Chapter 6

Teachers of Science

Since the teacher is central in creating a classroom environment that supports learning science, Chapter 6 presents information about the preparation and background of science teachers in the participating countries. The chapter begins with information about the licensing and/or certification requirements for teaching science at the eighth and fourth grades in the TIMSS countries. The National Research Coordinators were responsible for providing this information as part of completing the Curriculum Questionnaire.

The remaining sections of the chapter include information about the demographic characteristics of the teaching force and about teachers' educational background and preparation, including opportunities for professional development. To collect information from teachers, TIMSS administered a two-part questionnaire in which teachers were asked to provide information about their background and training and their instructional practices. Chapter 6 essentially presents teachers' responses to the first part of the questionnaire, while Chapter 7 presents information from the second part about classroom instruction.

Because the sampling for the teacher questionnaires was based on participating students, teachers' responses do not necessarily represent all eighth-grade or all fourth-grade science teachers in each country. Rather, they represent teachers of the representative samples

of students assessed. It is important to note that when information from the teacher questionnaire is being 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 instruction received by representative samples of students and the characteristics of the teachers delivering that instruction. Although this perspective may differ from that obtained by simply collecting information from teachers, it is consistent with the TIMSS goals of providing information about the educational contexts and performance of students.

The teachers who completed the questionnaires were the science teachers of the students who took the TIMSS 2003 test. At the eighth grade, 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 the questionnaire. In countries where science is taught as separate subjects, all science subject teachers of the students in the sampled mathematics classes were asked to complete a questionnaire. At the fourth grade, students often only have one teacher for all subjects, so this teacher is their science teacher and the one who completed the questionnaire. In either grade, the information about teachers' characteristics and instruction is tied directly to the students tested. Sometimes, however, teachers did not complete the questionnaire assigned to them, so most countries 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 country where teacher responses are available for at least 70 but less than 85 percent of the students, an "r" is included next to its data. Where teacher responses are available for at least 50 but less than 70 percent of the students, an "s" is included. Where teacher responses are available for less than 50 percent, an "x" replaces the data.

What Are the Requirements for Being a Science Teacher?

Exhibit 6.1 presents the country-level responses about the requirements for being certified or licensed to teach science at the eighth and fourth grades. Countries were asked about fi

organization. The responses at the fourth grade were similar, with ministries of education and universities/colleges being the organizations most often responsible for granting certification.

What Are the Background Characteristics of Science teachers?

Exhibit 6.3 presents a considerable amount of information about the background characteristics of science teachers at the eighth and fourth

ing force at either the eighth or fourth grades. At the eighth grade, on average, internationally, only 20 percent of students were taught by teachers younger than age 30. The four countries with the most students (more than 40 percent) taught by younger teachers were Botswana, Ghana, Lebanon, and Saudi Arabia. The pattern was very similar at the fourth grade. On average, internationally, 20 percent of the students were taught by teachers younger than 30 years old, and with the exception of Cyprus (48%) and Singapore (45%), this percentage was usually well under 40 percent.

At the other end of the age distribution, 22 percent of the eighth-grade students and 21 percent of the fourth-grade students internationally were taught by teachers age 50 or older. At the eighth grade, interestingly, the teaching force was relatively older in some countries. For example, at least half of the students in Italy and Macedonia had teachers at least 50 years of age.

Finally, from Exhibit 6.3, it can be seen that teachers at both the eighth and fourth grades, reported having full certification rather than provisional or emergency credentials. Given the potential problem of teacher shortages for a variety of reasons, it is interesting to note that, on average, internationally, 87 percent of the eighth-grade students and 84 percent of the fourth-grade students were taught science by certified teachers. Of course, the situation varied dramatically across the TIMSS countries. For example, in Lebanon, only 45 percent of the eighth-grade students and in Tunisia only 21 percent of the fourth-grade students were taught science by a fully certified teacher.

and benchmarking participants reported preparation in how to teach the intended curriculum as part of both pre- and in-service training, and most reported coverage in at least one of these places. Countries reporting no specific training in how to teach the intended curriculum included Chile, Korea, Moldova, Norway, and Sweden.

Teachers' reports about their major area or areas of study during their postsecondary education also can be found in Exhibit 6.5. At the eighth grade, on average, internationally, most students (82%) had teachers who studied a science subject – biology, physics, chemistry, or earth science. Science education was also a popular option, with 37 percent of students, on average, taught by teachers with science

	82 (2.1)	16 (2.0)	1 (0.4)	1 (0.3)	0 (0.0)
	56 (3.5)	38 (3.7)	5 (1.5)	0 (0.1)	0 (0.0)
	10 (1.8)	88 (2.2)	2 (1.1)	0 (0.0)	1 (0.0)
( )	0 (0.0)	0 (0.0)	100 (0.0)	0 (0.0)	0 (0.0)
	4 (2.0)	34 (4.7)	61 (4.8)	1 (0.6)	0 (0.0)
	67 (3.0)	24 (2.5)	(1.5)	0 (0.0)	0 (0.0)
	2 (1.1)	1 (2.6)	7 (2.3)	0 (0.0)	0 (0.0)
	27 (3.6)	70 (3.7)	2 (1.5)	0 (0.0)	0 (0.0)
	21 (1.0)	7 (1.0)	0 (0.0)	0 (0.0)	0 (0.0)
	8 (2.3)	2 (2.3)	0 (0.0)	0 (0.0)	0 (0.0)
	23 (2.2)	61 (2.6)	12 (1.6)	3 (1.1)	0 (0.0)
	2.3)	0 (.0)	0 (0.0)		

Preparation to Teach Science

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Countries								
	●	●	11 (1.6)	2 (1.2)	4 (0.)	16 (2.2)	13 (2.0)	13 (1.)
	●	●	65 (3.4)	80 (3.3)	23 (3.3)	30 (3.3)	42 (3.7)	3 (4.0)
	●	●	45 (3.2)	6 (1.4)	1 (0.)	(2.1)	23 (2.5)	13 (1.)
	●	●		77 (2.7)		23 (2.1)	8 (1.4)	35 (3.0)
	●	●	54 (4.5)	85 (3.4)	13 (3.0)	33 (4.4)	36 (4.7)	25 (4.5)
	●	●	68 (2.)	(0.6)	13 (1.3)	24 (1.8)	5 (3.1)	43 (2.)
	○	○	37 (4.3)	47 (4.1)	3 (1.6)	13 (2.5)	66 (3.6)	18 (3.0)
	●	●	3 (3.)	7 (1.4)	8 (1.7)	21 (3.1)	43 (4.4)	13 (2.7)
	○	●	(0.7)	(0.4)	3 (0.4)	12 (0.8)	8 (0.6)	12 (0.8)
	●	●	61 (4.1)	6 (1.8)	4 (1.8)	2 (4.0)	35 (4.1)	13 (2.8)
	●	●	33 (2.6)	0 (1.4)	7 (1.3)	17 (1.7)	34 (2.7)	21 (2.8)
	●	●	47 (4.8)	55 (5.3)	35 (5.1)	47 (4.)	70 (4.7)	45 (4.7)
	●	●	47 (4.)	71 (4.4)	25 (3.)	30 (4.4)	34 (4.8)	25 (4.4)
	●	●	33 (2.1)	84 (1.6)	25 (1.4)	21 (1.4)	5 (1.0)	28 (1.)
	●	●	51 (3.7)	74 (3.0)	10 (2.2)	13 (2.7)	22 (3.0)	20 (3.0)
	●	●	86 (3.0)	13 (2.8)	1 (0.5)	3 (1.3)	3 (1.3)	13 (3.0)
	●	●	60 (3.3)	4 (1.7)	1 (0.7)	11 (2.1)	34 (3.4)	21 (2.8)
	○	●		65 (3.4)		20 (3.4)	0 (0.0)	18 (2.6)
	●	●	42 (4.4)	8 (2.5)	1 (0.7)	3 (1.4)	24 (3.6)	20 (3.3)
	●	●	30 (3.8)	67 (3.)	1 (0.7)	1 (0.7)	1 (0.7)	(2.6)
	○	○	20 (3.1)	2 (1.8)	0 (0.0)	0 (0.1)	6 (1.5)	7 (2.0)
	●	●	50 (2.8)	7 (0.8)	1 (1.7)	38 (2.0)	76 (2.5)	52 (3.2)
	●	●	27 (3.6)	0 (1.7)	11 (2.6)	27 (3.0)	14 (2.7)	1 (2.)
	●	●	23 (2.2)	3 (1.3)	3 (0.8)	10 (1.5)	2 (2.5)	28 (2.3)
	●	●	2 (0.6)	7 (0.7)	3 (0.6)	7 (0.)	4 (0.)	6 (1.1)
	●	●	58 (4.2)	36 (4.1)	22 (3.6)	31 (4.0)	14 (3.2)	38 (4.1)
	○	○	14 (2.3)	0 (1.5)	7 (1.4)	18 (2.1)	18 (2.5)	1 (2.)
	●	●	10 (3.2)	7 (1.6)	0 (0.0)	5 (1.1)	3 (1.4)	7 (2.4)
	●	●	21 (2.7)	74 (2.2)	7 (1.7)		17 (2.6)	24 (2.8)
	●	●	33 (4.6)	0 (2.7)	7 (3.1)	32 (5.2)	26 (4.8)	31 (5.0)
	○	○	8 (2.6)	52 (4.)	2 (1.2)	34 (4.8)	31 (3.7)	52 (5.0)
	●	●	24 (4.0)	63 (4.3)	1 (0.)	1 (0.8)	6 (2.4)	13 (3.4)
	●	●	1 (3.7)	77 (3.)	3 (1.6)	4 (1.8)	10 (2.6)	22 (4.5)
	●	●	5 (1.0)	8 (1.5)	1 (0.4)	3 (0.)	10 (1.6)	1 (2.1)
	●	●		8 (0.5)	6 (0.8)	13 (0.8)		
	●	●	53 (5.2)	2 (2.8)	6 (2.3)	32 (5.8)	40 (5.3)	22 (5.2)
	●	●	43 (3.4)	(0.4)	10 (1.8)	33 (2.8)	28 (2.7)	15 (2.3)
	●	●	47 (2.5)	(0.5)	4 (0.)	12 (1.4)	42 (2.4)	27 (2.4)
	○	●	42 (2.7)	2 (1.4)	27 (2.5)	58 (3.0)	35 (2.8)	25 (2.4)
	●	○	7 (1.4)	76 (1.)	2 (0.6)	26 (2.5)	8 (1.4)	35 (2.5)
	●	●	31 (2.5)	7 (0.)	(1.3)	20 (1.6)	16 (2.2)	22 (2.1)
	○	●	38 (3.8)	76 (3.5)	17 (3.1)	36 (4.2)	42 (3.6)	33 (3.8)
	○	○	58 (3.1)	86 (2.2)	4 (2.)	62 (3.0)	36 (3.0)	34 (3.2)
	●	●	62 (3.7)	82 (3.2)	0 (0.0)	5 (1.8)	4 (1.7)	10 (2.6)
	●	--	43 (3.0)	58 (3.3)	6 (1.2)	(1.)		40 (3.0)
‡	●	●	45 (4.8)	5 (1.6)	5 (2.0)	18 (2.8)	26 (3.5)	17 (4.0)
			37 (0.5)	82 (0.4)	(0.3)	20 (0.4)	25 (0.4)	24 (0.5)
Benchmarking Participants								
	○	●	45 (4.)	41 (5.5)	25 (4.0)	13 (3.5)	(2.)	10 (2.8)
	●	○						
	●	○	25 (4.7)	46 (4.6)	13 (3.3)	14 (3.2)	56 (4.8)	72 (4.8)
	●	○	56 (4.5)	74 (3.)	15 (3.7)	14 (3.4)	23 (3.7)	22 (3.1)

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Countries						
	3	1-2		3	1-2	
	32 (4.4)	35 (4.8)	34 (4.3)	33 (4.3)	37 (4.6)	30 (4.4)
	40 (4.6)	48 (4.6)	12 (3.6)	50 (4.5)	47 (4.2)	3 (1.4)
	67 (0.2)	26 (0.1)	7 (0.1)	87 (0.2)	7 (0.0)	6 (0.2)
	16 (3.5)	66 (4.1)	18 (3.1)	14 (3.1)	60 (4.3)	26 (4.1)
	32 (4.2)	36 (4.)	33 (4.3)	40 (4.6)	36 (4.3)	25 (3.4)
	41 (4.5)	3 (4.0)	20 (3.6)	42 (4.7)	42 (4.1)	17 (3.0)
	38 (4.0)	4 (4.3)	12 (2.5)	46 (4.3)	45 (4.6)	(2.2)
	61 (4.2)	36 (4.1)	3 (1.4)	55 (4.1)	43 (3.)	2 (1.1)
	32 (0.3)	5 (0.3)	10 (0.2)	41 (0.3)	58 (0.3)	1 (0.0)
	4 (2.0)	5 (1.8)	2 (0.)	5 (1.7)	3 (1.4)	1 (1.0)
	56 (3.)	43 (3.8)	1 (0.8)	35 (4.5)	61 (4.4)	4 (1.8)
	4 (4.6)	2 (4.1)	21 (3.8)	48 (4.5)	35 (4.6)	17 (3.0)
	55 (4.)	43 (5.0)	2 (1.1)	51 (4.8)	46 (4.7)	3 (1.3)
	55 (3.8)	38 (4.0)	8 (2.3)	66 (3.6)	27 (3.)	7 (2.0)
	42 (4.2)	47 (4.3)	11 (2.8)	43 (4.1)	47 (4.1)	10 (2.)
	34 (3.6)	4 (3.7)	17 (3.0)	25 (3.5)	57 (4.1)	18 (3.2)
	87 (2.)	12 (2.8)	1 (1.0)	83 (3.4)	13 (2.)	4 (1.7)
	26 (3.4)	33 (3.8)	41 (3.)	3 (3.)	33 (3.8)	28 (3.4)
	44 (3.8)	4 (4.1)	7 (2.2)	42 (3.7)	4 (4.1)	(2.1)
	51 (4.3)	40 (4.1)	(2.7)	4 (3.)	41 (4.1)	10 (2.5)
	18 (3.3)	75 (3.7)	6 (2.0)	21 (3.0)	68 (3.)	11 (2.8)
	40 (4.4)	58 (4.4)	2 (1.3)	44 (4.6)	54 (4.4)	3 (1.6)
	3 (4.3)	33 (4.3)	28 (3.4)	47 (4.4)	30 (4.2)	24 (3.7)
	5 (5.0)	41 (5.1)	1 (0.6)	61 (4.6)	3 (4.6)	0 (0.0)
	32 (3.7)	56 (3.)	12 (3.0)	28 (3.8)	55 (4.1)	17 (3.3)
	68 (3.6)	32 (3.7)	1 (0.8)	62 (4.3)	36 (4.3)	2 (1.2)
	61 (4.)	37 (4.)	2 (1.1)	78 (4.5)	20 (4.2)	3 (1.5)
	12 (3.2)	33 (5.3)	55 (5.6)	23 (4.4)	43 (5.0)	35 (4.5)
	(2.7)	70 (4.3)	21 (4.2)	18 (3.7)	54 (5.5)	28 (4.8)
	36 (5.6)	60 (5.7)	4 (1.3)	35 (4.8)	56 (4.8)	8 (3.0)
	15 (3.4)	68 (4.1)	17 (3.1)	(2.5)	58 (4.5)	33 (4.3)
	62 (4.5)	34 (4.2)	5 (1.)	67 (4.1)	26 (3.5)	6 (2.4)
	73 (3.7)	24 (3.6)	3 (1.6)	85 (3.1)	14 (3.0)	1 (0.)
	83 (3.2)	14 (2.)	4 (1.7)	86 (3.2)	13 (2.)	2 (1.3)
	44 (3.4)	50 (3.4)	7 (1.8)	43 (3.5)	51 (3.6)	6 (1.)
	41 (5.4)	30 (4.3)	30 (5.3)	3 (5.5)	38 (5.0)	22 (5.1)
	41 (4.)	50 (4.)	(3.3)	35 (4.7)	5 (5.3)	6 (2.)
	45 (3.8)	4 (3.7)	6 (2.0)	37 (3.6)	51 (3.)	13 (3.2)
	5 (0.0)	40 (0.0)	0 (0.0)	68 (0.0)	32 (0.0)	0 (0.0)
	46 (4.4)	42 (4.3)	12 (2.)	44 (4.0)	4 (3.)	7 (2.0)
	40 (4.8)	53 (5.0)	7 (2.5)	36 (4.2)	53 (4.3)	11 (2.5)
	60 (3.2)	2 (3.3)	12 (2.3)	63 (3.0)	24 (3.1)	13 (2.2)
	16 (2.)	62 (4.0)	22 (3.6)	15 (3.2)	47 (4.4)	38 (3.6)
	5 (4.0)	25 (3.4)	16 (2.7)	62 (4.5)	23 (3.7)	15 (3.1)
	56 (3.3)	37 (3.4)	7 (1.8)	5 (3.4)	36 (3.5)	6 (1.6)
‡	55 (7.2)	36 (6.8)	(4.0)	68 (6.5)	30 (6.3)	2 (0.1)
	46 (0.6)	42 (0.6)	12 (0.4)	48 (0.6)	40 (0.6)	12 (0.4)
Benchmarking Participants						
	33 (4.)	37 (4.7)	30 (5.0)	41 (5.1)	42 (5.1)	17 (4.1)
	50 (6.0)	41 (5.)	(4.2)	47 (6.6)	46 (6.4)	7 (3.5)
	23 (4.2)	62 (4.6)	15 (3.7)	2 (4.0)	58 (4.6)	13 (3.5)
	14 (3.6)	45 (5.0)	41 (5.0)	21 (4.6)	58 (4.4)	21 (3.6)

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	28 (4.3)	35 (4.)	37 (4.6)	2 (4.1)	33 (4.6)	38 (4.8)
	40 (4.7)	37 (4.6)	23 (2.8)	44 (4.8)	42 (5.1)	14 (3.0)
( )	25 (4.0)	57 (4.3)	18 (3.4)	22 (3.3)	4 (4.4)	2 (3.6)
	47 (4.0)	47 (4.1)	6 (2.1)	53 (4.3)	43 (4.4)	4 (1.7)
	16 (3.)	57 (5.1)	28 (4.5)	27 (4.2)	62 (5.3)	11 (3.5)
	4 (5.6)	45 (5.7)	5 (2.4)	5 (5.8)	36 (5.7)	6 (2.5)
	53 (5.4)	45 (5.4)	3 (1.5)	56 (5.2)	42 (5.4)	2 (1.3)
	56 (3.7)	36 (3.7)	8 (2.1)	68 (3.8)	26 (3.7)	6 (1.8)
	22 (3.)	48 (4.2)	2 (3.8)	26 (4.4)	50 (4.7)	23 (3.5)
	26 (3.4)	31 (4.1)	43 (4.1)	35 (3.6)	33 (3.7)	32 (3.6)
	44 (4.2)	47 (4.1)	(2.2)	4 (4.2)	46 (4.1)	5 (1.8)
	28 (4.2)	58 (4.4)	15 (3.2)	35 (4.6)	55 (4.5)	(2.6)
	40 (4.4)	56 (4.5)	4 (1.6)	46 (4.2)	50 (4.1)	5 (1.)
	62 (4.8)	34 (4.)	4 (1.)	72 (5.0)	22 (4.5)	7 (2.6)
	15 (3.8)	27 (3.)	58 (4.5)	16 (3.8)	31 (5.1)	53 (5.2)
	30 (5.2)	37 (4.8)	33 (5.0)	38 (4.7)	37 (4.4)	26 (4.5)
	48 (3.6)	40 (3.7)	13 (2.5)	54 (3.5)	33 (3.5)	12 (2.7)

Professional Development Opportunities for Teachers in Mathematics and Science

Countries	[illegible]		
	[illegible]		
	3 [illegible]	1-2 [illegible]	[illegible]
[illegible]	1 (3.5)	2 (4.8)	52 (5.0)
[illegible]	48 (4.4)	3 (4.5)	13 (2.8)
[illegible]	35 (4.4)	47 (4.6)	18 (3.3)
[illegible]	46 (4.1)	51 (4.1)	4 (1.6)
[illegible]	26 (4.6)	52 (4.5)	21 (3.)
[illegible]	60 (5.6)	36 (5.2)	4 (2.1)
[illegible]	75 (3.8)	23 (3.8)	1 (0.)
[illegible]	37 (4.6)	44 (4.5)	18 (3.1)
[illegible]	20 (3.4)	33 (5.1)	47 (5.1)
[illegible]	47 (3.)	30 (3.7)	24 (3.5)
[illegible]	23 (3.5)	37 (4.0)	3 (4.1)
[illegible]	22 (4.0)	47 (4.8)	31 (4.2)
[illegible]	1 (3.6)	65 (4.5)	16 (3.0)
[illegible]	60 (5.1)	1 (4.0)	21 (3.)
[illegible]	7 (2.4)	13 (3.7)	7 (4.0)
[illegible]	46 (5.2)	33 (4.6)	20 (4.2)
[illegible]	58 (3.3)	35 (3.0)	8 (2.1)
[illegible]	41 (4.2)	3 (4.6)	20 (4.1)
[illegible]	50 (5.0)	31 (4.5)	1 (3.6)
[illegible]	5 (1.4)	22 (2.4)	74 (2.6)
[illegible]	54 (5.2)	3 (5.0)	7 (2.)
[illegible]	82 (3.0)	18 (2.)	0 (0.3)
[illegible]	20 (3.5)	65 (4.2)	15 (3.5)
[illegible]	3 (1.5)	5 (2.1)	2 (2.6)
[illegible]	46 (3.6)	42 (3.3)	11 (2.1)
[illegible]	38 (0.8)	36 (0.8)	26 (0.7)
Benchmarking Participants			
[illegible]	41 (6.0)	46 (6.1)	12 (4.8)
[illegible]	30 (4.6)	51 (4.8)	1 (4.2)
[illegible]	16 (3.6)	48 (4.5)	36 (4.1)

[illegible] 0 [illegible] 5% [illegible]

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	1 (1.8)	34 (3.0)	27 (2.6)	14 (1.8)	35 (2.3)	32 (2.7)
	6 (3.7)	57 (4.1)	71 (3.1)	64 (3.7)	53 (4.2)	60 (3.)
	66 (3.1)	68 (3.5)	50 (3.8)	62 (4.0)	41 (3.5)	52 (3.4)
( )	47 (3.1)	35 (3.2)	44 (3.3)	50 (3.3)	11 (2.0)	15 (2.2)
	27 (3.4)	22 (3.6)	10 (2.7)	18 (3.5)	32 (3.8)	33 (4.2)
	22 (2.6)	23 (2.7)	25 (3.0)	11 (1.)	1 (2.)	17 (2.5)
	6 (3.4)	65 (3.1)	45 (3.4)	3 (3.6)	40 (4.0)	46 (3.)
	82 (3.3)	74 (3.)	78 (3.5)	82 (3.0)	38 (3.5)	5 (4.0)
	61 (1.4)	5 (1.0)	56 (1.4)	5 (1.0)	46 (1.4)	38 (0.)
	41 (4.6)	56 (4.1)	27 (4.0)	4 (4.2)	66 (4.2)	66 (4.3)
	66 (2.8)	71 (2.2)	65 (2.7)	70 (2.5)	3 (2.4)	33 (2.5)
	50 (5.3)	3 (4.4)	45 (4.)	30 (4.7)	44 (4.)	53 (5.1)
	7 (3.6)	6 (4.2)	67 (3.)	68 (4.3)	61 (4.5)	45 (4.2)
	53 (2.7)	41 (2.6)	48 (2.6)	16 (1.8)	23 (2.3)	23 (2.3)

	38 (4.2)	27 (4.0)	44 (4.2)	27 (4.0)	41 (4.5)	21 (3.)
)	18 (2.7)	20 (2.7)	4 (1.4)	10 (2.4)	17 (3.0)	6 (1.6)
	64 (4.1)	67 (4.2)	63 (3.)	67 (3.7)	3 (4.2)	45 (4.3)
	46 (4.8)	52 (4.3)	21 (3.7)	35 (4.2)	40 (4.4)	15 (3.4)
	43 (4.8)	47 (4.)	47 (5.1)	31 (4.)	37 (4.)	30 (4.3)
	38 (4.3)	31 (4.2)	28 (4.0)	51 (5.1)	47 (4.6)	26 (4.3)
	21 (3.7)	21 (3.7)	13 (3.2)	6 (2.1)	1 (3.6)	10 (2.8)
	46 (4.)	52 (4.6)	33 (4.5)	20 (4.0)	31 (4.2)	3 (4.4)
	22 (2.)	15 (2.3)	10 (2.0)	11 (2.3)	5 (1.2)	5 (1.3)
	37 (3.8)	42 (3.8)	17 (2.7)	1 (3.3)	10 (2.1)	1 (2.)
	47 (4.8)	50 (5.0)	47 (4.8)	22 (3.)	57 (4.0)	54 (4.)
	22 (3.0)	36 (3.4)	18 (2.8)	26 (3.7)	50 (4.1)	34 (3.8)
	28 (4.3)	37 (4.4)	37 (4.5)	36 (4.5)	53 (4.)	60 (4.4)

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Types of Interactions Among Science Teachers *(...Continued)*

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Countries						
	t _t ..	2 3 . I . , . t	\ . . . t \ . . .	t _t ..	2 3 . I . , . t	\ . . . t \ . . .
	44 (5.)	50 (5.5)	6 (2.7)	34 (5.7)	53 (6.0)	13 (3.7)
	51 (4.2)	37 (4.8)	12 (2.7)	54 (4.6)	31 (4.)	15 (2.)
	52 (3.8)	3 (3.7)	(2.0)	41 (4.0)	3 (3.6)	21 (2.7)
	41 (3.7)	53 (3.8)	6 (2.0)	24 (3.3)	54 (3.7)	22 (3.2)
	58 (4.1)	2 (3.8)	13 (3.2)	61 (3.8)	28 (3.4)	11 (2.3)
	61 (5.2)	28 (5.0)	10 (2.7)	62 (4.)	20 (4.2)	17 (3.5)
	41 (4.5)	51 (4.7)	8 (2.4)	24 (4.3)	52 (5.0)	24 (3.8)
	55 (4.3)	41 (4.2)	4 (1.2)	57 (4.2)	35 (3.)	7 (2.3)
	62 (4.3)	35 (4.2)	3 (1.7)	64 (4.6)	31 (4.5)	5 (2.0)
	47 (3.0)	42 (3.0)	11 (2.0)	55 (3.6)	32 (3.3)	13 (2.5)
	46 (4.2)	40 (4.2)	14 (2.)	3 (3.7)	42 (4.2)	20 (2.)
	41 (4.3)	46 (4.4)	14 (2.)	30 (3.)	57 (4.4)	13 (3.1)
	60 (3.5)	33 (3.4)	7 (1.)	68 (3.2)	27 (3.0)	5 (1.8)
	57 (4.3)	37 (4.2)	6 (2.0)	74 (3.3)	18 (3.1)	8 (2.2)
	22 (3.7)	40 (5.3)	38 (4.)	12 (2.)	18 (3.3)	6 (4.0)
	42 (4.7)	42 (4.7)	16 (3.2)	25 (4.4)	44 (4.7)	32 (4.4)
	64 (3.3)	31 (2.8)	5 (1.5)	54 (3.4)	35 (3.2)	12 (2.2)
	64 (2.)	28 (3.)	8 (2.6)	50 (3.6)	30 (3.)	20 (3.3)
	58 (5.0)	38 (5.1)	3 (1.4)	71 (4.6)	26 (4.6)	3 (1.3)
	55 (3.3)	43 (3.2)	2 (1.0)	46 (3.4)	48 (3.)	6 (1.)
	43 (4.)	41 (4.7)	16 (3.2)	3 (4.7)	37 (4.5)	24 (3.5)
	46 (4.4)	45 (4.5)	(2.5)	38 (3.8)	52 (4.0)	10 (2.6)
	64 (4.0)	30 (3.7)	6 (2.2)	38 (4.5)	45 (4.6)	17 (3.4)
	55 (4.4)	23 (3.3)	23 (3.7)	2 (3.)	2 (3.7)	42 (4.4)
	63 (3.0)	30 (2.5)	7 (1.7)	60 (2.8)	2 (2.7)	11 (1.)
	52 (0.8)	38 (0.8)	10 (0.5)	46 (0.8)	36 (0.8)	18 (0.6)
Benchmarking Participants						
	60 (5.4)	33 (5.1)	7 (2.6)	4 (4.8)	37 (4.4)	14 (2.7)
	46 (4.8)	45 (4.7)	(2.7)	47 (5.1)	33 (4.6)	20 (3.7)
	53 (5.0)	33 (4.4)	13 (2.)	47 (4.7)	30 (4.4)	23 (3.6)

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about how often they interacted with their colleagues. More specifically, they were asked about discussing teaching strategies for particular concepts, preparing instructional materials, and classroom observations. As shown in Exhibit 6.9, on average, the results for the TIMSS participants were consistent across grades. Teachers of most students (80% or more) reported weekly or monthly interaction about instructional issues. In contrast, observing other teachers or being observed themselves was relatively infrequent (63% never).

How Ready Do Teachers Think They Are to Teach Science?

TIMSS 2003 asked teachers how ready they felt to teach the science topics included in the TIMSS 2003 science assessment. Across the five major content areas (life science, chemistry, physics, earth science, and environmental science), the eighth-grade teachers were asked about 21 topics (sub-areas). Exhibit 6.10 contains teachers' reports, indicating that the teachers of almost all the eighth-grade students felt ready to teach nearly all the topics. On average, internationally, the results ranged from 86 to 97 percent, with the results above 90 percent for all but the three earth science topics (Earth's structure and physical features; Earth's processes, cycles, and history; and Earth in the solar system and the universe) and two of the three environmental science topics (trends in human population and its effects on the environment; and changes in environments).

Although in most countries essentially all students were taught the topics in the basic science subjects – life science, chemistry, and physics – by teachers who felt ready to teach the topics, there were some notable exceptions, including Morocco, for all three subjects, and the Philippines and Tunisia for chemistry and physics. Also, teachers in Singapore and Sweden felt somewhat less ready to teach the topics in biology than in the other two subjects, and teachers in Belgium (Flemish) less ready to teach the physics topics. Among the benchmarking participants, Quebec teachers felt somewhat less ready to teach the biology topics and the majority of topics in chemistry and physics. Con-

sistent with information presented in Chapter 5 showing that topics in earth science and environmental science were included less often in the intended curricula of TIMSS participants and taught less often to the students, teachers in many countries reported that they felt less ready to teach these than the other science subjects.

At the fourth grade, teachers felt generally less well-prepared. Teachers were asked about 19 science topics, with the results ranging from 66 to 94 percent, on average, internationally. The results were above 90 percent for 8 of the 19 topics: two of the six life science topics (relationships in a living community and changes in environments), two of the seven physical science topics (states of matter and differences in their physical properties; and common energy sources and forms and their practical uses), and four of six earth science topics (features on Earth's landscape; water on Earth; air; and common features of Earth's landscape and their relationship to human use). However, results dipped below 70 percent for three topics: reproduction and development in plants and animals (life science - 66%); forming and separating mixtures (physical science – 66%); and fossils of animals and plants (earth science – 69%).

In every country, there were at least some fourth-grade science topics that teachers indicated they were less ready to teach. However, in Belgium (Flemish), the Netherlands, and Quebec, for all topics in both life science and physical science and the majority in earth science, the percentage of students taught by teachers ready to teach the topics

	100 (0.0)	100 (0.5)	(0.7)	100 (0.0)	100 (0.4)	(0.)	(1.0)	(0.1)	8 (0.)	7 (1.0)
	8 (1.1)	8 (0.)	6 (1.4)	7 (1.3)	(0.8)	8 (1.3)	(0.4)	(0.8)	8 (1.2)	8 (0.)
	100 (0.0)	100 (0.0)	6 (1.1)	1 (2.0)	(1.2)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
( )	7 (0.7)	6 (0.)	3 (1.8)	73 (3.4)	87 (2.2)					
	(0.5)	100 (0.0)	5 (2.0)	5 (2.2)	8 (1.3)	7 (1.5)	5 (2.0)	(0.)	4 (2.2)	1 (2.6)
	100 (0.0)	100 (0.0)	100 (0.5)	5 (2.7)	7 (2.6)	100 (0.0)	100 (0.0)	7 (2.4)	100 (0.0)	7 (2.5)
	(0.6)	(0.6)	(0.6)	(0.6)	100 (0.1)	6 (1.6)	3 (1.)	1 (1.7)	82 (2.8)	82 (2.5)
						(0.7)	(0.7)	(0.7)	(0.7)	(0.7)
						(0.7)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
	100 (0.0)	(0.8)	(1.0)	5 (2.0)	(0.7)	100 (0.0)	100 (0.0)	100 (0.1)	(0.8)	100 (0.1)
	100 (0.0)	100 (0.0)	100 (0.0)	(0.6)	(0.6)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)	100 (0.0)
	7 (1.6)	7 (1.7)	8 (1.5)	88 (3.0)	5 (1.)	7 (1.)	8 (1.4)	8 (1.7)	4 (2.0)	87 (3.1)
	2 (2.4)	(1.0)	1 (2.6)	87 (2.)	4 (2.3)	8 (1.2)	7 (1.7)	8 (1.4)	(1.0)	6 (1.)
	100 (0.0)	(0.7)	(0.)	85 (3.3)	4 (1.7)	8 (1.2)	8 (1.2)	8 (1.2)	8 (1.2)	8 (1.2)
	100 (0.0)	8 (1.4)	2 (2.8)	5 (2.3)	7 (2.0)					
	(0.8)	100 (0.0)	7 (1.6)	1 (2.4)	7 (1.2)	7 (1.3)	8 (1.2)	8 (1.0)	6 (1.4)	7 (1.2)
	2 (1.6)	3 (1.7)	2 (1.8)	0 (2.0)	2 (1.7)	7 (1.0)	7 (1.0)	5 (1.7)	0 (2.4)	5 (1.6)
	(0.8)	(0.8)	8 (1.1)	6 (1.3)	8 (0.)	8 (1.1)	(0.8)	8 (1.2)	87 (2.5)	85 (2.6)
	(1.0)	5 (1.)	8 (2.7)	81 (3.0)	1 (2.4)	100 (0.0)	7 (1.6)	7 (1.4)	6 (1.6)	(0.7)
	7 (1.5)	7 (1.5)	5 (1.6)	4 (2.0)	7 (1.3)	8 (1.2)	(0.7)	(0.)	6 (1.7)	8 (1.1)
	1 (2.1)	6 (1.4)	2 (2.1)	87 (2.7)	2 (1.)	5 (2.0)	6 (1.)	4 (2.1)	0 (2.7)	3 (2.3)
	7 (2.1)	6 (2.0)	4 (2.6)	8 (3.8)	5 (2.3)					
	1 (2.0)	2 (1.8)	1 (1.)	84 (2.)	84 (2.)	8 (1.0)	7 (1.1)	5 (1.6)	5 (1.4)	6 (1.4)
	100 (0.0)	100 (0.0)	(1.0)	8 (1.3)	100 (0.0)	8 (1.2)	8 (1.2)	6 (1.8)	6 (1.5)	8 (1.3)
	100 (0.2)	100 (0.2)	100 (0.0)	100 (0.0)	100 (0.0)	8 (1.1)	(1.0)	(0.8)	(1.1)	100 (0.0)
	8 (1.1)	(0.)	8 (2.5)	7 (1.5)	8 (1.2)	7 (1.3)	2 (2.0)	8 (1.2)	8 (1.4)	5 (1.)
	88 (3.1)	8 (3.7)	78 (4.3)	6 (6.0)	83 (4.7)	88 (4.6)	82 (4.7)	84 (5.4)	85 (5.1)	87 (4.)
	100 (0.0)	(0.7)	100 (0.0)	(0.7)	(0.8)	3 (3.0)	8 (1.5)	8 (3.6)	834 (52( )-1630(8)-0.2 7	(4.)

10 Readiness to Teach Science *(Continued...)*

Countries	Percentage of Students Whose Teachers Report Feeling Ready to Teach Science Topics					
	Life Science					
	83 (4.3)	64 (4.3)	76 (3.4)	8 (2.4)	3 (2.1)	73 (4.2)
	48 (4.0)	30 (3.5)	43 (3.8)	82 (2.6)	81 (2.6)	3 (3.8)
	7 (1.5)	87 (2.7)	5 (1.)	(0.7)	8 (1.1)	7 (1.5)
	8 (1.2)	3 (2.5)	87 (2.5)	(0.8)	8 (1.2)	8 (0.8)
	86 (3.2)	61 (4.4)	85 (3.4)	5 (2.4)	2 (2.5)	1 (2.4)
	3 (2.2)	68 (4.4)		7 (1.2)	1 (2.3)	53 (4.0)
	4 (2.0)	7 (1.4)	2 (2.4)	8 (1.2)	2 (2.1)	8 (2.3)
	8 (2.2)	84 (2.8)	82 (2.)	8 (1.0)	0 (2.2)	63 (3.7)
	65 (3.6)	4 (4.0)	56 (3.8)	3 (2.2)	74 (3.7)	85 (2.8)
	7 (4.4)	63 (6.1)	77 (4.6)	8 (1.1)	4 (2.5)	42 (6.0)
	82 (3.1)	46 (3.8)	82 (2.5)	87 (2.2)	6 (1.1)	70 (3.4)
	83 (3.5)	65 (4.)	7 (3.7)	6 (1.2)	2 (2.1)	72 (4.0)
	63 (4.6)	38 (4.5)	5 (4.5)	82 (3.2)	87 (3.0)	53 (4.4)
	2 (1.4)	78 (2.7)	77 (2.8)	3 (1.7)	4 (1.7)	88 (2.1)
	67 (3.)	46 (4.1)	74 (3.)	1 (1.7)	3 (2.3)	71 (3.8)
	1 (3.0)	8 (3.3)	3 (2.3)	100 (0.0)	5 (2.4)	77 (3.4)
	76 (4.1)	65 (5.3)	67 (5.0)	88 (3.6)	3 (3.1)	78 (4.6)
	8 (1.3)	72 (4.3)	80 (3.5)	(0.5)	6 (1.6)	87 (3.0)
	8 (3.2)	72 (4.2)	6 (4.6)	1 (2.3)	5 (2.2)	0 (2.)
	3 (2.4)	52 (3.)	55 (4.6)	8 (1.1)	7 (1.4)	6 (4.1)
	3 (1.3)	74 (2.6)	82 (1.)	4 (1.3)	3 (1.5)	86 (2.0)
	84 (0.7)	66 (0.)	76 (0.8)	4 (0.4)	2 (0.5)	75 (0.8)
Benchmarking Participants						
	3 (3.0)	72 (5.3)	82 (5.1)	(1.0)	4 (2.6)	84 (3.)
	4 (2.1)	63 (5.0)	75 (4.4)	1 (2.5)	3 (2.6)	76 (4.0)
	73 (3.7)	42 (4.2)	43 (4.7)	84 (3.4)	75 (4.1)	46 (4.7)

Countries	Percentage of Students Whose Teachers Report Feeling Ready to Teach Science Topics						
	Physical Science						
	86 (2.)	64 (4.3)	76 (3.4)	8 (2.4)	3 (2.1)	73 (4.2)	86 (2.)
( )	55 (4.0)	30 (3.5)	43 (3.8)	82 (2.6)	81 (2.6)	3 (3.8)	55 (4.0)
	6 (1.8)	87 (2.7)	5 (1.)	(0.7)	8 (1.1)	7 (1.5)	6 (1.8)
	8 (1.2)	3 (2.5)	87 (2.5)	(0.8)	8 (1.2)	8 (0.8)	8 (1.2)
	84 (3.6)	61 (4.4)	85 (3.4)	5 (2.4)	2 (2.5)	1 (2.4)	84 (3.6)
	58 (3.4)	68 (4.4)		7 (1.2)	1 (2.3)	53 (4.0)	58 (3.4)
	1 (2.2)	7 (1.4)	2 (2.4)	8 (1.2)	2 (2.1)	8 (2.3)	1 (2.2)
	82 (2.)	84 (2.8)	82 (2.)	8 (1.0)	0 (2.2)	63 (3.7)	82 (2.)
	68 (3.)	4 (4.0)	56 (3.8)	3 (2.2)	74 (3.7)	85 (2.8)	68 (3.)
	65 (5.5)	63 (6.1)	77 (4.6)	8 (1.1)	4 (2.5)	42 (6.0)	65 (5.5)
	61 (4.0)	46 (3.8)	82 (2.5)	87 (2.2)	6 (1.1)	70 (3.4)	61 (4.0)
	73 (4.1)	65 (4.)	7 (3.7)	6 (1.2)	2 (2.1)	72 (4.0)	73 (4.1)
	65 (3.)	38 (4.5)	5 (4.5)	82 (3.2)	87 (3.0)	53 (4.4)	65 (3.)
	2 (1.8)	78 (2.7)	77 (2.8)	3 (1.7)	4 (1.7)	88 (2.1)	2 (1.8)
	84 (3.2)	46 (4.1)	74 (3.)	1 (1.7)	3 (2.3)	71 (3.8)	84 (3.2)
	1 (3.3)	8 (3.3)	3 (2.3)	100 (0.0)	5 (2.4)	77 (3.4)	1 (3.3)
	88 (3.4)	65 (5.3)	67 (5.0)	88 (3.6)	3 (3.1)	78 (4.6)	88 (3.4)
	82 (3.4)	72 (4.3)	80 (3.5)	(0.5)	6 (1.6)	87 (3.0)	82 (3.4)
	73 (4.2)	72 (4.2)	6 (4.6)	1 (2.3)	5 (2.2)	0 (2.)	73 (4.2)
	84 (3.4)	52 (3.)	55 (4.6)	8 (1.1)	7 (1.4)	6 (4.1)	84 (3.4)
	2 (1.5)	74 (2.6)	82 (1.)	4 (1.3)	3 (1.5)	86 (2.0)	2 (1.5)
	7 (0.7)	66 (0.)	76 (0.8)	4 (0.4)	2 (0.5)	75 (0.8)	7 (0.7)
Benchmarking Participants							
	2 (2.6)	72 (5.3)	82 (5.1)	(1.0)	4 (2.6)	84 (3.)	2 (2.6)
	3 (2.6)	63 (5.0)	75 (4.4)	1 (2.5)	3 (2.6)	76 (4.0)	3 (2.6)
	53 (4.2)	42 (4.2)	43 (4.7)	84 (3.4)	75 (4.1)	46 (4.7)	53 (4.2)

	8 (0.)	4 (2.3)	2 (2.2)	8 (1.2)	82 (3.1)	7 (1.3)
( )	3 (2.0)	82 (3.3)	68 (3.3)	1 (2.3)	46 (4.0)	81 (2.)
	7 (1.3)	8 (1.2)	8 (1.1)	8 (1.3)	85 (3.1)	5 (1.8)
	3 (2.1)	3 (2.1)	(0.6)	6 (1.)	67 (4.1)	88 (2.7)
	2 (3.0)	86 (3.4)	7 (1.3)	2 (3.0)	68 (4.3)	86 (3.0)
	100 (0.0)	(0.)	6 (1.7)	6 (2.0)	63 (4.1)	2 (1.7)
	4 (1.7)	4 (1.)	1 (2.3)	5 (1.)	74 (3.7)	0 (2.5)
	100 (0.0)	100 (0.0)	100 (0.0)	8 (0.8)	86 (2.7)	7 (1.3)
	75 (3.4)	75 (3.1)	76 (3.6)	76 (3.4)	47 (4.4)	77 (3.4)
	100 (0.3)	(0.6)	(0.6)	(0.5)	76 (5.0)	7 (1.)
	(0.7)	7 (1.2)	8 (0.8)	7 (1.4)	78 (3.3)	4 (1.8)
	7 (1.5)	7 (1.5)	(0.8)	100 (0.0)	78 (3.7)	5 (1.4)
	5 (2.2)	3 (2.6)	88 (2.8)	5 (2.0)	70 (4.1)	65 (4.6)