery County, MD	s	81 (6.2)	s	17 (5.5)	s	30 (6.5)	s	15 (3.1)	s	24 (6.4)	s	70 (4.8)
Naperville Sch. Dist. #203, IL	r	17 (3.1)	r	37 (5.5)		28 (4.4)		30 (4.4)	r	29 (5.3)		57 (5.0)
Project SMART Consortium, OH		42 (4.6)		26 (3.5)		28 (4.1)		24 (3.0)		25 (4.3)		57 (4.6)
Rochester City Sch. Dist., NY	r	5 (2.4)	r	54 (6.2)	r	34 (4.7)	r	35 (5.1)	r	21 (5.6)	r	65 (4.8)
SW Math/Sci. Collaborative, PA		36 (7.4)		27 (7.5)		41 (8.7)		44 (9.1)		36 (6.9)		55 (6.0)
United States	r	52 (3.8)	r	42 (3.5)	r	39 (3.8)	r	41 (3.9)	r	47 (4.2)	r	60 (4.2)

Percentage of Students Whose Teachers Reported That the Content Area is Focused On in Their Professional Development[1]

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

Background data provided by teachers.

1 Content areas are focused on in professional development if 80% or more of the TIMSS topics in the content area are reported by teachers to have been focused on in their professional development from June 1998 until the time of testing.

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 teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Exhibit 6.23 Familiarity with Curriculum Documents

8th Grade Science

	Percentage of Students Whose Teachers Reported Being Fairly Familiar or Very Familiar with the Curriculum Document											
		American Association for the Advancement of Science (AAAS) *Benchmarks for Science Literacy*		State Education Department Curriculum Guide		School District Curriculum Guide		School Curriculum Guide		National Assessment of Educational Progress (NAEP) Assessment Frameworks/ Specifications		State Education Department Assessment Specifications
States												
Connecticut	s	58 (7.0)	s	67 (7.8)	s	94 (3.5)	s	95 (1.8)	s	42 (6.9)	s	45 (9.1)
Idaho	r	15 (4.0)	r	77 (6.4)	r	88 (6.7)	r	86 (6.9)	r	5 (3.0)	r	24 (4.7)
Illinois		35 (6.6)		66 (8.1)		93 (3.8)		80 (4.0)		20 (4.6)	r	57 (6.7)
Indiana		48 (6.3)		96 (2.0)		95 (2.8)		100 (0.2)		13 (4.3)		43 (7.1)
Maryland	r	61 (6.2)	r	69 (5.0)	r	98 (1.0)	s	90 (2.6)	r	37 (7.1)	s	68 (5.8)
Massachusetts		30 (4.8)		97 (1.9)		96 (2.4)	r	96 (2.6)		33 (6.2)		66 (6.4)
Michigan	r	32 (6.2)	r	87 (4.4)	r	95 (3.0)	r	95 (3.1)		26 (4.7)	r	69 (5.9)
Missouri		26 (6.6)		81 (5.9)		96 (2.9)		94 (3.3)	r	45 (7.7)		79 (5.4)
North Carolina		32 (6.1)		99 (1.1)		91 (2.1)		90 (1.2)		29 (6.5)	r	48 (6.2)
Oregon		51 (5.0)		88 (4.8)		96 (2.4)		97 (1.5)		30 (6.6)		88 (4.3)
Pennsylvania		33 (5.5)		53 (6.1)		91 (3.9)		69 (4.4)		24 (4.0)	r	51 (6.4)
South Carolina		30 (6.2)		97 (2.1)		93 (4.2)		86 (6.1)		59 (4.9)		61 (7.1)
Texas	r	28 (8.0)	r	69 (5.6)	r	94 (3.4)	s	94 (3.8)	r	26 (6.5)	r	65 (7.1)
Districts and Consortia												
Academy School Dist. #20, CO		45 (0.5)		86 (0.3)		82 (0.4)		91 (0.3)		18 (0.2)		52 (0.4)
Chicago Public Schools, IL		47 (13.3)	r	72 (12.3)		99 (0.8)	r	97 (3.5)		25 (9.3)	r	52 (9.8)
Delaware Science Coalition, DE	r	29 (5.2)	r	97 (2.4)	r	88 (3.8)	r	80 (5.3)	s	45 (9.0)	r	50 (6.7)
First in the World Consort., IL	r	37 (7.0)		80 (5.4)		100 (0.0)		100 (0.0)	r	30 (7.6)		67 (6.9)
Fremont/Lincoln/WestSide PS, NE		63 (4.5)		87 (1.0)		100 (0.0)	r	99 (0.7)		39 (6.8)		43 (8.3)
Guilford County, NC		25 (5.7)		97 (2.5)	r	76 (5.8)	r	66 (5.7)		21 (4.1)		54 (6.7)
Jersey City Public Schools, NJ	r	31 (3.3)	r	90 (0.7)	r	97 (0.2)	r	92 (0.5)	r	50 (3.0)	r	70 (1.8)
Miami-Dade County PS, FL	s	28 (6.9)	s	89 (5.7)	s	95 (2.6)	s	80 (8.2)	s	32 (4.7)	s	59 (11.0)
Michigan Invitational Group, MI		44 (7.2)	r	82 (6.0)		100 (0.0)		97 (1.9)	r	18 (3.1)	r	75 (6.0)
Montgomery County, MD		x x		x x		x x		x x		x x		x x
Naperville Sch. Dist. #203, IL		53 (3.9)		84 (0.8)		96 (0.4)		95 (0.6)		12 (2.4)		39 (4.1)
Project SMART Consortium, OH		29 (2.7)		59 (4.3)		94 (2.6)		89 (4.2)		11 (1.6)		36 (5.1)
Rochester City Sch. Dist., NY		37 (5.6)		63 (4.9)		100 (0.0)	r	77 (5.6)		19 (4.7)		28 (5.7)
SW Math/Sci. Collaborative, PA		20 (5.6)		44 (5.5)		94 (3.1)		87 (5.7)		10 (4.2)		43 (6.6)
United States		31 (3.5)	r	79 (3.3)	r	90 (2.1)	r	93 (1.8)	r	26 (2.5)	r	52 (3.6)

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

Background data provided by teachers.

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 teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students. An "x" indicates teacher response data available for <50% of students.